

ENVIRONMENTAL ASSESSMENT

May 2007

Streelow Creek Fish Passage
Redwood National and State Parks
Humboldt County, California

Introduction

The National Park Service is proposing to remove failing culverts and replace them with a footbridge on an abandoned logging road that has been converted to the Streelow Creek Trail used by hikers and bicyclists in Redwood National Park. Replacing the culverts with a footbridge would improve habitat for threatened fish species. Several other failing drainage structures would be replaced and unstable road sections would be removed to prevent future damage to fish habitat. This project has been awarded a grant for \$43,950 under the California Department of Fish and Game Fisheries (CDFG) Restoration Grant Program for restoration of salmonid habitat in California streams.

Redwood National Park was established by Congress in 1968 to "preserve significant examples of the coastal redwood ... forests and the streams and seashores with which they are associated for purposes of public inspiration, enjoyment, and scientific study." The NPS was directed to "minimize human-induced erosional threats and impacts to terrestrial and aquatic resources within the park" that resulted from logging practices allowed at that time. [Public Law 90-245, Section 3(e)]

In 1978, Congress expanded the national park by acquiring privately owned timber lands that had already been logged and directed the NPS to develop a watershed rehabilitation program to "minimize human-caused sediment entering Redwood Creek and its tributaries." [Public Law 95-250, Section 101(a)(6)] Since 1978, the NPS has been conducting watershed rehabilitation and restoration activities in accordance with the legislative direction.

The 1999 Redwood National and State Parks *Final General Management Plan/General Plan, Environmental Impact Statement/Environmental Impact Report* (RNSP GMP/EIS) included proposals to remove or treat abandoned logging roads to reduce the potential for erosion at stream crossings and from unstable road segments. The proposed action is intended to implement the watershed restoration program described in the GMP; the environmental assessment is tiered off the GMP/EIS.

Purpose and Need for Action

The Streelow Creek Trail was a former logging road that was converted to a hike/bike trail. The trail crosses the North Fork of Streelow Creek just upstream of the confluence of the North Fork and the main stem of the creek. Streelow Creek is a tributary of Prairie Creek, which has some of the best remaining salmonid spawning habitat in the region.

The crossing on the North Fork of Streelow Creek is earthen fill covering three 36-inch-diameter corrugated metal pipe culverts placed in the original stream channel to allow the stream to flow beneath the road. These culverts are currently above the grade of the streambed and act as a barrier to fish passage up the North Fork of Streelow Creek. The configuration of the inlets in relation to the stream channel has caused ponding at the inlets and has led to aggradation of approximately 100 feet of channel upstream of the crossing. The outlets are perched 2½ feet above the downstream end of the culvert and the discharge from the elevated outlet has scoured out the streambed. The configuration of the culvert outlets and the elevated discharge (essentially a waterfall) are obstacles to fish passage upstream of the culvert.

The culvert inlets are prone to plugging by woody debris and sediment that wash into the stream from the hillslopes upstream and that are carried down the stream channel at high stream flows. Because the area was logged prior to becoming part of the park, logging debris upstream and upslope can be carried into the stream and plug the culvert. A plugged culvert can cause sediment from upstream to be deposited in the streambed, artificially raising the level of the bed and causing streamflow to exceed the capacity of the channel.

In addition to the culverts now above the grade of the streambed and the inlets that are prone to plugging, the pipes have rusted. These pipes are possibly the original pipes installed during construction of the road and are in poor condition. Water leaks through holes in the rusted pipes into the surrounding road fill, which saturates and weakens the earthen fill and leads to collapse of adjacent stream banks, road fill failure, and holes along the road surface.

A metal trash rack intended to catch debris and keep the upstream culvert opening clear has accumulated debris that has plugged the main channel of the North Fork of Streelow Creek a few feet upstream of the culverts. The plugged channel has caused aggradation of approximately 500 cubic yards of sediment, causing the stream to divert around the plugged trash rack and scour the left bank of the North Fork of Streelow Creek.

Two additional stream crossings are located on the North Fork of Streelow Creek approximately ½ mile upstream of the trail crossing. One is a failing log stringer bridge across the North Fork and the second is an earthen fill crossing of a side channel of the North Fork with a plugged drainage structure. The type of drainage structure is unknown because of the volume of debris plugging both the upstream and downstream ends. It is possible that this crossing is a Humboldt crossing because several stream crossings nearby incorporate woody debris to create a Humboldt crossing (logs placed parallel to the original stream channel and filled with sediment to create a level road bed).

The potential for failure of drainage structures and roads increases as the culverts continue to deteriorate and the channels fill with debris. In a large storm, the crossings would not be able to convey the volume of water and would act as dams, saturating the fill and increasing the likelihood of failure. Failure of any of the three stream crossings is likely to lead to failure of the adjacent road prisms, causing sediment to be delivered into both Streelow Creek and Prairie Creek and damaging aquatic habitat.

Complete failure of the North Fork crossing on the trail would destroy portions of the Streelow Creek Trail. As the crossing gradually deteriorates, holes and slumps on the trail surface are growing larger and the uneven surface creates hazards on the trail for both hikers and bicyclists.

The NPS proposes to replace the damaged undersized culverts at the trail crossing on the North Fork of Streelow Creek with a footbridge to improve fish passage for three species of salmonids

listed as threatened and to improve visitor safety on the Streelow Creek Trail. The NPS would also remove the log stringer bridge and the earth-fill stream crossing to prevent eventual failure, which would cause further damage to fish habitat on the North Fork of Streelow Creek.

The purpose of this project is to remove culverts and a failing log bridge to improve habitat for threatened fish species. This project is needed to prevent additional damage to fish habitat from sediment associated with failure of these drainage structures and stream crossings. One set of culverts would be replaced with a footbridge to ensure that the Streelow Creek Trail continues to provide a safe and enjoyable experience for hikers and bicyclists.

Background

Redwood National Park was established by Congress in 1968 to "preserve significant examples of the coastal redwood ... forests and the streams and seashores with which they are associated for purposes of public inspiration, enjoyment, and scientific study." (Public Law 90-545)

In 1978, Congress expanded the national park, in part "to establish a more meaningful Redwood National Park for the use and enjoyment of visitors." (Public Law 95-250) (see Figure 1: RNSP Location Map)

The expanded park area included approximately 50,000 acres that had been privately owned timber lands. A road network had been constructed to provide access to timber cutting areas and to haul the cut logs on trucks to a mill. The expansion area included many miles of roads that were abandoned when the timber companies vacated the land.

The old logging roads now in the park were constructed and maintained at a lower standard than the current California Forest Practice Rules require. In particular, drainage structures such as ditches and culverts were not designed to modern standards intended to protect streams and watersheds.

Stream crossings are places where roads cross streams or drainage channels. Stream crossings are composed of road fill and a drainage structure, although many smaller crossings in timber harvest areas were built with no drainage structure at all. When streamflow exceeds the capacity of the channel and drainage structure, the stream overtops the fill and erodes it, causing failure of the road fill. Road failures also occur when the fill becomes saturated which causes slumps and holes in the roadbed. When crossings fail, either a significant proportion of the road fill placed in the stream valley and the accumulated sediment will erode, or the stream will divert out of its original channel and run down the road or hillslopes, creating gullies or initiating landslides. The majority of sediment eroded from failed roads and stream crossings ends up in the stream system.

Although bridges are used to cross larger streams, they are expensive to construct, so logging roads often used culverts to convey a stream beneath a road and filled around the culvert with soil to create a level roadway. Culverts channel water under a road to keep the road base and surface dry and stable. Logging road stream crossings typically used a zinc-plated corrugated metal pipe culvert as the drainage structure. Zinc-plated pipes are prone to rusting as sediment, gravel, and rocks transported through the pipe during higher flows abrade the surface of the pipes and remove the protective zinc plating, exposing the underlying iron and leading to rusting and corrosion. Corroded culverts allow rainfall and runoff to leak which saturates and destabilizes road fills.

Water flowing through a culvert can erode the stream channel at the downstream end if the culvert is located on a steep area. With high enough flows in soft road fill, water running from

the culvert outflow is essentially a waterfall that further erodes the soil at the downstream culvert outlet.

Culverts do not function properly when they become plugged with debris, when they deteriorate because of rust, or when they are crushed or bent. In some crossings, two culverts are joined together with a metal band that may break, causing the two culverts to separate and leak at the separation.

The older culverts are smaller than current logging regulations require and are too small to carry high flows. Current state Forest Practice Rules require culverts with a 100-year-storm-event capacity to protect the road fill and reduce road failure that deposits sediment into streams.

Most permanent streams in RNSP are occupied by three species of anadromous salmonid fishes that are listed as threatened under the federal Endangered Species Act. Anadromous fish spend most of their adult lives in the ocean and migrate from the ocean to spawn in the same freshwater streams in which they spent the first part of their lives. These fish require spawning gravels that are free of sediment to allow the eggs and early life stages to obtain enough oxygen to survive.

Culverts that are too small, plugged by debris, collapsed, or placed higher than the level of the streambed act as barriers to fish migration and reduce the numbers of fish that are able to spawn. As old culverts are replaced due to failure or as part of watershed restoration or routine road maintenance, the National Marine Fisheries Service (NMFS, aka NOAA Fisheries) requires that NPS install culverts capable of accommodating a 100-year storm event on its roads.

Overview of the Project Area

The Streelow Creek Trail is located on a logging road that was abandoned when the area was acquired for the park (see Figure 2: Project Location). The Arcata Redwood Company constructed the 240 Road in the early 1960s to move logs from harvest sites to its Mill B south of Davison Road via a major haul road that runs along Prairie Creek. Davison Road turns west from US Highway 101 about three miles north of Orick to Gold Bluffs Beach Road, which provides access along the coast to Fern Canyon, one of the most visited attractions in Prairie Creek Redwoods State Park.

In 1996, the NPS developed the Elk Meadow Trailhead on the site of the former Arcata Redwood Company Mill B and converted the haul road along Prairie Creek to the Davison Trail. The Davison Trail is a hike-bike trail between Prairie Creek Redwoods State Park and the Elk Meadow Trailhead.

As part of the trailhead and trail development project, the Streelow Creek Trail was established on the 240 Road as a hike/bike trail to connect the Davison Trail to Davison Road and the Coastal Trail. These trails are very popular because they form a loop with the Ossagon and Coastal Trails, and with portions of both the Davison Road and the Newton B. Drury Scenic Parkway, a low speed paved road through old growth redwood forest at Prairie Creek Redwoods State Park.

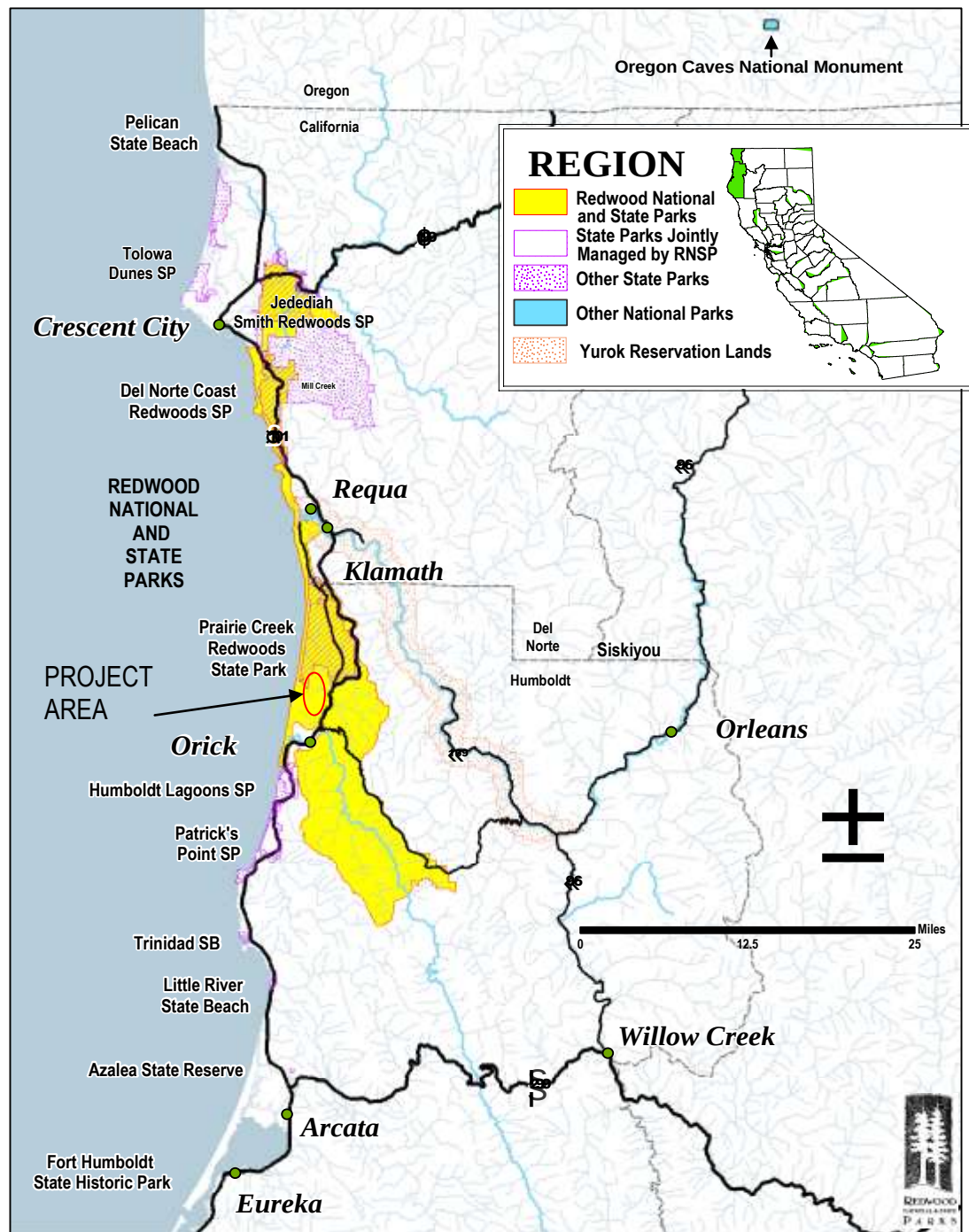
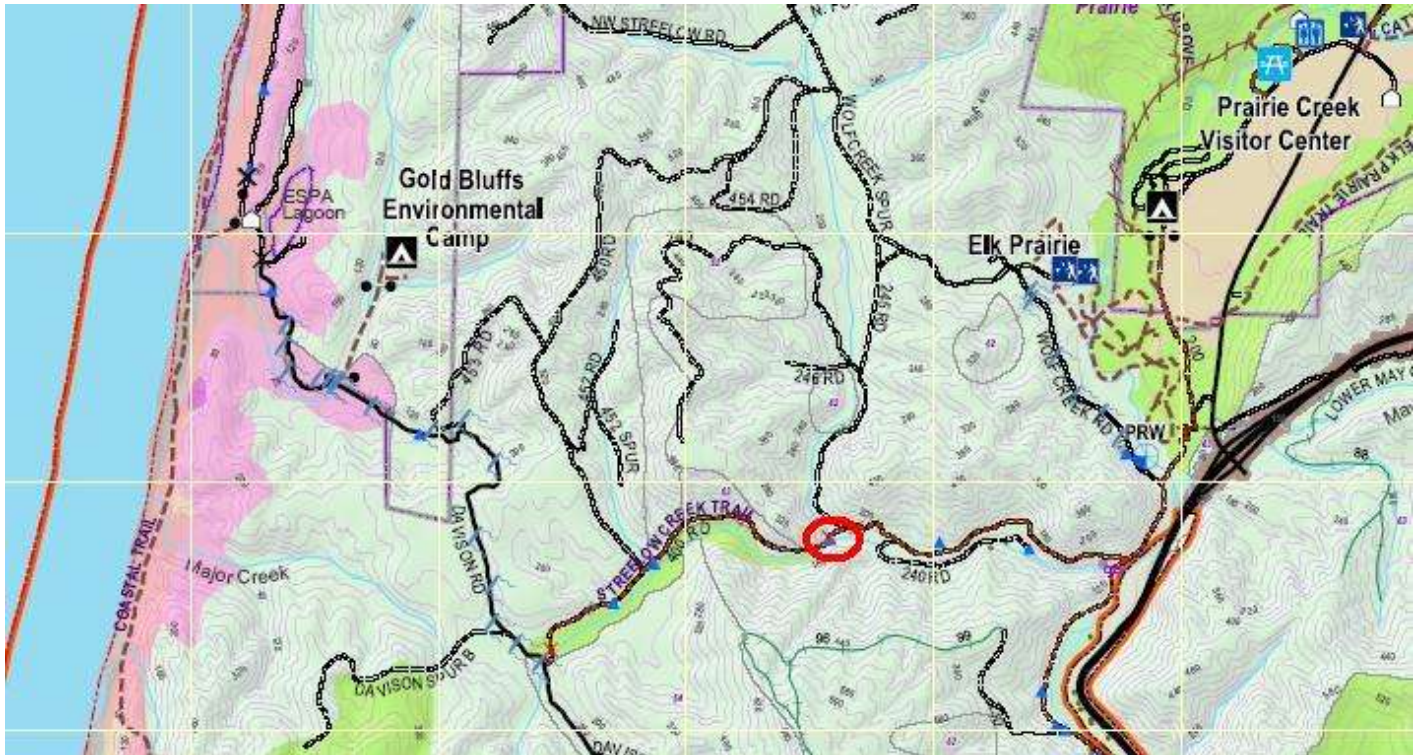


Figure 1. Redwood National and State Parks Location Map



Map 2: Project Location. The proposed project is located along the Streelow Creek Trail, approximately 1 mile west of the intersection of the Streelow Creek Trail and the Davison Trail. Proposed project site is outline by the red ellipse in the middle of the lower part of the figure.

Alternatives, Including the Proposed Action

Two alternatives are being considered for this project: removal of three failing stream crossings, one of which would be replaced by a bridge on the trail (the proposed action), and a no action alternative.

The no action alternative is required under NPS guidelines for compliance with the National Environmental Policy Act (NEPA) and is used to compare the existing conditions with the proposed action. No action means either a continuation of existing management practices or “no project.” In this case, no action (the current management action) includes maintenance of the existing culverts and trail surface but no removal or replacement of the two culverts or the log stringer bridge.

Alternative 1: No Action—Under this alternative, the NPS would perform minimal maintenance of the existing culverts by periodically removing debris that accumulates at the culvert inlets and wash rack. Holes and slumps in the trail surface would be marked as trail hazards to warn hikers and bicyclists. The log stringer bridge has never been repaired or received any routine maintenance because of its location on an unmaintained abandoned logging road.

Alternative 2: Improve Fish Passage (Proposed Action, Environmentally Preferred Alternative)—Under this alternative, the NPS would remove three stream crossings and unstable portions of associated road fill and restore the stream channels to resemble their original configuration as closely as possible. The three corrugated metal pipe culverts on the Streelow Creek Trail stream crossing would be replaced by a footbridge.

The stream would be diverted around excavation sites if there is sufficient flow to warrant diversion. If fish are present in the reaches of stream that would be affected by dewatering, the protocols required by NMFS for fish relocation and dewatering would be followed (Appendix 1).

Heavy equipment (excavator, bulldozer) would be used to excavate 4900 cubic yards of fill altogether from the three stream crossings, the associated road segments and material that has aggraded above the lower culverts. Of that total, 2400 cubic yards would be excavated from the road segment adjacent to the three lower culverts that would be replaced by the footbridge. Removal of the three culverts is estimated to require excavation of 1000 cubic yards. An additional 1000 cubic yards of material that has aggraded upstream of the three culverts would be excavated. Removing the log stringer bridge and the earthen fill crossing on the North Fork one-half mile upstream of the trail crossing would entail the excavation of approximately 150 and 350 cubic yards of material, respectively.

All excavated material would be moved to a stable location near the excavation site where it would not erode into the stream and shaped to blend in with the surrounding topography. Excavated fill placed along the trail and finished slopes exposed during excavation would be covered with vegetation removed during excavation or other locally obtained mulch to reduce post-excavation erosion of newly disturbed soils. Mulching with local native plant materials would avoid the need for revegetation.

The metal trash rack and any culverts associated with the crossing upstream of the trail would be removed and salvaged if possible for use elsewhere in the park. If these structures are not salvageable, they would be disposed off site in an approved disposal facility along with the three damaged culverts that would be replaced with the bridge.

The three culverts on the Streelow Creek Trail would be replaced by a footbridge delivered as a kit and assembled on site. The wooden bridge would be 8 feet wide and 80 feet long, with laminated wooden stringers (“glulams”) and pedestrian guard rails 54 inches in height. Metal-reinforced concrete abutments would be poured on site.

Concrete bridge abutments covering approximately 18 square feet and containing about 5 cubic yards would be constructed on each end of the excavated crossing. The abutments would be located above the high water mark on the North Fork of Streelow Creek. The new bridge would be hauled in kit form along the Davison Hike-Bike Trail and the Streelow Creek Trail on a truck and trailer. Heavy equipment and block and tackle would be used to lay the stringers across the abutments. Bridge decking and handrails would be constructed with hand tools.

An earthen fill stream crossing with a plugged drainage channel would be removed by excavating road fill down to the level of the original stream channel and the channel reshaped to resemble its original configuration. The earthen fill crossing is estimated to contain 350 cubic yards of material, including fill material and any woody debris that might be part of a Humboldt crossing. If the earthen crossing contains a metal pipe culvert or drainage structure other than woody material, the structure would be removed and disposed offsite in an approved disposal facility. If the crossing contains woody material, the wood would be dispersed on the slopes after excavation to degrade and contribute to the initial stabilization of the newly excavated slopes.

The old log stringer bridge upstream of the trail crossing is 40 feet long and contains an estimated 150 cubic yards of material, including the log stringers. Sediment associated with the bridge

would be excavated and placed on a stable location adjacent to the site, and the log stringers placed on the finished slopes.

The proposed action would require excavation or disturbance of an estimated total of 8080 square feet (0.23 acre) of soils for construction of a pedestrian footbridge with an additional estimated 1200 square feet of disturbance associated with the excavation of the two upstream stream crossings of North Fork of Streelow Creek.

Heavy equipment and other tools that create noise in excess of ambient noise would be used for all work performed after September 15th to reduce adverse effects on noise-sensitive threatened bird species. Instream channel excavation would occur after September 15th and would be completed prior to the onset of the rainy season to avoid erosion and run-off of disturbed soils into the stream. Instream work generally must be completed prior to October 15th. If work involves soil excavation adjacent to the active stream channel after October 15th, work sites would be “winterized” at the end of each work day to reduce the chance of erosion and run-off in the event of an unexpected rain storm. Winterizing, seasonal timing and other best management practices (Appendix A) would be implemented to reduce short-term adverse effects on listed salmonids from erosion. A complete list of required mitigation measures to minimize adverse effects on listed fish species from projects funded under the CDFG Fisheries Restoration Grant Program is found in the CDFG California Salmonid Stream Habitat Restoration Manual, Third Edition, Volume II with three new chapters added in 2003 and 2004 (Part IX: Fish Passage Evaluation at Stream Crossings, Part X: Upslope Assessment and Restoration Practices, and Part XI: Riparian Habitat Restoration) (Flosi *et al*, 1998).

The trail would be closed during equipment operations and bridge construction. Information and trail closures related to the project would be posted at the trailheads and visitor centers and announced through news releases. The project is expected to require trail closure for about four weeks. 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 Fish Passage (the Proposed Action) is the environmentally preferred alternative. This alternative would improve designated critical habitat for three species of anadromous salmonids listed as threatened species by

- improving passage to upstream spawning areas by removing stream crossings that completely or partially block the stream channel;
- restoring the stream channel through removal of aggraded sediment;
- reducing the threat of erosion from unstable road fill that reduces water quality through input of fine sediment.

The Proposed Action would also improve visitor safety and enjoyment by stabilizing the old logging road that has been converted to a hike-bike trail. The existing trail has holes and slumps

that form in the original logging road fill due to improper drainage and unstable soils on which the road was constructed.

The No Action alternative is not the environmentally preferred alternative because it would not reduce the potential for eventual failure of the culverts and the unstable road segments. The culverts, other stream crossings, and the associated road segment would continue to erode gradually or eventually fail massively in a storm. Sediment would continue to be delivered into streams either slowly through gradual erosion or from large-scale slope, culvert, and stream-crossing failures. The sediment delivered into streams would move downstream and further degrade the quality of spawning habitat for threatened coho and chinook salmon and steelhead trout.

Consultation with Other Agencies

Removing the stream crossings, associated road segments and aggraded material in the stream channel, and installing a pedestrian footbridge on the trail at the North Fork of Streelow Creek would be conducted under the U.S. Army Corps of Engineers (Corps) San Francisco District's Regional General Permit No. 12 (RGP 12, Corps File No.: 27922N) in compliance with Section 404 of the Clean Water Act. The RGP was issued on September 9, 2004 and expires on December 1, 2009. RGP 12 covers all projects funded by the CDFG Fisheries Restoration Grant Program for the purpose of restoring salmonid fisheries habitat in non-tidal reaches of rivers and streams, improving watershed conditions impacting salmonid streams and improving the survival, growth, migration and reproduction of native salmonids. Specific activities listed in the RGP that would occur under the proposed action include improving fish passage at stream crossings by replacing barrier culverts with bridges; fish passage improvements such as the removal of obstructions such as landslides; upslope restoration to reduce sediment delivery to streams through activities such as road upgrading and removal of unstable sidecast and fill materials from steep slopes; and watershed and stream bank stability activities to reduce sediment from watershed and stream bank erosion.

Effects on listed salmonids and their designated critical habitat from activities authorized under RGP12 have been analyzed in NOAA Fisheries' RGP 12 Biological Opinion, dated May 21, 2004 (151422SWR03AR8912:FRR/JTJ) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA; 16U.S.C.1521 *et seq.*). The NOAA Fisheries RGP 12 Biological Opinion analyzed the effects of the RGP 12 authorized activities on six populations of threatened salmonids occupying coastal streams in northern and central California. The NOAA Fisheries' RGP 12 Biological Opinion provides section 7 consultation coverage for the potential effects to listed salmonids from the North Fork of Streelow Creek fish passage improvement project.

Three federally-listed threatened salmonids occupy the project area—the Southern Oregon/Northern California Coast coho salmon (*Oncorhynchus kisutch*), California Coastal Chinook salmon (*O. tshawytscha*) and the Northern California steelhead (*O. mykiss*). NOAA Fisheries determined that the location and proposed timing authorized through the RGP would not affect the California Coastal Chinook salmon. NOAA Fisheries also determined that the proposed RGP is not likely to jeopardize the continued existence of the Southern Oregon/Northern California Coast coho salmon or Northern California steelhead. NOAA Fisheries anticipates that take of listed species as a result of projects authorized under the RGP will be in the nature of temporary displacement and/or reduction in feeding rates (with a possible minimal level of mortality) and will have no long-term negative effects on the survival and recovery of listed species.

NPS wildlife biologists have inspected the project area and determined that no suitable habitat or designated critical habitat for spotted owl or marbled murrelets would be affected by the proposed action. The project would be conducted after September 15 and completed prior to February 1, so there would be no noise or disturbance effects on either northern spotted owls or marbled murrelets. Therefore, there would be no effects on northern spotted owls and marbled murrelets from this project and the NPS did not consult with the U.S. Fish and Wildlife Service under section 7 of the Endangered Species Act.

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 purpose of the proposed action is to remove structures that degrade the natural floodplain and wetland values associated with Streelow Creek and its tributaries, and to restore natural floodplain and wetlands functions and values in a small area.

Public Involvement

This project is similar to the watershed restoration project that is underway in the Lost Man Creek drainage although the Streelow Creek project is on a much smaller scale. Public comment received on the watershed restoration proposal in the 1999 GMP/EIS, the Lost Man Creek restoration project, and other similar projects in and around the parks and in the region directed at restoration of salmonid habitat indicates broad public support for such projects. Therefore, no specific public involvement was conducted for this project. The impact topics addressed in this environmental assessment are the same for natural and cultural resources as those addressed in the Lost Man Creek restoration project. In addition to effects on resources, this environmental assessment addresses effects on visitors from making improvements to an existing trail that would be damaged by culvert and slope failure.

Affected Environment

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 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 rainfall in the project area is about 60 inches annually. Snow is very rare. High winds occur in the Prairie Creek valley during major winter storms. Sustained wind speeds exceeding 35 mile per hours generally cause trees and branches to fall, and result in road and trail closures throughout the parks.

Air quality in the project area, as in all of RNSP, is excellent due to lack of major pollutant sources from the direction of the prevailing northwest winds across the Pacific Ocean. Primary pollutant 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 joins Prairie Creek at an elevation of 60 feet above sea level. The project area lies in the inner gorge of the North Fork of Streelow Creek, with relatively steep sides and unstable soils characteristic of park streams.

The North Fork of Streelow Creek flows entirely through the Prairie Creek Formation. Soil materials of the Prairie Creek Formation are weakly consolidated and are highly unstable 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 laid down by the Klamath River more than two million years ago.

Downstream of the North Fork confluence with the main stem, Streelow Creek is underlain by the Franciscan formation comprised of Mesozoic-age (Jurassic to Cretaceous) 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 RNSP. 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 parks is mostly composed of sedimentary graywacke sandstone, mudstone, metamorphic schist, and minor amounts of conglomerates and mélange.

Hydrology and Water Quality—Streelow Creek is a tributary of Prairie Creek, which is the largest tributary of Redwood Creek with a drainage area of 40.6 square miles. The North Fork of Streelow Creek has a drainage area of slightly more than 1 square mile and flows for 2.2 miles to its confluence with the main stem of Streelow Creek. Streelow Creek (exclusive of its North Fork tributary) has a drainage area of 2.76 square miles and a length of 3.15 miles from its headwaters to its confluence with Prairie Creek. At the project area, the streamflow for Streelow Creek ranges from 1-2 cubic feet per second (cfs) at 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 site is estimated to be 16,200 cfs.

Temperature and turbidity are the two primary 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 was unlogged. As soils stabilized and vegetation regrew (particularly overstory trees that provide shade to cool a stream) since logging ceased in 1964, water quality in Streelow Creek is assumed to have improved.

Floodplains and Wetlands—The floodplain of Streelow Creek is narrow because of the stream gradient and narrow channel. Prior to logging and road construction, the Streelow Creek floodplain was probably less developed but aggradation of the stream channel from eroded sediment has produced a wider floodplain. The Prairie Creek floodplain is seasonally inundated by high flows on a yearly basis. The road that is now the Streelow Creek Trail is located in the Prairie Creek floodplain. Based on the size of the existing culverts to be removed, the road is assumed to be subject to inundation by storms exceeding the 25-year event. If culverts plug with debris during a storm, the road would likely be flooded by lesser flows.

Wetlands in the project area consist of riparian zones 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 gradient, precluding the development of extensive riparian zones and wetlands. Red alder and skunk cabbage in the riparian zones are the primary obligate wetland plants in the project area.

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

Following clear-cut logging, the forest regrew without forest management practices typically employed in industrial timberlands (slash removal, re-seeding, thinning.) The project area exhibits some multi-layered canopy development, with understory vegetation and higher plant species diversity than other unmanaged second growth redwood forest in the parks.

The current vegetation away from the creeks is a dense stand of second growth redwood, Douglas-fir, and Sitka spruce. The largest redwoods are about 24 inches in diameter. Red alder have regrown along the riparian zones. The understory vegetation consists of huckleberry, salal, ferns, and other species typically found in second-growth forests in regrown clear-cuts. 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, but the project area itself is too overgrown and shady for these unwanted plants.

Fish and Wildlife— Sensitive or threatened 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*), coastrange 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 zones in the parks. Pacific giant salamander larvae (*Dicamptodon ensatus*) have been observed in the Streelow Creek and probably occur throughout perennial streams in the watershed. Adult Pacific 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 blacktail deer.

Sensitive, Threatened and Endangered Species—Botanical surveys of the project area were conducted under contracts issued by CDFG. No rare or sensitive plants were discovered in the project area.

No suitable habitat or designated critical habitat for spotted owl or marbled murrelets would be affected by the proposed action. The project would be conducted after September 15 and completed prior to February 1, so there would no noise or disturbance effects on either northern spotted owls or marbled murrelets.

Four species of anadromous salmon and trout occupy the stream 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 steelhead (*Oncorhynchus mykiss*), coastal cutthroat trout (*O. clarki*), coho salmon (*O. kisutch*), and Chinook salmon (*O. tshawytscha*). Most spawning and rearing occurs along the main stem of Streelow Creek.

Coastal cutthroat trout are native to northwestern California, inhabiting most coastal streams north of the Eel River. Adult anadromous cutthroat return to freshwater in late autumn and early winter and spawn in small streams between February and May. Cutthroat trout are often found in the summer in the Redwood Creek estuary. Anadromous coastal cutthroat trout occupy the project area are anadromous but this species is not currently listed or proposed, or a candidate species for listing, as threatened or endangered. RNSP fisheries staff suspects that a few resident, non-migratory populations of cutthroat trout inhabit Streelow Creek. The project area also is inhabited by resident rainbow trout (*O. mykiss*), the non-anadromous form of steelhead trout.

Streelow Creek contains designated critical habitat for Southern Oregon/Northern California Coast coho salmon, Coastal California Chinook salmon and Northern California steelhead. All three species are listed as threatened under the federal Endangered Species Act. Coho salmon are listed as threatened by the State of California. Reaches of streams accessible to coho and Chinook salmon in RNSP 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 still be occupied by any life stage of salmon. The three fish species and critical habitat would be adversely affected if excess sediment were delivered into Streelow Creek.

Cultural Resources—RNSP contain 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 parks, 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 parks. 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 parks.

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 RNSP 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 RNSP) 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 U.S. 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 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 1978 expansion.

A 1960s era log stringer bridge was identified and recorded in the project area. This type of structure is common in Humboldt County and is common to the northwest coast of California timber operations. The bridge is estimated to have been constructed in the 1960s during the time logging operations are known to have occurred in Streelow Creek. The bridge is not yet 50 years old and therefore does not meet eligibility criteria for the National Register of Historic Places.

Visitor Use and Experience—Streelow Creek Trail is a 2-mile-long hike-bike trail that connects the Davison Trail to Davison Road. Davison Road is a narrow, winding gravel road that runs about 4 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 3.75 miles along the base of the ocean bluffs to Fern Canyon, one of the major visitor attractions in northern Humboldt County.

Bicyclists on the Streelow Creek Trail can ride along Davison Road to Gold Bluffs Beach Road. It is possible by riding or walking a bike across the sandy beach to reach Ossagon Trail, an unpaved trail which climbs the steep bluffs and descends down to the Newton B. Drury Scenic Parkway. By riding along the parkway towards Elk Prairie, a cyclist can pick up the Davison Trail at the south end of the parkway and make a loop back to Streelow Creek Trail. Cyclists generally do not use the Ossagon Trail as part of a loop because the trail descends onto a broad sandy beach on which riding a bike is very difficult. Trailheads at Elk Meadow south of Davison Road, at the Elk Prairie Visitor Center in Prairie Creek Redwoods State Park, and along the parkway provide access for hikers.

The parkway and Ossagon Trail pass through old growth redwood forest. Davison and Streelow Creek trails traverse riparian zones through advanced second growth forests with occasional remaining old growth trees.

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 RNSP and other NPS units. Impacts to vegetation, wildlife, threatened and endangered species and cultural resources were assessed through site visits and discussions among RNSP botanists, biologists and the archeologist. Impacts on threatened and endangered species were assessed in consultation with US Fish and Wildlife Service and NOAA Fisheries personnel and review of the biological opinions issued by these agencies. Impacts on water quality, hydrology and geomorphology were determined through inspection of the project area and on-site analyses by RNSP watershed restoration geologists.

General impact analyses on fish and aquatic habitat from removal of migration barriers and associated watershed restoration are based on the impacts described in the NOAA Fisheries RGP 12 Biological Opinion for projects funded under CDFG Fisheries Restoration Grant Program.

Some of the short-term effects of culvert removal and restoration of associated logging road segments such as erosion and vegetation removal are considered to be adverse. However, these effects are unavoidable in order to remove potential threats to water quality, stream and riparian functions, and threatened fish species from the existing culverts and road segment. The short-term adverse effects on the stream system can be readily mitigated through accepted best management practices such as erosion control and timing of the project. The potential 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 establishing and expanding Redwood National Park that 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)

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. Under the proposed action, there would be temporary localized decreases in air quality from emissions on heavy equipment

working at the site and from dust during excavation. These effects would be adverse but negligible.

Cumulative Effects—Cumulative effects on air quality in the parks 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 firelines and smoke from prescribed fires and wildfire suppression, 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 fire 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 parks 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—Under the no action alternative, there would be no new 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 project-related construction effects to soils in the project area, all of which was previously disturbed by logging and road building. The road fill and soils adjacent to the stream crossings would continue to gradually erode in rain storms. The erosion rate would increase as the culverts, stream crossings and road fill degrade. Eventually, the culverts and stream crossings would fail completely, causing erosion of an estimated 2500 cubic yards of road fill that could be delivered directly into the North Fork of Streelow Creek.

Catastrophic failure of stream crossings and adjacent road segments could also lead to stream bank failures as the stream channels adjust to an influx of eroded sediment. Bank failures are a common source of slope failures in steep inner gorges such as that along a portion of the North Fork of Streelow Creek.

Gradual erosion at 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.

The proposed action would require excavation or disturbance of an estimated total of 8080 square feet (0.23 acre) of soils for construction of a pedestrian footbridge with an additional estimated 1200 square feet of disturbance associated with the excavation of the two upstream stream crossings of North Fork of Streelow Creek. These soils were previously disturbed for original road construction and timber harvest operations.

Under the proposed action, a total of 4900 cubic yards of soils would be excavated for removal of all three stream crossings and the road segment associated with the trail crossing. All these soils are either road fill or sediment that has aggraded into the stream channel. Removal of the North Fork crossing on the Streelow Creek Trail would require excavation of 1000 cubic yards to

remove the three culverts and an additional 1000 cubic yards of aggraded material in the stream channel. Excavation of soils to remove the portion of the road adjacent to the crossing would disturb an additional 2400 cubic yards and 500 cubic yards would be disturbed to excavate the upstream crossing of the North Fork side channel (350 cubic yards) and remove the log stringer bridge (150 cubic yards). The stream channels would be excavated to the level and shape of the original channel, which is determined by locating the rock armoring of the original stream bed and matching the steepness of the adjacent slopes. The excavated road fill would be moved to stable locations as close as possible to the work site and where it would not erode into the stream. Newly excavated soils would be covered with mulch obtained by grubbing vegetation from the excavation areas on the slopes and adjacent to the stream crossings.

There would be short-term effects of the proposed action on soils and topography from excavation of 4900 cubic yards of road fill from the stream crossings, stream channel, and associated road segments. The effects on soil and topography are judged to be beneficial and minor from restoration of topography in the Streelow Creek stream channel, and beneficial and moderate for reduction of erosional threat to Streelow Creek and Prairie Creek posed by failing culverts and road fill. The benefit to Streelow Creek would be greater than the benefit to Prairie Creek because the Streelow Creek channel would be directly blocked if the North Fork crossing fails and because Streelow Creek is smaller than Prairie Creek so that a given volume of soil has a proportionately greater impact on the smaller stream.

Cumulative Effects on Soils and Topography—Under the proposed action, removal of stream crossings and associated road segments in the North Fork of Streelow Creek would have no direct effect on topography and soils in other subbasins in the Redwood Creek watershed. Topography in the other subbasins of Redwood Creek would remain altered by presence of logging roads. Soils would continue to erode in unstable areas along roads in the rest of the watershed. Landslides related to the presence of untreated roads would occasionally alter topography, particularly after 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 basin. About 445 miles of roads and 3,000 miles of skid trails were included within the national park boundaries. Removal of a few hundred feet of abandoned 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 main stem 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 basin from preventing unnaturally high levels of erosion. The long-term benefit to the Redwood Creek estuary from reducing the influx of sediment would be a moderate benefit to estuary functioning because the Redwood Creek levees would continue to alter the hydrology and functioning 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-crossing would gradually degrade as these drainage structures continue to 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 crossing would fail completely, which would most likely occur during a major storm. Complete failure would release at least 2500 cubic yards of road fill directly into the North Fork of Streelow Creek. Because the

largest crossing is at the confluence of the North Fork and the main stem of Streelow Creek, failure of the crossing and associated road segment would deliver sediment almost directly into Streelow Creek. This eroded material would in turn be delivered into Prairie Creek which is located several hundred yards 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 long-term chronic turbidity would be a minor adverse effect most noticeable after rainstorms. Complete failure of the stream crossings would have a moderate to significant adverse effect on water quality in Streelow Creek and 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 erosion of sediment from excavation of 4900 cubic yards of road fill to remove culverts, adjacent road segments, and the stream crossings to expose the natural channel elements and side banks. Erosion would be reduced by working during low flow periods in September, use of silt fences and other standard best management practices for erosion control, by mulching of newly exposed soils, and by completing the project prior to the onset of the rainy season. The 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 of failing undersized culverts and from restoring the stream channel to its original configuration. 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 flood events), the benefit from removal of the stream crossings would most likely be minor. In large flood events (25 years flood events) or intense rainfall over a period of weeks, there would be moderate benefit from removal of road fill that could fail and be delivered into the creek.

The footbridge that would replace the culverts on the Streelow Creek Trail would completely span the active channel and would not constrict most flows. Removal of the log stringer bridge upstream would completely remove the constriction to the channel. These actions would have a moderate long-term benefit to the hydrology of the North Fork of Streelow Creek and a minor 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 stream channel. 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 stream crossings and restoration of the channel morphology. 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 basin.

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. The removal of stream crossings on the North Fork of 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 activities 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 causes increased surface erosion and fine sediment production and delivery, and an increased potential for stream diversions, rill and gully erosion, and road related landslides with corresponding increased in sediment production and delivery. Past timber harvest in what is now the park and outside the park on unstable slopes prior to the enactment of the state Forest Practice Rules and removal of riparian vegetation also contributed to increased erosion and sediment production. These factors led to the designation of Redwood Creek as a sediment-impaired stream by the EPA under section 303(d) of the Clean Water Act.

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% of 1400 miles of roads in the basin 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 on the North Fork of Streelow Creek would be negligible because of the small amount of sediment removed under the proposed action compared to the erosion potential remaining in the Redwood Creek watershed. A major storm would cause erosion in unrestored areas in the Redwood Creek basin and the contribution of the North Fork of Streelow Creek to improved conditions in Redwood Creek would be negligible in comparison to the magnitude of adverse effects basinwide.

Effects on Floodplains and Wetlands—Under the no action alternative, the floodplain of Streelow Creek near its confluence with Prairie Creek would continue to be altered by undersized culverts and road fill within the stream channel. When the culverts eventually fail, approximately 1000 cubic yards of road fill would be delivered directly into Streelow Creek. If the road segment fails, at least 1000 additional cubic yards would be delivered directly into Prairie Creek. This volume of sediment would move several hundred yards downstream and be delivered to Prairie Creek, where it would fill in the channel and cause the floodplain to widen (aggrade). Floodwaters would move into the floodplain on Prairie Creek, and would probably cause loss of riparian wetland vegetation, primarily red alder. Delivery of sediment to the Prairie Creek floodplain following catastrophic failure of stream crossings on Streelow Creek would be a long-term adverse effect that would vary from minor to severe, depending on the intensity of the storm and the volume of the flood flows. A storm of sufficient intensity to cause catastrophic failure of old roads on Streelow Creek would cause similar effects on other tributaries of Prairie Creek, which would cause severe damage to the floodplain through scouring 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 excavation areas from removal of about 1500 square feet of riparian vegetation, primarily red alders and understory plants. This adverse effect would be negligible because the riparian vegetation would recover in one to two growing seasons, and all the riparian vegetation present 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 of undersized drainage structures and restoration of the original stream channel. This benefit would be negligible in the short-term but minor to moderate in the long-term from prevention of future catastrophic failure of the drainage structures and road fill that could bury riparian zones and fill in the floodplain.

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 parks, and new logging roads upstream of the parks are constructed and maintained to standards in the state Forest Practice Act, there would be a long-term moderate benefits to the floodplain of Redwood Creek. Removal of stream crossings and associated road removal would have a negligible benefit to the Redwood Creek floodplain, because Prairie Creek enter 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 the more heavily logged tributaries, have been destroyed or degraded by the original logging and road construction, and the effects of road failures. Riparian zones along the main stem 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, so that the riparian zone retained most natural functions and values. The greatest benefit to riparian wetlands outside the project area relies on the effectiveness of watershed restoration at preventing erosion that would lead to landslides that could bury riparian areas and vegetation with sediment.

Road removal and landform restoration drain the isolated wetlands that form behind blocked culverts, filled stream channels, ditches with no outflow, and slumps in road fills. These ponds and puddles 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 the wetlands are not an original component of the ecosystem and have very limited values. 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 road and stream crossing failures.

Effects on Vegetation—The vegetation in the project area was previously disturbed by clear-cut logging and road building. Under both the no action alternative and the proposed action, vegetation growing along the trail would be occasionally trimmed and downed trees and limbs removed to maintain an open trail 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 would cause loss of riparian vegetation along both Streelow and Prairie Creeks. This effect would be adverse, and minor to moderate depending on the intensity of the storm that causes the failure.

Under the proposed action, approximately 10,000 square feet of vegetation that has regrown following the original disturbance from road construction and logging would be cut or grubbed for excavation of culverts, stream crossings, and adjacent road corridor. The largest trees that would be cut would be red alders and Douglas-fir less than 18 inches in diameter at breast height.

No old growth or mature conifers would be removed. The vegetation that would be removed is common in the project area. Vegetation along the trail corridor is routinely cut or trimmed to maintain an open trail 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.

Newly disturbed soils would be covered with mulch to reduce erosion. To avoid importing unwanted exotic plants, vegetation removed along the roadsides during excavation would be salvaged and replaced on the excavation sites on the slope. Revegetation would occur naturally from the seed bank 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 trees that have regrown following clear-cut logging in the 1960s. Roadside understory vegetation would be removed in conjunction with the culverts being removed and slope excavation, but most of the disturbed area is road surface that does not support vegetation or that has been routinely cleared. Road construction and maintenance have continuously disturbed all vegetation adjacent to the road corridor for many years and the entire area associated with the project site has been previously logged.

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 continue through 2010 (NPS 2006a). Restoration on about 1700 acres of second growth forests (thinning dense Douglas-fir and tan oak) in the Lost Man Creek drainage is proposed. Second growth forests along streams or in old-growth buffer zones would not be thinned. The proposed second growth management would not occur in same areas where soils and vegetation would be disturbed by watershed restoration. Outside the watershed and forest restoration project areas, logged areas of the parks would continue to recover although the recovery in some dense second growth stands that were not thinned after replanting would require centuries to reattain 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 2004). Fire road preparation includes brushing, culvert and ditch cleaning, and grading.

Effects on Wildlife—Under both no action and the 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 US 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, blacktail 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 using the trail. Overall visitation and trail use is light in comparison to other areas and consists of temporary passage along 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. Therefore, the overall adverse effect on wildlife from project-related excavation or bridge installation 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 slopes. 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.

There would be no adverse effects on northern spotted owls and marbled murrelets because there is no suitable habitat or designated critical habitat for spotted owl or marbled murrelets would be affected by the proposed action. The project would have no adverse effects on northern spotted owls or marbled murrelets from noise disturbance because the project would be conducted after September 15 and completed prior to February 1. Heavy equipment work would create noise and disturbance within one-quarter mile of murrelet habitat but would occur outside the noise restriction period.

Cumulative Effects on Threatened Birds—Timber harvest is on-going on private timberlands adjacent to the parks. 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 being operated on private lands, from helicopter logging that has occurred on private lands near the ridge top in the past few years, 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.

The total allowable incidental take authorized by the USFWS for marbled murrelets for all park projects for consultations completed by December 2005 is 5,671 acres of habitat potentially affected by noise disturbance. The NPS reported potential incidental take of 3,687 acres (64% of total allowed) in 2005. Projects for which take of murrelets due to noise disturbance was reported in 2005 were annual maintenance of facilities, roads and trails (2,110 acres in six locations under authorization originally obtained in 1998); Skunk Cabbage Trail use (59 acres under 1998 authorization); and Howland Hill Road repair (1,577 acres under 1999 authorization). Projects for which take was authorized but not reported in 2005 because no actions were taken under these authorizations are two watershed restoration projects (take originally authorized in 1998 and

2001); helicopter use for emergency access (2001 authorization); and culvert replacement on the Mill Creek and Lost Man Creek trails (2005 authorization). The Lost Man Creek watershed restoration project begun in 2006 has been authorized incidental take by the USFWS for expected adverse effects on marbled murrelets in occupied or potentially occupied nesting habitat due to degradation of 24 acres of suitable nesting habitat due to habitat modification; harassment on 2 acres of suitable habitat from heavy equipment operation during the breeding season; and harm from degradation of habitat due to the increased risk of corvid predation on 73 acres (NPS 2006b). The NPS has requested and the USFWS has authorized incidental take for operation, use, maintenance and construction of visitor facilities including campgrounds, picnic areas, trails and backcountry facilities from now through 2017 due to harm from increased corvid predation threat in occupied nesting habitat along existing and proposed trails on 11,539 acres and harassment from noise disturbance from facility operation, construction and maintenance on 3,763 acres of occupied nesting habitat (NPS 2006c, USFWS 2007).

The total allowable incidental take for northern spotted owls authorized by the USFWS for all park projects under consultations completed by December 2005 (other than the Lost Man Creek watershed restoration project) is 5,167 acres of habitat potentially affected by noise disturbance. The NPS reported potential incidental take of northern spotted owls on 775 acres (15% of total allowed) in 2005. All reported take of spotted owls in 2005 was due to noise disturbance for annual maintenance of facilities, roads and trails due to downed tree removal and brushing trails. Other sites and projects for which incidental take of marbled murrelets was reported either do not affect northern spotted owls (helicopter use, Lost Man Creek watershed restoration under the 2001 authorization) or surveys were completed to determine that no owls would be affected in these areas. The 2006-2010 Lost Man Creek watershed restoration project was determined to have negligible to minor adverse effects on spotted owls through loss or modification of suitable habitat (NPS 2006b). Approximately 118 acres (1.3%) of the total suitable owl habitat in the Lost Man Creek restoration project area would be removed by road rehabilitation activities in the home ranges of the three known owl territories that overlap the action area. An additional 82 acres of suitable owl habitat would be removed outside the known home ranges. The NPS has requested and the USFWS has authorized incidental take of northern spotted owls for operation, use, maintenance and construction of visitor facilities including campgrounds, picnic areas, trails and backcountry facilities from now through 2017 due to harassment from noise disturbance from facility operation, construction and maintenance on 2,475 acres of unsurveyed nesting and roosting habitat (NPS 2006c, USFWS 2007).

On-going projects for which consultations with the USFWS have been completed and which have been determined that the projects may affect but are not likely to adversely affect northern spotted owls or marbled murrelets are management of exotic plants throughout RNSP, fire management throughout the parks, management of Port-Orford-cedar in the northern part of the parks, and vehicle beach access (although beach access does have adverse effects on western snowy plovers and the NPS has been authorized direct take of one plover annually.) The NPS has been authorized incidental take of up to six breeding adult western snowy plovers and their broods and 15 wintering adults annually through 2017 from harassment due to disturbance from recreational facilities on park beaches.

Projects for which consultations with the USFWS have been completed but the project has not been implemented include rehabilitation of Alder Camp Road in Del Norte County, and development of visitor facilities at Freshwater Lagoon Spit. The USFWS has concurred with the NPS determination that these projects may affect but are not likely to adversely affect northern spotted owls or marbled murrelets and would not affect western snowy plovers.

Proposed projects for which consultations are underway and for which incidental take is expected to be requested in 2007 but the amount of take has not been determined include tree-clearing from 2005-6 winter storms and management of second growth forests in the South Fork of Lost Man Creek.

Effects on Threatened Fish

Three federally-listed threatened salmonids, the Southern Oregon/Northern California Coast coho salmon (*Oncorhynchus kisutch*), California Coastal Chinook salmon (*O. tshawytscha*) and the Northern California steelhead (*O. mykiss*), occupy the project area. The proposed action has the potential to affect these listed threatened fish species and their designated critical habitat. Effects on listed salmonids and their designated critical habitat have been analyzed in NOAA Fisheries' RGP 12 Biological Opinion under section 7 of the Endangered Species Act. NOAA Fisheries determined that the location and proposed timing authorized through the RGP would not affect the California Coastal Chinook salmon. NOAA Fisheries also determined that the proposed RGP is not likely to jeopardize the continued existence of the Southern Oregon/Northern California Coast coho salmon or Northern California steelhead. NOAA Fisheries anticipates that take of listed species as a result of projects authorized under the RGP will be in the nature of temporary displacement and/or reduction in feeding rates (with a possible minimal level of mortality) and will have no long-term negative effects on the survival and recovery of listed species. Multiple fish and habitat protection measures that would be applied as conditions of the Corps' RGP would minimize the level and effect of take associated with the restoration project. Best management practices typically applied to park watershed restoration and road maintenance projects would reduce the site-specific incidental take for listed fish. Appendix A lists some of the mitigation measures typically used for park watershed restoration projects. A complete list of required mitigation measures to minimize adverse effects on listed fish species from projects funded under the CDFG Fisheries Restoration Grant Program is found in the CDFG *California Salmonid Stream Habitat Restoration Manual* (Flosi *et al*, 1998).

Replacing culverts on Streelaw Creek would have long-term benefits to coho and Chinook salmon and steelhead trout and to designated critical habitat for coho and Chinook salmon. Coho salmon are also listed as threatened by the State of California. The existing three metal pipe culverts would be replaced with a pedestrian footbridge beneath which fish can pass more easily. Pedestrian footbridges are not prone to culvert failures in which holes worn from rusting and abrasion allow the stream to flow but up which fish cannot swim. Bridges also reduce the potential for streams to scour the streambed at the downstream end of the culvert which creates an abrupt drop between the streambed and culvert bottom.

Removing the culverts that are currently a fish barrier and providing fish access to the upper basin of the North Fork of Streelaw Creek would increase the amount of available habitat for several endangered anadromous fish species, as well as reducing the immediate threat to the fish from erosion of sediment if the culvert fails completely.

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 application of mitigation measures required for projects funded through the DFG Fisheries Restoration Grant Program. The short-term adverse effects would be negligible to minor.

The long-term effects on listed salmonids from the project to improve fish passage, restore portions of the watershed adjacent to the spawning streams, and reduce the threat of erosion would be beneficial and moderate.

Cumulative Effects on Fish—Anadromous fish stocks throughout the Pacific Northwest region are threatened by the cumulative impacts of livestock use, 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 1997a and 1997b).

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 salmonid 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 significant storms have deposited large amounts of sediment in Redwood Creek and degraded habitat. Erosion and hillslope mass wasting caused sedimentation of the mainstem that filled deep pools, and major flood events caused significant channel adjustments including channel widening, aggradation, and bank erosion. The resultant widened streambed and shallow riffles provide 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 drainage in Prairie Creek Redwoods State Park was negatively affected by a large influx of fine sediment in 1989 from a slope failure during construction of the U.S. Highway 101 Redwood Park Bypass. Other factors contributing to and exacerbating population declines are natural events including severe floods, extended drought and poor ocean conditions, overfishing, and the prolonged effects of past hatchery practices.

The Redwood Creek TMDL 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. Tributary water temperatures are generally suitable for salmonids but suboptimal along much of the mainstem.

Other on-going and reasonably foreseeable projects for which the NPS has prepared biological assessments and completed consultations with NMFS for potential effects to listed fish species throughout the parks include annual and periodic road maintenance (NMFS biological opinion and letter of concurrence 151422SWR02AR6347, March 2003); Lost Man Creek Watershed Restoration projects (151422SRW01AR54:BW, July 2003); fire management (NMFS biological opinion and letter of concurrence 151422SWR04AR99149:BW, January 2005); and relocation of the RNSP maintenance facility (NMFS biological opinion 151422SWR2003AR8948:BAD, October 2005). The maintenance facility project will be located outside the Redwood Creek watershed and will not have any effects on fish in the project area or in Redwood Creek but will have short-term adverse effects on juvenile coho salmon from minor habitat disturbance to replace undersized culverts with a larger arch culvert that will have long-term benefits by improving fish passage to upstream reaches of a stream.

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 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 a biological opinion and letter of concurrence 151422SWR02AR66347 issued in March 2003.

Future actions anticipated within the project area include road and trail maintenance downstream of the project area, fire suppression in case of wildfire but no planned fire management actions (fuel reduction, prescribed fire), and management of second growth forests on less than 400 acres outside riparian and old growth areas. Of these projects, trail and road maintenance is likely to have negligible to minor short-term adverse effects on listed fish if culverts are replaced.

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 parks 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 and geomorphic processes.

Based on the size, nature and duration of the 2006-2010 Lost Man Creek watershed restoration project and other planned watershed restoration actions in the parks, the NPS has determined that the proposed projects may affect and are likely to adversely affect California Coastal chinook salmon, Southern Oregon/Northern California Coasts coho salmon, and Northern California steelhead, their habitat, and Essential Fish Habitat (NPS 2006b). However, the short term adverse effects will be outweighed by the long-term benefits to the species and their habitats from the long-term reduction in sedimentation of streams in the parks.

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 adverse effects to cultural resources are anticipated from either 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.

Based on field knowledge of cultural resources throughout RNSP and the vicinity, the project area is considered to have low sensitivity for cultural resources because it was a densely forested area prior to being logged. The project area was systematically inventoried for cultural resources by contractors for CDFG. No surface evidence of cultural resources was found and it was determined that the likelihood of affecting previously unknown cultural resources would be extremely low. Under regulations of the National Register of Historic Places (36 CFR 800) this means that no historic properties are expected to 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 has evaluated the find. Resources that should be evaluated by an archeologist could include, but are not limited to concentrations of historic bottles and cans, wood, metal or ceramic artifacts, bone, flaked stone artifacts, and shellfish. In that event that such resources are encountered, the NPS would then further consult with the SHPO under standard 36 CFR 800 regulations.

Cumulative Effects on Cultural Resources

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

In addition, the proposed action (Alternative 2) would not change the treatment and/or management of archeological resources in Redwood National and State Parks. Cultural resources throughout the remainder of the Redwood National and State Parks would be unaffected.

Under the terminology of the implementing regulations of Section 106 of the National Historic Preservation Act (36 CR 800), no adverse affect to historic properties determined eligible for or listed on the National Register of Historic Places is expected from either the No Action or proposed Action.

Effects on Visitors and Visitor Experience—This project would provide an opportunity to educate and inform park visitors about the history of the national park, the effects of roads on park resources, and current efforts to remove roads and improve fish habitat in the parks and the region.

Under the no action alternative, there would be no direct effects on visitors or the visitor experience. If the Streelow Creek culvert fails catastrophically, visitors would be unable use the Streelow Creek Trail to reach Gold Bluffs Beach and Fern Canyon, two of the most visited places in RNSP, until repairs can be made. The length of time that visitors are inconvenienced would depend on when the culvert fails, but major failure during wet periods could close the trail (old road) for substantially longer than the few hours the trail would be closed under the proposed action. Under the proposed action, there would be short-term adverse effects on visitor use from the trail closure until project is complete.

Removing the present crossing and constructing a pedestrian footbridge would improve safety and visitor experience by providing an attractive bridge with a good walking-riding surface and handrails. The visitor experience would also be improved by removal of the damaged metal trash rack immediately upstream of the stream crossing.

The project would have long-term benefits to public safety and the quality of the experience of park visitors. Both the no action and the proposed action would have minor to moderate short-term adverse effects on the public from construction delays outside the primary visitor season, depending on how fast the concrete sets at the Streelow Creek site.

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 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.

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 culverts and the stream crossing, 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 parks.

Non-Impairment of Soils and Topography—Under the no action alternative, soils would continue to erode from logged slopes and abandoned roads upstream of the trail crossing. 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 parks, 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 parks that resulted from logging and road construction prior to park establishment and expansion.

Under the proposed action, 4900 cubic yards of soil would be excavated from the stream crossings, the associated road segment, and what has aggraded into the stream upstream of the trail crossing. These soils are road fill, or aggraded material that has washed downstream from logged slopes and abandoned logging roads. Therefore, excavation of soils under the proposed action would not impair or derogate park values but would reduce the overall impairment by a negligible amount.

Water Quality, Hydrology, Floodplains, and Wetlands—Under the no action alternative, there would be continued adverse effects on water quality and hydrology of the North Fork and main stem of Streelow 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 earthen stream crossing. Water quality and hydrology in Streelow 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.

Under the no action alternative, there would be adverse effects to the floodplain of Streelow Creek and the riparian wetlands associated with the Streelow Creek crossing in the event of catastrophic failure of any of the three stream crossings or adjacent abandoned roads. If the culverts fail catastrophically, 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. The capacity and orientation of the drainage system upslope of the creek would not be improved under the no action alternative. In periods of heavy rainfall, drainage from the road ditch would enter the creek directly and deposit sediments washed down the ditch, which would increase the volume of sediment delivered into the creek. Therefore, the no action alternative could substantially impair water quality, hydrology, the floodplain and riparian wetlands associated with the North Fork and the main stem of Streelow Creek in the event of a catastrophic failure of a stream crossing or the associated road segments.

Under the proposed action, there would be unavoidable localized short-term adverse effects on water quality of the creek and associated riparian wetlands from removal of the stream crossings, the associated road segment and aggraded sediment in the stream channel. There would be a

long-term benefit to water quality, hydrology, the floodplain and riparian wetlands from removal of stream crossings, aggraded sediment and the associated road segment that alter the original drainage patterns and pose an erosional threat. Therefore, the proposed action would not impair water quality, hydrology, the floodplain and riparian wetlands in the North Fork and the main stem of Streelow Creek and would reduce the potential for impairment to these resources related to the stream crossings and the associated roads.

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

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

Under the proposed action, there would be adverse effects on vegetation from removal of small numbers of small trees and understory vegetation for removal of the stream crossings and associated road segment. The vegetation has regrown following original disturbance from clear-cut logging and road construction. The vegetation is common in the park and routinely cut for annual trail and road maintenance. The alders would re-establish within five years and the understory vegetation by the next growing season. No large mature conifers would be removed. Therefore, vegetation in the project area would not be impaired under the proposed action.

Terrestrial Wildlife and Aquatic Biota—Under the no action alternative, there would be no direct effects on terrestrial wildlife or aquatic biota. Aquatic biota would suffer indirect adverse effects in the event of catastrophic failure of any of the stream crossings or associated road segments. In the event of catastrophic failure, aquatic biota in the downstream reaches of the North Fork or the main stem of Streelow Creek could be impaired if the stream channel is completely buried with sediment. Catastrophic failure of the Streelow Creek stream crossings would likely be associated with widespread road and stream crossing failures throughout the parks, leading to impairment of aquatic biota over a larger area than the lower reaches of Streelow Creek. The no action alternative has the potential for localized impairment of aquatic resources in Streelow Creek.

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 parks. Individuals of larger more mobile wildlife would move away from the work area during project work and would move back into the area when people and equipment are not working at night and when the project is done. None of the affected animals are considered sensitive by any agency. Therefore, the proposed action would not impair wildlife resources.

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 the stream crossings that block free movement upstream of the crossings because the crossings constrict the stream channel. In the event of failure of the stream crossings or the associated road segments, there could be direct adverse effects on fish should failure occur 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 stream crossing failure would be destroyed, which would be considered an impairment of the fish resources of the North Fork of Streelow Creek or the main stem below the North Fork crossing. Catastrophic failure of the Streelow Creek stream crossings would likely be associated with widespread road and stream crossing failures throughout the parks, leading to impairment of designated critical habitat over a larger area than the lower reaches of Streelow Creek. Depending on the timing of a storm large enough to cause catastrophic failure of the stream crossings, there could be direct 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 other streams in the park.

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 Biological Opinion for RGP 12 as excerpted from the CDFG *California Salmonid Stream Habitat Restoration Manual* would be used to capture and move juveniles out of the immediate work area.

Excavation of sediment from the stream channel and excavation to remove the culverts and log stringer bridge would directly affect designated critical habitat in the short-term by increasing turbidity from mobilization of sediment but would have a long-term benefit from restoration of the stream channels to their original configuration and removal of the erosional threat posed by the stream crossings, the associated road segments and the aggraded fine sediments that reduce the depth of the stream and cover spawning gravels. 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 increased sediment (reduced water quality) 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 of the stream channel to allow passage for adult fish to upstream spawning habitat, from reduction of the erosional threat posed by the stream crossings and associated road segment, and from the removal of 1000 cubic yards of aggraded sediment within designated critical habitat has been determined by NOAA Fisheries and CDFG to outweigh the short-term adverse effects of excavation within the stream channel. 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.

Cultural Resources—There are no significant cultural resources in the project area. Therefore, cultural resources would not be impaired.

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Appendix 1- 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 (NMFS 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's *Water Drafting Specifications* (NMFS 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 from 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.

Appendix 2—Best Management Practices to Minimize Project Effects on Fish

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.