



U.S. Highway 101 Lake Crescent and East Beach Road Rehabilitation Environmental Assessment March 2016



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How to Comment on this Environmental Assessment

This EA is being made available to the public, federal, state and local agencies and organizations through press releases distributed to a wide variety of news media, direct mailing, placement on park websites and announcements in press releases as well as in some local public libraries and other public places.

Copies of the document may be obtained from PEPC or Olympic National Park:

Internet: <http://parkplanning.nps.gov/olymp> (PEPC Project Number 184701)

In addition, written comments will be accepted at the above or following locations:

Email: olymp_information@nps.gov

Fax: (360) 565-3015

Mail:

Olympic National Park
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Port Angeles, Washington 98362-9798

Phone: (360) 565-3130

Note to Reviewers: Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you can ask the NPS in your comment to withhold your personal identifying information from public review, the NPS cannot guarantee that it will be able to do so.

Responses to substantive comments on the EA will be addressed in the proposed Finding of No Significant Impact (FONSI) or will be used to prepare an Environmental Impact Statement (EIS) (if warranted).

Note: For more information about specific agency and staff consultation, see Chapter V: *Consultation and Coordination*, List of Persons and Agencies Consulted / Preparers.

Chapter I. Purpose of and Need for Action

This chapter identifies the purpose and need and introduces Olympic National Park, the project area, and the planning background for the project. It also includes “Impact Topics,” which describes the potentially affected resources and laws and/or policy relating to their inclusion in the Environmental Assessment (EA). Impact Topics also identifies those resources that have been dismissed from further analysis because they have no or negligible to minor impacts.

A. Introduction

Olympic National Park is located on the Olympic Peninsula in Washington State. The park protects nearly one million acres of glacier-capped mountains, Pacific coast and old-growth temperate rain forest.

This environmental assessment examines the environmental impacts associated with the proposal to rehabilitate 12.3 miles of U.S. Highway 101 along Lake Crescent within Olympic National Park and approximately 4.0 miles of East Beach Road. Lake Crescent is approximately 18 miles west of Port Angeles and 25 miles northeast of Forks. This environment assessment was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and the National Park Service Director’s Order (DO)-12 (Conservation Planning, Environmental Impact Analysis, and Decision-Making) (2004, 2015).

NEPA requires federal agencies to fully consider the impacts of proposals that would affect the human environment prior to deciding to take action. NEPA also requires federal agencies to involve the interested and affected public in the decision-making process.

An interdisciplinary team comprised of NPS and FHWA staff, including engineers, landscape architects, maintenance and natural and cultural resources professionals determined the purpose and need for the project and identified the likely beneficial and adverse effects of the proposed actions compared to existing conditions as documented herein. Based on this information, the NPS has prepared this environmental assessment.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS Management Policies (The Guide to Managing the National Park System) (NPS 2006) states that while the NPS has discretion to allow adverse impacts, NPS managers must always seek ways to avoid, or to minimize adverse impacts on park resources and values to the greatest extent practicable (NPS 2006: 1.4.3). The conclusions regarding impacts to park resources and values that are reached during the NEPA process are used by NPS managers when making decisions about NPS-administered resources, including when assessing whether or not an action would result in impairment to park resources.

A. Purpose and Need

The purpose of this project is to rehabilitate 12.3 miles of Highway 101 adjacent to Lake Crescent and 4.0 miles of East Beach Road to address safety and long-term maintenance concerns. Coupled with the rehabilitation of U.S. Highway 101, a Clallam transit shelter is proposed near Barnes Point (Figure 1).

There is a mix of public recreational, local commuter, and commercial (primarily logging truck) traffic on U.S. Highway 101 in the park. Highway 101 has substandard and/or failing guardrail, roadside hazards such as missing drop inlet grates, rock fall hazards, and poor pavement conditions (potholes, edge failures, and poor surfacing). Rehabilitation is needed to improve subsurface pavement conditions, apply new pavement, stabilize cut and fill slopes, improve drainage, improve and replace guardrails, mitigate rockfall hazards and improve intersections while protecting natural, cultural and recreational resources within Olympic National Park.

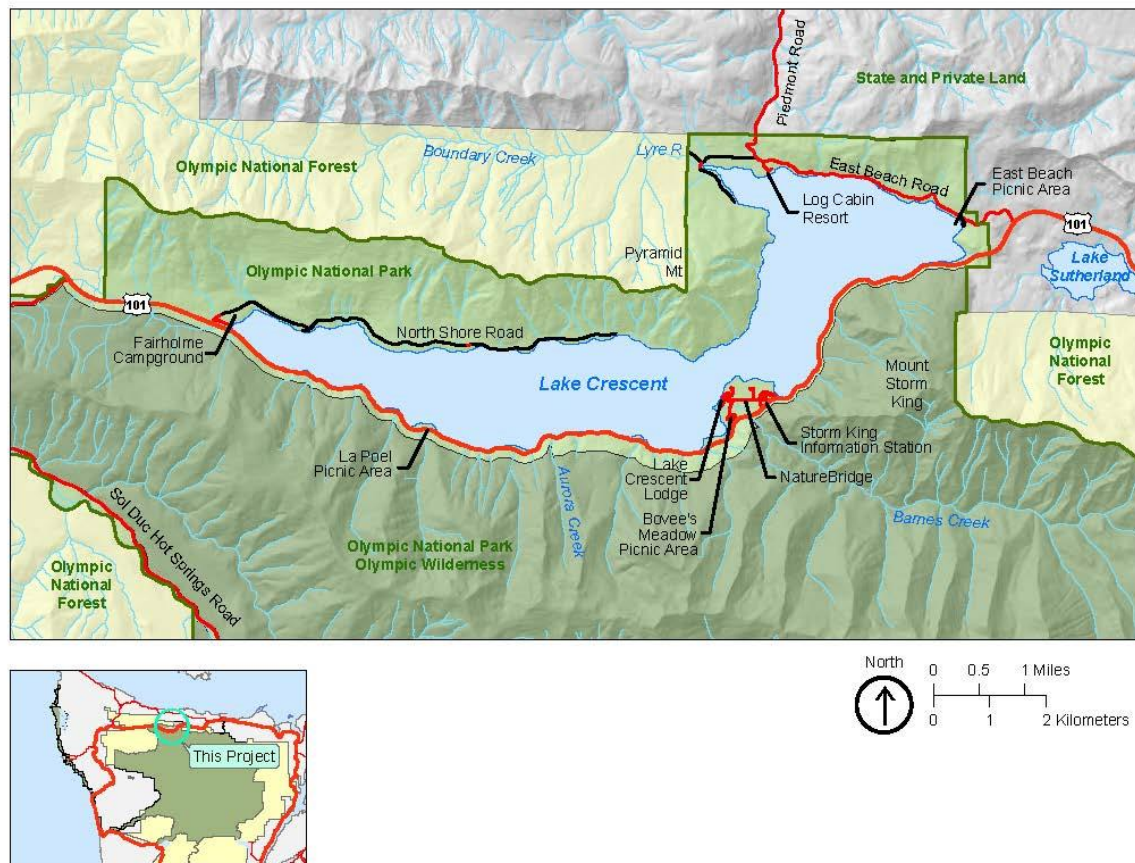


Figure 1: Project Location Map

A transit stop is located at Barnes Point but does not have facilities for pedestrians or bicyclists waiting for the bus. As a result, Clallam Transit and the Federal Lands Access Program have identified the need for bus shelters at this location.

East Beach Road is a very narrow road primarily used for travel on the north side of Lake Crescent, including for access to park lands at the East Beach Picnic Area and Log Cabin Resort as well as for access to private cabins on that side of Lake Crescent. At Log Cabin Resort, the road divides with East Beach Road continuing east toward the Lyre River, providing access to the Spruce Railroad Trail, and Joyce Piedmont Road traveling north toward the town of Joyce. Rehabilitation is needed to improve pavement conditions and safety along the roadway. The paved topwidth of the road ranges from 16-21 feet. It has no centerline striping, limited shoulders, blind curves and multiple residential driveways that descend steeply to Lake Crescent. There are breaks where the road moves away from the lake and the hillside, but it is largely characterized by its tight fit between existing features.

B. Decision to be Made

This Environmental Assessment (EA), which evaluates impacts of the proposed project on natural, cultural and socioeconomic resources, visitor use and experience and park operations, will be used to help the NPS Pacific West Regional Director based on a recommendation from the Superintendent of Olympic National Park make a decision about whether to rehabilitate U.S. Highway 101 and East Beach Road along Lake Crescent in Olympic National Park and whether to add a Clallam Transit shelter on U.S.

Highway 101. The decision would be documented in the proposed Finding of No Significant Impact (FONSI) for this EA. The EA will also be used by the Federal Highway Administration, as a cooperating agency, to prepare a NEPA decision document supporting their prospective decision to construct and manage the rehabilitation projects.

Should the EA reveal significant impacts on park resources from the project, an Environmental Impact Statement and Record of Decision would be prepared.

C. Background

U.S. Highway 101

U.S. Highway 101 is the main artery for travel between the eastern and western sides of the Olympic Peninsula. The highway extends from southern California to the Olympic Peninsula. The highway passes through Olympic National Park along Lake Crescent and provides access to some of the more popular and heavily visited areas in the park. In 2010, the annual traffic count for this route was 465,000 vehicles, based on a counter located at the east end of Lake Crescent that captured westbound traffic. Peak traffic reaching 70,000 per month occurs between June and September. Part of Highway 101 around the Olympic Peninsula (from Olympia to near Ilwaco -- Chinook) has been designated as part of the Pacific Coast National Scenic Byway by the Federal Highway Administration (FHWA), and the segment along the Lake Crescent shoreline is considered among the most scenic segments on the byway.

Since Highway 101 is a through route, the road serves not only park visitors, but also commercial users (including heavy logging truck traffic), and local commuter and non-commuter traffic. Most of the visitor facilities at Lake Crescent are located at the Barnes Point Area, which is accessed from U.S. Highway 101. Facilities at Barnes Point include Lake Crescent Lodge, the Storm King Ranger Station (including a boat launch and dock), Nature Bridge Environmental Education Center and the Bovees Meadow day use/beach area. The Fairholme area is located at the west end of Lake Crescent, and includes an 87-site campground, boat launch, and store with boat dock. Approximately 75 percent of the park's visitors use this road to access facilities at Lake Crescent or the western side of the Olympic Peninsula. This route serves as the only access to the south side of Lake Crescent, including park-related facilities at either end. There is no feasible alternative route to access the facilities on the south side of Lake Crescent; however there is an alternate route around the lake that has previously been used when the road has been closed.

The Lake Crescent stretch of Highway 101 is considered particularly dangerous given its current physical deterioration in an area that receives approximately sixty inches of precipitation annually (FHWA 2014).



Figure 2: U.S. Highway 101

Between 2006 and October 2013, there were 127 documented motor vehicle accidents on this stretch of highway. Since then, Clallam County has documented another two non-fatal accidents. None of the incidents were fatal, but seven resulted in serious bodily injuries. Most accidents were minor incidents involving loss of control by the driver that resulted in vehicle damage. In the early 1990s, the park reduced the speed limit to 35 mph. Regular patrols of the road occur to enforce this speed limit in an attempt to reduce the accident rate. Speed reduction alone, however, cannot address the conditions contributing to an increasingly unsafe roadway.

Highway 101 through Olympic National Park is currently maintained through a cooperative agreement between the park and the Washington State Department of Transportation (WSDOT). Because the road is within Olympic National Park, proposed rehabilitation would be planned and managed in cooperation with the Federal Highway Administration (FHWA).

According to FHWA, the park and WSDOT, over the past 10 years several small projects have been completed along the highway to repair or preserve the roadway. These projects have included rock fall mitigation (scaling and rock bolting), bank stabilization (riprap placement), pavement patching, and sub-excavation of numerous problem areas within the roadway, among other projects. A chip seal treatment was applied in 2010, and although it was successful in sealing the road, the chips have peeled off on numerous sections of road. This was partially due to improper application by the contractor, and partially due to snow-plowing the following winter. Because of wheel path rutting and a non-level riding surface, the plow blade chatters along the top of the ruts, removing the chip coating. Consequently, the road is unevenly plowed and often may be more slippery in the wheel paths (FHWA 2014).

Despite the projects that have occurred to fix some problems on the roadway, increasing maintenance needs mean that the roadway is in need of rehabilitation to address the additional problems noted above. Until then, the park would continue to work with WSDOT to maintain the roadway and pavement in the best possible condition.

U.S. Highway 101 along Lake Crescent last underwent rehabilitation in the 1980s. In the 1981 Environmental Assessment, the National Park Service, in conjunction with the Federal Highway Administration, noted that improvements to increase public safety along the south shore of Lake Crescent included:

- upgrading guardrail,
- realigning hazardous curves,
- widening the roadway (to 28-feet) where possible by paving,
- constructing gabion retaining walls (4,400 feet /22 walls), and
- providing safe turnouts and passing lanes (NPS DSC 1981 and NPS DSC 1981a 21).

In addition, a pair of 36-inch elliptical culverts were installed at Eagle Creek, and box culverts at Cross Creek, Aurora Creek and Smith Creek, as well as near Barnes Point, were also enlarged (NPS DSC 1981a: 21). Slope modifications to widen the road were estimated at 468,000 square feet (10.74 acres).

Barnes Point Transit Stop

Currently Clallam Transit buses stop alongside U.S. Highway 101 adjacent to Barnes Point. Although there are wide turnouts, that are long enough to allow buses to pull safely onto the roadway after stopping, these are unpaved and there are no shelters or access trails for pedestrians or cyclists waiting for the bus. Prior to realignment of the roadway out of the Barnes Point area, buses formerly stopped within the developed area to pick up passengers.

East Beach Road

East Beach Road is a Clallam County Road within Olympic National Park constructed between 1911 and 1925. It is approximately three miles long and runs immediately adjacent to Lake Crescent with private residents on one side and an over-steepened hillside on the other. The proposed project is eligible to receive funding under the Federal Lands Access Program pending an agreement with Clallam County to assume full maintenance responsibilities for this portion of the road. Maintenance normally consists of ditch cleaning, drainage improvement, signage, striping, guardrail repairs, overlays, and patching in spot locations. Traffic volumes range from 744 Average Daily Traffic (ADT) near the east end of the project to 488 ADT near the west end of the project.

D. Park Purpose and Significance

Olympic National Park Purpose

Olympic National Park was “set apart as a public park for the benefit and enjoyment of the people” (35 Statute 2247, June 29, 1938). According to House Report 2247 (April 1938), the park purpose is to preserve for the benefit, use, and enjoyment of the people, the finest sample of primeval forests of Sitka spruce, western hemlock, Douglas fir, and western red cedar in the entire United States; to provide suitable winter range and permanent protection for the herds of native Roosevelt elk and other wildlife indigenous to the area; to conserve and render available to the people, for recreational use, this outstanding mountainous country, containing numerous glaciers and perpetual snow fields, and a portion of the surrounding verdant forests together with a narrow strip along the beautiful Washington coast.

Olympic National Park Significance

- Olympic National Park protects several distinctly different and relatively pristine ecosystems, ranging from approximately 70 miles of wild Pacific coast and islands, through densely forested lowlands, to the glacier-crowned Olympic Mountains.
- The ecosystems protected within Olympic National Park contain a unique array of habitats and life forms, resulting from thousands of years of geographic isolation, along with extreme gradients of elevation, temperature, and precipitation. At least 16 kinds of animals and 8 kinds of plants on the Olympic Peninsula exist nowhere else in the world.
- Olympic National Park contains some of the last remaining undisturbed, contiguous aquatic habitat throughout the range of several west coast fish species. The park protects 12 major river basins, more than 3,500 miles of rivers and streams within 13 watersheds, more than 300 high mountain lakes, and two large lowland lakes. The park also supports more than 70 unique stocks of Pacific salmonids, 29 native freshwater fish species, and one endemic fish species.
- Olympic National Park protects the primeval character of one of the largest wilderness areas in the contiguous United States.
- Olympic National Park protects some of the finest remaining stands of old-growth temperate rain forest in the United States. These forests of ancient and immense trees provide habitat for dozens of smaller plants and animals, including important habitat for a number of threatened species.
- The Olympic rocky intertidal community is considered one of the most complex and diverse shoreline communities in the United States. Olympic National Park protects about 1,400 square miles of the intertidal, island, and shoreline habitat, and when combined with the neighboring
- Olympic Coast National Marine Sanctuary and U.S. Fish and Wildlife Service Washington Islands National Wildlife Refuge Complex, a total of 3,600 square miles of intertidal, island, and ocean habitats is protected.
- Olympic National Park protects the largest population of Roosevelt elk in its natural environment in the world. Decades of protection from human harvest and habitat manipulation have sustained not only high densities of elk, but also preserved the natural composition, social structure, and dynamics of this unique coastal form of elk found nowhere else in the world.
- Olympic National Park protects important cultural resources with regional and national significance, including more than 650 archeological sites, hundreds of ethnographic sites, 31 cultural landscapes, and 16 historic districts. Within the park boundaries, 128 historic structures are on the List of Classified Structures.

E. Impact Topics

Impact topics for this plan have been identified on the basis of federal laws, regulations and executive orders, Management Policies (NPS 2006) and NPS and partner knowledge of resources at Olympic National Park. Specific impact topics were developed to address potential natural, cultural, recreational and social impacts that might result from the proposed alternatives as identified by the public, NPS, and other agencies, and to address federal laws, regulations and executive orders, and NPS policy. This

information will be used to analyze impacts against the current conditions within the project area in the *Environmental Consequences* chapter.

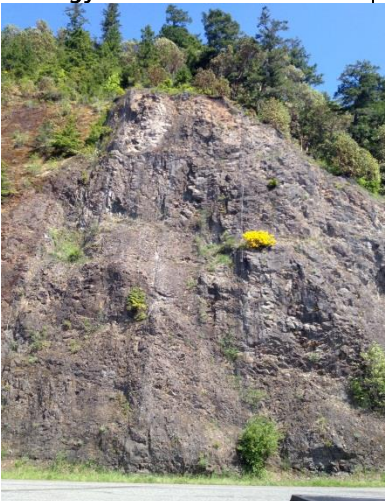
This section of the EA also provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area, or
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be no measurable effects from the proposal, and there is little controversy on the subject or reason to otherwise include the topic.

1. Impact Topics Retained For Further Analysis

Impacts of the alternatives on the following topics are presented in this EA: geology/soils, soundscapes and the acoustic environment, water resources (hydrology, water quality, and wetlands), vegetation, fish and wildlife, special status species, archeological resources and historic structures, visitor experience (access and transportation [including for gateway communities], visitor use opportunities, and interpretation and education), human health and safety, park operations and socioeconomics. Table 1 gives a brief explanation of why these impact topics are included in the analysis.

Table 1: Impact Topics Retained for Analysis

Impact Topic	Need for Consideration	Reason this Impact Topic is Retained
Geology/Soils  Portion of Rock Scaling Site	The NPS will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue (NPS 2006: 4.8.2). The NPS will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources (NPS 2006: 4.8.2.4).	Rehabilitation of U.S. Highway 101 and East Beach Road would require excavation to improve the road substrate, replace culverts, and to construct walls, among other actions. This would displace and disturb soils, primarily in the footprint of the existing roadway. Soils may also be disturbed and compacted to access the construction area and alongside the road in the road prism (cut-slope to fill-slope). Because much of U.S. Highway 101 is constructed on bedrock or is close to bedrock, including cliffs, geological hazards, including the potential for rock fall and slides would continue (see Human Health and Safety).
Soundscapes	In accordance with <i>Management Policies</i> (NPS 2006) and Director's Order-47 <i>Sound Preservation and Noise Management</i>, an important component of the National Park Service's mission is the preservation of natural soundscapes associated with national park units (NPS 2006). In the park, natural soundscapes exist in the absence of human-caused sound. (Highway 101 however is a highly modified environment.) The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for	Because U.S. Highway 101 is adjacent to bedrock cliffs and the flat landscape of Lake Crescent, intense use by logging trucks and other large vehicles has created a very loud ambient noise environment. In contrast, East Beach Road is much quieter. During construction, human-caused sounds would add to the noise generated by the roadway from construction activities, equipment and additional traffic.

	transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units, including within each park unit, and is often greater in developed areas than undeveloped areas.	
Water Resources: Hydrology and Streamflow Characteristics	<i>Management Policies</i> (NPS 2006) provides direction for the preservation, use, and quality of water in national parks.	The proposed 12.3 mile section of Highway 101 to be rehabilitated and East Beach Road are adjacent to glacial Lake Crescent. Numerous intermittent and several perennial streams now cross underneath Highway 101 toward Lake Crescent, while numerous intermittent streams cross under East Beach Road.
Water Resources: Water Quality	The 1972 Federal Water Pollution Control Act, as amended by the Clean Water Act (CWA) of 1977, is a national policy to restore and maintain the chemical, physical, and biological integrity of the nation's waters, to enhance the quality of water resources, and to prevent, control, and abate water pollution. Implementation of the Clean Water Act (CWA) protects water quality. The purpose of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The U.S. Army Corps of Engineers evaluates federal actions that result in potential degradation of waters of the United States and issues permits for these actions consistent with the CWA (Section 404). The EPA or its designee – the states – reviews permits and actions under Section 401 (water quality certification).	Pristine water quality is an intrinsic value of the park, which is important to maintain for a variety of beneficial uses, including for freshwater fish and invertebrate habitat in Lake Crescent. Rehabilitation of the road would require a variety of in-water and close-to water work to improve and to place riprap along the shoreline of Lake Crescent as well as to replace culverts to improve drainage and fish, sediment and amphibian passage (where applicable) along the length of the roadways. Replacement of culverts and placement of riprap could result in sedimentation of waterways and therefore require best management practices and mitigation measures to be implemented.
Water Resources: Wetlands  Waterfall Near the Eastern End of U.S. Highway 101	The Service will (1) provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; (2) preserve and enhance the natural and beneficial values of wetlands; and (3) avoid direct and indirect support of new construction in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands (NPS 2006: 4.6.5). Executive Order 11990 <i>Protection of Wetlands</i> requires federal agencies to avoid, where possible, adversely impacting wetlands. The CWA (§404) authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge or dredged or fill material or excavation within waters of the United	The project area contains numerous small wetlands, primarily associated with perennial and intermittent streams that cross Highway 101 and East Beach Road via culverts. This topic has been retained to ensure that mitigation measures are included to avoid or minimize impacts.

	States. Depending on the extent of impacts, proposed actions that have the potential to adversely impact wetlands must be addressed in a statement of findings for wetlands (DO 77-1 <i>Wetlands Protection</i>).	
Vegetation	The National Park Service will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems. . .The Service will successfully maintain native plants and animals by: • preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur; • restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and • minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them (NPS 2006: 4.4.1).	The shoreline of Lake Crescent, which comprises much of the project area, contains numerous old-growth trees, shrubs and forbs as well as a variety of ferns and mosses. Although the projects have been designed to avoid impacts to old-growth trees, some vegetation would be removed associated with rehabilitation of the roadways to improve drainage and to fix pavement subsidence and other problems. In addition, there are numerous nonnative invasive species that have been documented along the roadway. Preventing migration of these into new areas and containing existing infestations is an important planning consideration for the projects.
Fish and Wildlife	See Vegetation for key considerations identified in Management Policies (NPS 2006). Approximately 66 mammals, 4 reptiles, 13 amphibians, 260 birds, 24 freshwater fish species, 58 marine fish species (including 15 anadromous species), and an unknown number of invertebrates, including insects, are known to inhabit the park. There are also two species of trout endemic to Lake Crescent. Lake Crescent also contains several species of fish, as well as invertebrates, such as freshwater mussels and crayfish. Natural areas adjacent to Lake Crescent are also used by mammals, birds and fish. Habitat for bald eagles, deer, and other wildlife is present in the area.	Much of the project area is comprised of the U.S. Highway 101 roadway and East Beach Road. Highway 101 is adjacent to Lake Crescent. Because of the vegetation alongside the road, some wildlife species, such as deer may be attracted to this area. Between the road and the lake numerous areas have been ripped to stabilize the road and have affected fish and wildlife habitat. Although the project would be designed to avoid impacts during sensitive seasons for fish and wildlife species, including Beardslee and crescenti trout, mitigation measures are necessary to ensure this.
Special Status Species  Beardslee Rainbow Trout	The Endangered Species Act of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, <i>Management Policies</i> (NPS 2006) and Director's Order-77 <i>Natural Resources</i>	Among the special status species that could be affected by the proposed rehabilitation include water lobelia, bald eagles and marbled murrelets. Because the proposed project may affect federally-listed species, consultation with the USFWS is necessary.

	<i>Management</i> (including the Handbook) require the NPS to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006). For the purposes of this analysis, the U.S. Fish and Wildlife Service and the Washington Department of Fish and Wildlife were contacted to ensure that the park list of federally- and state-listed species for the project area is complete. Although bald eagles are no longer a federally-listed species, they are protected under the Migratory Bird Treaty Act which makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, they are protected under the Bald and Golden Eagle Protection Act.	
Archeological Resources and Historic Structures	Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment in the consultation process. The term "historic properties" is defined as any site, district, building, structure, or object eligible or listed in the National Register of Historic Places, which is the nation's inventory of historic places and the national repository of documentation on property types and their significance. "Historic structures" refers to both historic and prehistoric structures, which are defined as features that shelter any form of human habitation or activity. The National Historic Preservation Act and <i>Management Policies</i> (NPS 2006) affirm a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. NPS Director's Order-28B <i>Archeology</i> also calls for preservation and research associated with archeological resources.	The project has been designed to avoid impacts to archeological resources and historic structures. Because excavation would occur, there is the potential to affect previously unidentified archeological resources. Therefore mitigation measures are necessary to minimize this potential.
Visitor Experience: Access and Transportation / Gateway Communities	The enjoyment of park resources and values is part of the fundamental purpose of all park units (NPS 2006). The NPS is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. The NPS will continue to provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative	The proposed rehabilitation has the potential to disrupt traffic along a portion of a major through road within Olympic National Park. During construction, traffic could be delayed periodically on both U.S. Highway 101 and East Beach Road. Design options are being considered that would reduce overall impacts on gateway

	natural and cultural resources found in the parks.	communities, including residents who commute using U.S. Highway 101 along Lake Crescent. The improved roadway will ensure that the route remains available. A proposed Clallam County transit stop has also been integrated into the project.
Visitor Experience: Visitor Use Opportunities  Marymere Falls / Lake Crescent Lodge Trail Junction	Many different types of uses take place in national park system units. Some of those uses are carried out by the National Park Service, but many more are carried out by park visitors, permittees, lessees, and licensees. The 1916 Organic Act, which created the National Park Service, directs the Service to conserve park resources “unimpaired” for the enjoyment of future generations. The 1970 National Park System General Authorities Act, as amended in 1978, prohibits the Service from allowing any activities that would cause derogation of the values and purposes for which the parks have been established (except as directly and specifically provided by Congress). Taken together, these two laws establish for NPS managers (1) a strict mandate to protect park resources and values; (2) a responsibility to actively manage all park uses; and (3) when necessary, an obligation to regulate their amount, kind, time, and place in such a way that future generations can enjoy, learn, and be inspired by park resources and values and appreciate their national significance in as good or better condition than the generation that preceded them (NPS 2006: 8.1). A variety of visitor use opportunities are available via U.S. Highway 101 and East Beach Road in the park.	Although existing visitor use opportunities would be retained, depending on the alternative selected there may be effects on visitor use opportunities, including opportunities during construction to explore areas accessed off of U.S. Highway 101 and East Beach Road, such as Barnes Point and Log Cabin Resort. With rehabilitation of the roadway, visitors would find improved conditions when traveling through the park. Among the improvements associated with the roadway would include evaluation of and changes to pullouts.
Visitor Experience: Interpretation	National parks are among the most remarkable places in America for recreation, learning, and inspiration. Interpretive programs are the methods the Service uses to connect people to their parks, with opportunities for all visitors to form their own intellectual, emotional, and physical connections to the meanings and values found in the parks’ stories. Facilitating those opportunities through effective interpretive and educational programs will encourage the development of a personal stewardship ethic and broaden public support for preserving and protecting park resources so that they may be enjoyed by present and future generations (NPS 2006:7.0). Current interpretive information at Barnes Point highlights the formation of Lake	Proposed rehabilitation of the road includes opportunities to improve interpretation at Barnes Point.

	Crescent and offers a safe place from which to view the opposite side of the lake.	
Human Health and Safety  Missing Drop Inlet Grate	While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessioners, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees (NPS 2006: 8.2.5.1)	Roadway hazards, including from weather conditions and shading of the road combined with rock fall hazards are prevalent along U.S. Highway 101 on its 10.3-mile stretch from East Beach Road to Fairholme. In some areas, the smoothness of the road combined with shading contributes to icy conditions in winter. The road is also narrow and winding and in some areas, there are few places to pull-off and/or to pass. The presence of vegetation attractive to species, such as deer, along the roadway also contributes to potential hazards. Previous concerns with speed along the roadway were addressed in past projects.
Park Operations	Impacts to park operations are often considered in environmental documents to disclose the degree to which proposed actions would change park management strategies and methods and what additional costs (including staffing) are associated with the proposal.	Because the project is for rehabilitation of an existing roadway and does not include new facilities (aside from the proposed transit shelter at Barnes Point) or new commitments to manage resources, the project would not appreciably affect park operations. Although Highway 101 maintenance would be reduced following rehabilitation, maintenance would continue to occur.
Socioeconomics	Management Policies (NPS 2006) provides direction for protection of lands and resources within park units, acquisition of nonfederal lands that are within park units, and cooperation with agencies, tribes, and private property owners to provide appropriate protection measures. Land use refers to the general characteristics of how land is allocated among various administrative, preservation, recreational, and development needs.	Implementation of the proposed action could have an impact on local or regional economies, depending on the extent of construction and whether closures would occur. The area could also experience a temporary increase in employment opportunities for the construction workforce and revenues for local businesses and governments generated from these additional construction activities and workers.

2. Impact Topics Dismissed from Further Analysis

The following topics were eliminated from detailed study because there would be no potential impacts or only negligible impacts would be expected: air quality, water quantity, floodplains, marine/estuarine resources, cultural landscapes, ethnographic resources, museum collections, lightscapes, energy use, land use, urban quality, Indian trust resources; wild and scenic rivers, environmental justice, prime and unique farmlands, and sacred sites. Table 2 gives a brief explanation of why these impact topics were dismissed from further analysis.

Table 2: Impact Topics Dismissed from Further Analysis

Impact Topic	Need for Consideration	Reason for Dismissal
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Land Use/ Topography	Projects often affect land use by changing the primary characteristics of an area from one use to another and/or by altering the topography of an area. The portion of U.S. Highway 101 through the park is also part of a National Scenic Byway that extends to Olympia, Washington via the Olympic Peninsula.	Rehabilitation of U.S. Highway 101 and East Beach Road would be in an area that does not contain significant topographic features and in an area that has been previously disturbed by past construction of the road. The areas would continue to be used for the roads. No change in land use would occur. Therefore this topic has been dismissed from further consideration.
Air Quality	The Clean Air Act of 1963 (42 U.S.C. 7401 <i>et seq.</i>) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Under the Clean Air Act federal land managers have an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts (EPA 2000). Olympic National Park is designated as a Class I area as defined by the Clean Air Act, as amended. All areas immediately surrounding the park are considered Class II areas. Class I areas are afforded the highest degree of protection under the Clean Air Act. This designation allows very little additional deterioration of air quality. Protecting the overall park visibility and impacts on the views that are most important to park visitors is a management concern. Pristine air quality is important to the visitor experience because it allows the long-range scenic views of the Olympic Mountains. Air quality is also important for human health and the preservation of natural and cultural resources. A visibility camera documented daily conditions at Lake Crescent from 1985 to 1991 and from 2003 - present (NPS PWR 2008: 173).	Construction activities such as hauling materials and operating heavy equipment could result in temporary increases of vehicle exhaust, emissions, and fugitive dust in the general project area. Any exhaust, emissions, and fugitive dust generated from construction activities would be temporary and localized and would likely dissipate rapidly because air stagnation at Olympic National Park is rare. Although the projects could result in negligible degradation of local air quality, such effects would be temporary, lasting only as long as construction. In addition, an existing area in Port Angeles would be used for the batch plant production of the asphaltic concrete overlay. As a result, the Class I air quality designation for Olympic National Park would not be affected by the proposal. Because there would be negligible effects on air quality, this topic has been dismissed from further analysis.
Water Quantity	See Water Resources section in Table 1.	Minimal, short-term use of water during construction (for concrete mixing, dust abatement, etc.) would have negligible impacts. Water used in the project would be from an area approved in advance by the park and would use filters to prevent unintended impacts to aquatic species.
Floodplains	Executive Order 11988 <i>Floodplain Management</i> requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under 2006 <i>Management Policies</i> and Director's Order 77-2 <i>Floodplain Management</i> will strive to preserve	Proposed actions would not involve filling or modification of the ground surface such that people or structures would be exposed to flooding. There would be no permanent occupancy or direct or indirect modification of floodplains. The proposed actions would not adversely affect the functions of a floodplain or

	floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2 <i>Floodplain Management</i>, certain construction within a 100-year floodplain requires preparation of a statement of findings for floodplains. Floodplains are areas of low-lying land that are subject to inundation by the lateral overflow of waters from rivers or lakes with which they are associated. EO 11988 (Floodplain Management) requires an examination of impacts to floodplains, including the potential risk involved in placing facilities within floodplains. It states that federal agencies must: "... take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains..." Accordingly, agencies must determine whether a proposed action is located in or would impact the 100-year floodplain.	increase flood risk. Actions would not violate National Flood Insurance Program requirements or result in changes that would increase an existing floodway or the flood elevation level associated with the 100-year flood event. Because there are no actions that would affect floodplains proposed in this plan, this topic has been dismissed from further analysis. No statement of findings will be prepared because there would be no impacts to floodplains.
Cultural Landscapes	According to NPS Director's Order-28 <i>Cultural Resource Management Guideline</i>, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built.	Because no cultural landscapes are present in the project area, this topic has been dismissed from further analysis.
Ethnographic Resources / Sacred Sites	National Park Service's Director's Order-28 <i>Cultural Resource Management</i> defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to DO-28 and Executive Order 13007 on sacred sites, the National Park Service should try to preserve and protect ethnographic resources.	In consultation with Native American tribes, ethnographic resources are not known to exist in the proposed project area. Native American tribes traditionally associated with the park were apprised of the proposed project in a letter dated May 11, 2015. Because no ethnographic resources are known from the project area, there would be no effect.
Museum Collections	According to Director's Order-24 <i>Museum Collections</i>, the National Park Service requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, National Park Service museum collections.	The proposed project would not affect and is not expected to contribute to museum collections.
Lightscaapes	In accordance with 2006 <i>Management Policies</i>, the National Park Service strives to preserve natural ambient lightscaapes, which are natural resources and values that exist in the absence of human caused light (NPS 2006). Olympic National Park strives to limit the use of artificial outdoor lighting to that which is necessary for basic safety requirements.	No lighting is currently present along Highway 101 or East Beach Road in the project area and none would be added under the proposed project.
Wilderness	Olympic National Park wilderness was designated on November 16, 2988 (PL 100-	There is no wilderness within the proposed project area. Although wilderness is adjacent to

	668). Approximately 95 percent of the park is comprised of wilderness, while another 378 acres are classified as potential wilderness.	the proposed project area, no effects have been identified that would impact it.
Wild and Scenic Rivers	Analysis of wild and scenic rivers is required under the Wild and Scenic Rivers Act (Public Law 90-542) (16 USC 1271 - 1287). No management actions may be taken that could adversely affect the values that qualify a river for inclusion in the National Wild and Scenic Rivers System.	There are no rivers proposed or designated under the Wild and Scenic Rivers Act within the project area.
Indian Trust Resources	Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.	There are no Indian trust resources at Olympic National Park. The lands comprising the park are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. There would be no effects because there are no Indian trust resources.
Environmental Justice	Executive Order 12898 <i>General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations</i> requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.	There would be no disproportionately adverse effects on minority or low income populations from the implementation of the proposed project.
Prime and Unique Farmlands	The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts.	The project area does not contain prime or unique farmlands. There would be no effects on prime and unique farmlands.
Urban Quality, historic and cultural resources, and design of the built environment	Quality of open spaces is a key adjunct to urban quality and quality of life issues.	The project area does not include urban areas. There would be no effect on urban quality.
Energy Consumption	Energy consumption (including electricity, propane, wood, fuel oil, gas, or diesel) is often considered in combination with new facilities development and sustainability.	The project does not include new sources of energy use. There would be short-term effects on energy use from consumption of fuels during construction.

F. Public Participation Summary

Olympic National Park conducted public scoping of six preliminary alternatives identified for rehabilitation of the Lake Crescent portion of U.S. Highway 101 in spring 2015. No specific public scoping was conducted for rehabilitation of East Beach Road. For U.S. Highway 101, there were two public meetings, held in Port Angeles and Forks, Washington on May 18 (Port Angeles) and May 20 (Forks), 2015, respectively. Approximately 14 people signed in at the meeting in Port Angeles and 34 signed in at the meeting in Forks.

The public comment period extended from May 7 – July 7, 2015. Articles about the public scoping were published in the following newspapers: Peninsula Daily News (5-11-15), Sequim Gazette (5-13-15), and The Tacoma News Tribune (5-16-15). Radio broadcasts also occurred on KONP Radio Port Angeles (5-11-15) and KBKW Newstalk Grays Harbor (5-8-15). Notice of the public meeting was also sent to approximately 75 people, businesses and organizations, as well as other civic and government entities on the park's mailing list.

For a summary of public comments, please see Chapter V: *Consultation and Coordination* or the comment summary posted on the NPS planning website: <http://parkplanning.nps.gov/olym>.

Issues and Concerns Addressed in this Document

The following issues and concerns raised by public scoping were considered in the planning process and/or are addressed in this document:

- Keep access to Barnes Point open
- Consider impacts to bicyclists/bicycle use
- Address impacts on public transportation
- Evaluate impacts on scenic resources
- Identify impacts from hazard trees
- Address impacts from noxious weeds
- Consider impacts on safety related to road rehabilitation
- Address pullouts on U.S. Highway 101
- Consider socioeconomic impacts on commuters, local communities, tribes, businesses, provision of emergency medical services, education
- Consider including work at night or during other slow periods
- Offer contractor incentives
- Ensure that there is public communication and outreach during construction

The following issues were considered but dismissed by the planning team. Reasoning is given in Chapter II: *Alternatives* under the heading Alternatives Considered but Dismissed.

- Impact on or from taking the Highway 112/113 reroute

Issues and Concerns NOT Addressed in this Document

The following issues generated through public scoping are not within the scope of this project and are therefore not analyzed in detail in the document:

- Providing ATV access to area beaches
- Providing fiber-optic Infrastructure
- Providing a Lake Crescent shuttle boat
- Rehabilitating the Spruce Railroad Trail as a one-way road
- Providing a Bailey bridge bypass
- Providing a temporary gravel road along the north shore of Lake Crescent.

Chapter II: Alternatives

The alternatives were developed by NPS and FHWA staff based on collaborative interdisciplinary analysis derived from the expertise of planning team members. Internal and external scoping with Native American Tribes, other city, county, state, and federal agencies, interested organizations and individuals also contributed to the development of the alternatives.

The alternatives described in this chapter include:

- Alternative 1: No Action (Continue Current Management)
- Alternative 2: Rehabilitate Lake Crescent Segment of U.S. Highway 101 and East Beach Road. To complete construction, there would be maximum 30-minute delays throughout the duration of construction plus a small number of shoulder season day-time delays of up to 4 hours for actions, such as rock fall mitigation and culvert replacement
- Alternative 3: Rehabilitate Lake Crescent Segment of U.S. Highway 101 and East Beach Road. To complete construction, there would be maximum 30-minute delays throughout the duration of construction, plus a small number of 4-hour delays to complete rock-fall mitigation. To expedite construction, there would also be night work (up to 6-hour delays) between Labor Day and March 31 when it would be less likely to affect nesting Marbled Murrelets.

Alternative 1: No Action (Continue Current Management)

General Description

Under Alternative 1, U.S. Highway 101 and East Beach Road would not be rehabilitated. Existing deteriorated pavement and slope conditions would remain. Although ongoing maintenance activities would continue, over time, this section of the roadway would become increasingly uneven and patched. Because existing conditions would continue without rehabilitation, catastrophic failure of portions of the U.S. Highway 101 could occur, necessitating an increasing frequency of unplanned delays and closures to repair the road.



Figure 3: Failing Crib Wall

As noted under Purpose and Need, Highway 101 in the park currently includes substandard and/or failing guardrail, roadside hazards such as missing drop inlet grates, rock fall hazards, and poor pavement conditions (potholes, edge failures, and poor surfacing). Geotechnical evaluation of the roadway for the proposed project under Alternatives 2-3 has identified numerous unstable areas, where catastrophic failure of the road could occur if the roadway is not repaired.

Among the existing conditions of the roadway that could cause future problems include:

- Substandard and/or failing guardrail, including rotting guardrail posts and rails
- Deteriorated, uneven pavement, including potholes and pavement edge failures
- Unstable slopes
- Subsurface pavement problems
- Poor drainage, including blocked and/or undersized culverts and missing drainage features, such as drop-inlet grates
- Rockfall hazards
- Failing retaining walls (including concrete crib, riprap, and gabion basket) (Figure 3)

U.S. Highway 101 is maintained by the Washington State Department of Transportation (WSDOT) for Olympic National Park. Except for a short right-of-way section (approximately 4,000 linear feet/0.76 miles) near the park boundary close to Port Angeles, which is owned by WSDOT, the roadway is fully within Olympic National Park and is federally owned.

East Beach Road is sandwiched tightly on the side of a hill above Lake Crescent. This narrow road has no centerline striping, limited shoulders, blind corners and residential driveways that descend steeply to Lake Crescent. Pavement rehabilitation on the roadway, which is within the park, but maintained by Clallam County is needed. Areas beneath the road have slumped and several culverts are in need of replacement.

The following section describes routine roadway maintenance activities conducted by WSDOT and the park on the Lake Crescent section of Highway 101 and by the park and Clallam County on East Beach Road.

Scope of Routine Work

Under Alternative 1, no new rehabilitation or comprehensive resurfacing would take place. This alternative would not address improvements to the condition of the road, resource impacts from the existing road, safety issues or improvements to visitor experience. Although no comprehensive repairs to the road would occur, this alternative would continue to result in ongoing routine maintenance actions, including snow removal, grading of unpaved turnouts, road shoulder shaping and repair; paved road asphalt patching and crack sealing; ditch clearing; culvert cleaning; vegetation maintenance; traffic control striping; guardrail and post replacement; and signage replacement as needed (and as summarized below). This alternative would also result in some minor reconstruction of existing road features, such as culverts or roadway slopes, if failure occurred. It would also include periodic application of slurry- or chip-seal treatments.

Because the overall condition of the road would not undergo comprehensive improvements, the road would likely continue to deteriorate. Over time, this deterioration could result in increasingly uneven pavement (warping and cracking), narrowing lane width and other road conditions that would adversely affect both visitor safety and experience on the road and within the park, as well as on the quality of wetland, forest and other resources along the road.

Routine Road Maintenance Program

The purpose of the park road maintenance program is to provide safe vehicular access on park destination roads, campground roads, administrative roads, etc. and in public and administrative parking areas. To accomplish this, regular maintenance of the road surface, including bridges, culverts and ditches occurs.

Routine road maintenance activities include: repair of pavement cracks and holes, restriping, ditch cleaning, sign repair or replacement, vegetation control, litter pickup, snow/ice management, and tasks associated with bridges, guardrails, and related structures, slide removal, repair of erosion damage, [management of] unplanned road closures, and removal of fallen trees (NPS OLYM 2015).

Routine road maintenance also includes a variety of actions to prevent the invasion and to control the spread of nonnative (exotic) plants and noxious weeds. Among these actions include practices such as using clean traction sand and gravel, limiting mechanical disturbance to soils, and precluding the use of contaminated top soils. Control includes both manual/mechanical and chemical methods, depending on the plant and the site and is done by WSDOT in consultation with the NPS and in accordance with NPS and park policies. Mechanical removal is the first choice for control, however the park may also use chemical control. Hand-pulling or other manual/mechanical means occurs where use of herbicides would cause adverse impacts to park resources.

Day to day maintenance may also include:

- Sweeping paved road/parking surfaces, including intersections and curb gutters to remove dirt, sand and other debris;
- Cleaning drainage structures by removing rocks, debris and silt from pipe culverts, box culverts, inlets and storm sewers to maintain adequate drainage and to prevent roadway flooding.
- Repairing pipe culverts, drop inlets, catch basins, headwalls, and manholes to provide proper drainage;
- Maintenance and repair of curbs and gutters damaged by snowplows and/or traffic to ensure proper drainage flow, including the replacement of short curb sections;
- Cutting and removing brush, hazard trees and overhanging limbs along roads to eliminate traffic hazards and to remove encroaching vegetation;
- Picking-up and disposing of litter along roads, at overlooks and along/in parking areas for aesthetics and to remove objects that could be hazardous or could obstruct drainage or damage road maintenance equipment;
- Repairing slope failures and erosion near roads and developed areas and the removal of eroded material, including occasional reseeding, replanting or installing mechanical erosion control measures as needed to prevent such an occurrence from happening again in the same area;
- Removing rock fall and slide material from the roadway and roadsides;
- Striping the centerline, lane, fog and edge markings on roads and other pavement markings and roadway directions for traffic safety, parking and pedestrian control;
- Cleaning road bridge decks and bearing surfaces to remove sand and other debris, including the cleaning of drain holes, joints and curbs; and
- Repairing minor bridge components such as railing and decks.

The following section describes the timing associated with various routine and day to day road maintenance activities.

Fall/Winter

Mechanical removal of snow occurs as needed. Snow removal can include the application of sand or other abrasives or salts as needed to provide traction enhancement for vehicles on icy roads. Snow removal reduces hazardous winter driving conditions and ensures that some park roads are open to visitor use in winter. To assist with vehicle traction in icy areas, approximately 24 cubic yards of sand is applied annually. Snow and ice melt sand is also used (approximately 22 cubic yards annually).

Spring

Road maintenance increases in spring to ensure availability during the peak visitor use season (May through October). Increased road maintenance activities may include cleaning culverts, and repairing minor sections of the road surface, shoulders or embankments. Road drainage is also improved by clearing moss and other vegetation and soil accumulation along the roadway between guardrail posts to improve opportunities for water to leave the roadway.

Summer/Fall

Road maintenance activities occurring during normally dry weather include grading unpaved turnouts, shoulder maintenance, removal of sloughed material from ditches, pavement repairs and leveling, pothole patching, crack sealing, slurry sealing, repaving, pavement marking, signage installation, etc.

Unpaved turnouts are graded, reshaped and smoothed as needed (without adding material or widening) to restore crown, proper shape, drainage and a smooth traveling surface. Maintenance may include pulling material from and cleaning roadside ditches and culverts and disposing of this material as needed. It also includes reshaping shoulders as necessary.

Unpaved road surface materials are often lost due to traffic, erosion during storms and other predictable and unpredictable events. As needed, repair and stabilization of unpaved roads occurs by adding crushed rock to the road surface. To accomplish this, reshaping and compacting to control ruts, potholes, washouts, and corrugation may also be done.

On paved roads, patching of small areas of asphalt paving with cold, premix asphalt concrete to correct abrupt depressions, potholes, edge failures and other potential road/parking surface hazards is undertaken to provide a smooth paved surface. Occasionally, permanent pothole patching is conducted with a premix asphalt concrete and asphalt emulsion (tack) to correct abrupt depressions, potholes, edge failures, and other potential road/parking surface hazards to provide a smooth paved surface.

Other maintenance actions include clearing road shoulder and parking ditches to enable rapid melt water and rain dispersion off the road surface. This includes the cleaning and reshaping of roadside ditches along paved and unpaved roads and parking areas as well as the removal, hauling and disposal of excess material to restore the original grade and to ensure adequate drainage. On occasion, it can include the importation of additional material. It also includes the trimming or removal of woody vegetation from roadside ditches and shoulders and the removal of overgrown herbaceous vegetation. These actions are done to eliminate or improve edge ruts, washouts, ridges, corrugation and encroaching vegetation.

When pavement failures are encountered, these areas may be repaired by removing and replacing areas of failed surfaces with premix asphalt, including a base course, if required, to provide a structurally sound surface and to eliminate safety hazards from roads and parking areas. Work may include the placement of a new asphalt surface leveling course on asphalt-paved surfaces to provide a smooth driving surface and to eliminate safety hazards. Premix asphalt concrete is then applied with either a grader or a spreader box. Slurry seal or chip seal is applied as needed and includes the placement of liquid asphalt with an aggregate or chip seal coat to seal cracks and prevent water entry and related damage to base course materials, correct minor surface depressions to seal asphalt surfaces, to restore skid resistance and to retard further surface deterioration.

The impacts of major rehabilitation or reconstruction treatments, however, have not been included in the analysis. Therefore, major repairs or rehabilitation not falling into these categories would undergo separate environmental impact analysis. This includes construction activities such as any major event that by nature of its extent or cost of repair goes beyond what normally is considered as routine for the location. This may include, but is not limited to, pavement overlays, chip seals, other resurfacing, reconstruction, and general rehabilitation.

Actions Common to Alternatives 2-3

The existing road prism of the Lake Crescent section of U.S. Highway 101 typically consists of 28-foot travel lanes with two-foot paved shoulders. Under all alternatives, these characteristics of the highway would remain. No widening or alignment modifications to the road would be made. It would be rehabilitated in place within the existing road prism (cut slope to fill slope).

1. U.S. Highway 101 Road Rehabilitation Actions

a) Barnes Point Access

Although road delays and timing of rehabilitation would vary between Alternatives 2 and 3, access to Barnes Point would be maintained from either the east or west portion of U.S. Highway 101. Access to Barnes Point, however, could include delays, depending on the activity being conducted and the direction of travel.

b) Vehicle Passage through the Construction Area

Several construction mitigation measures would be used to facilitate vehicle (including bicycle) passage through the construction areas. Provisions would also be made to allow emergency vehicles to pass

immediately through the construction area. Radio communications on either end of the project would be tied into emergency communications (park dispatch center and the project traffic and safety supervisor), who could be alerted to the need for emergency vehicle passage and would then work to facilitate it.

On Highway 101, bicycle passage through the construction area would also continue to be facilitated through the use of the existing advance warning system as well as by notification of supervisory construction personnel when bicyclists approach flaggers. The existing warning system, which is triggered near East Beach Road and Fairholme, flashes for approximately 0.5 hours when bicyclists trigger it. The time length of the flashing could also be extended during construction to improve safe passage for bicyclists during delays.

c) Pavement Modifications

• Repair Pavement Deterioration and Stabilize Road Shoulders

A variety of actions would be taken to alleviate the underlying causes of 12.3 miles of pavement deterioration on U.S. Highway 101. Among these include excavation of one or both lanes of the roadway and replacement of fill material (deep patches); construction of mechanically stabilized earthen (MSE) walls; fixing existing gabion walls; and adding riprap along the edge of proposed and existing retaining walls lake shoreline. The walls would also prevent slope failure along the roadway. Several (approximately three) would replace existing concrete crib walls. The recommendations along the roadway vary based on geotechnical analysis, which included test drilling within the roadway in preparation for the proposed project. Initial geotechnical recommendations were also analyzed and modified during the 30 and 70 percent design field review for the project.

There are numerous areas alongside U.S. Highway 101 in the project area where the soil mass outside of the guardrail has slumped toward the lake, or has been completely eroded from wave action during storms, resulting in loss of shoulder support for the roadway. Surface water beneath the pavement has also resulted in the loss of subgrade strength. Without repair, these areas would continue to slump toward the lake, resulting in the need for continual maintenance (FHWA 2015) and potential for failure of the road prism in these areas would remain.

○ Excavate and replace soils (Type I, II and III Deep Patches)

Depending on the type of subgrade strength (pavement settlement), a variety of deep patches are recommended. Type II deep patches are proposed in areas where there is a loss of shoulder support and slope down toward Lake Crescent. Type I and Type III deep patches would be excavated entirely within the area underneath the road. Excavation under the road to replace the subgrade fill material can stabilize the road surface. Placement of rock and soil (select borrow) in layers separated by geotextile fabric would create a firmer road base that would be less subject to subsidence. Although many of the proposed deep patch locations would include excavation in one lane, others would include excavation of both lanes. All deep patches would have collector pipes to drain groundwater away from the patch area subgrade. Slopes associated with Type II deep patches would be revegetated following disturbance. Approximately 17 one-lane deep patches and six two-lane deep patches are called for to improve the roadway.

Table 3: Proposed Type II Deep Patches on Highway 101

Location (Stations)	Location (Milepost)	Approx. Length	Notes
272+00 – 273+00	224.2	100 feet	Douglas-fir, alders
324+20 – 324+80	225.2	60 feet	big leaf maple, Douglas-fir, alder, shrubs
412+00 – 412+55	226.9	35 feet	alder
481+60 – 484+50	228.2	290 feet	small big leaf maple, alder, seedling Douglas-fir, shrubs
518+50 – 520+50	228.9	200 feet	fairly large Douglas-fir, cedars, big leaf maples, shrubs
530+30 – 532+00	229.1	170 feet	small big leaf maple, alder, Douglas-fir

- **Construct Mechanically Stabilized Earthen (MSE) Walls**

Approximately three MSE walls (ranging from 50- 230 linear feet) would be constructed along U.S. Highway 101 between Fairholme and Port Angeles. These would be constructed in various locations, would vary in size, and would primarily be constructed in areas where constructing a steep vertical slope would prevent additional impacts to natural and/or cultural resources along the road. Compared to Type II deep patches, MSE walls require less space.



Figure 4: Fairholme Parking Area Wall

One large MSE wall is proposed to replace the failing rigid concrete wall located adjacent to the Fairholme store. At this location, the wall and railing are bowed out toward the lake. The parking area has also developed subsidence issues. Depending on whether these are related to road drainage or the wall position, wall failure could affect only the turnout or may also affect the road. The rigid construction of the wall is also a potential seismic hazard. Reconstruction of this wall would require removal of native and nonnative trees and other vegetation, including a European Mountain Ash (*Sorbus aucuparia*), red alders (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), willows (*Salix* sp.), sword fern (*Polystichum munitum*) and periwinkle (*Vinca major*), and mosses among other plants. At the bottom of the wall riprap would extend into the edge of the lake and the area would be replanted with willow cuttings. The parking area would also likely be reconfigured with designated wheel stops.

Table 4 shows this and other areas identified for construction of MSE walls during the 30% design phase.

Table 4: Proposed Walls on Highway 101

Location (Stations)	Approx. Length	Notes
203+90 – 204+40	50 feet	small Douglas-fir, alders, shrubs
406+00 – 407+40	140 feet	very large Douglas-fir, moderate Douglas-fir, big leaf maple, alder
409+30 – 411+60	230 feet	alder

- **Add Riprap along the Bank of Lake Crescent**

Approximately 33 sites along Lake Crescent require additional riprap placement. Replacement riprap needs are estimated at 2,000 cubic yards. Approximately 0.13 acre of riprap is anticipated to be placed below the ordinary high water mark of Lake Crescent.

Most riprap would be placed from a barge located on Lake Crescent, with materials staged on the barge and on shore in areas identified for the proposed Highway 101 rehabilitation. Some riprap placement or vegetation trimming needed to replace riprap may also be completed from shore (including traffic control as needed). An excavator on the barge would be used to excavate as needed for placement of riprap (Class 5 rock with a diameter of 12 to 36-inches). There are several locations that would require in-water placement of riprap. Numerous locations would have rock placed along the shoreline. Individual site repairs range from 5 - 15 feet high and 20 - 500 feet long. Volumes of rock proposed for placement at each site range from approximately 5 – 200 cubic yards. Equipment to be used would include a barge, small motor boat, pickup truck, 10 yard dump truck, excavator, front-end loader, backhoe, and chainsaw.

- **Improve Drainage**

Surface water is conveyed across the existing roadway by a variety of crossings. These include concrete, plastic, and corrugated metal pipes, bridges, and concrete box culverts. Drainage modifications would include replacing some culverts in-kind and increasing the diameter of others to improve water passage. Most replacement culverts would be corrugated metal pipes (CMP), however, when available cover is a concern reinforced concrete pipe (RCP) is recommended. Most of the culvert replacements would be related to other road work, including constructing deep patches and MSE walls. At these locations the opportunity to dig out sections of roadway would include the opportunity to replace undersized culverts or other culverts in poor condition. Other replacements are in response to an inventory conducted in 2013 by WSDOT. Replacing most culverts would consist of excavating on either side of the culvert to a depth of 6-8 feet. Larger culverts would likely require additional excavation. Replacement would be done during dry conditions.

Per USGS mapping, there are approximately 32 defined drainage way or stream crossings along the Lake Crescent segment of U.S. Highway 101. In addition to the culverts and bridges which convey surface water outside of the roadway prism, there are approximately 79 ditch relief culverts to accommodate roadway and hillside runoff. Of the approximately 111 drainage way, stream, and ditch relief culverts on the roadway, approximately 26 would be replaced as part of this project. Based on initial design (30-70 percent), of the smaller culverts, approximately 15 would be increased in size (generally from 18 to 24 inches).

Drainage modifications would also include replacing missing drop inlet grates (see photo in *Impact Topics Considered*). A mechanism for securing the grates to the drop inlets would also be added. This would make the steel drop inlet grates more difficult to remove. (It is believed that they have been systematically taken from the area and sold for scrap metal.) The drop inlet grates would allow passage of materials approximately three inches in diameter or smaller to improve opportunities for sediment to reach the lake. Approximately 20 inlets require replacement grates.

Stormwater management practices to be incorporated include cleaning and/or restoring roadside ditches and installing paved waterways or curb and gutter when available space for ditches is limited. To facilitate the determination of whether to reopen roadside ditches, an inventory of these has been conducted. If reopening the ditch line would affect the toe of the slope it would not occur (to avoid continuously sloughing material off the slope).

Surface drainage would also be improved by minimizing or fixing slope toe-cuts where raveling of the slope above the ditch is continuing to slough off into the ditch. In these locations, a small fill-side wall could be used to increase the area available for the ditch without impacting the slope toe.

- **Replace guardrail (posts and rail)**

There are approximately 44,269 feet of guardrail currently present along U.S. Highway 101 which would be replaced. Most of the guardrail is located on the Lake Crescent side of the road. Guardrail would be added in several locations, to improve safety and to replace log barriers in some turnouts. Therefore an

additional estimated 3,500 feet of guardrail would also be constructed. Because approximately one of every four existing wooden posts have rotted, the guardrail posts would be upgraded and replaced with Corten, a rusted metal-like coating/texture created by alloy elements added during steel making), or weathering steel posts and rails, similar to the guardrail now on the portion of roadway just past the Fairholme Store (Figure 5). Both the aboveground portion of the post and the rails would be treated. The portion of post in contact with soil or vegetation (approximately four inches above ground) would be galvanized to prevent excess rusting. Although replacement of wooden posts would increase longevity, the posts would likely be more difficult to replace when damaged in an accident. According to maintenance staff, the wooden posts generally go directly back into the former hole, while the metal posts require additional equipment to insert.

- **Conduct Rockfall Mitigation**

Rock scaling (removing) rocks and rock bolting at joints and cracks from the rock face above Sledgehammer Point would reduce the potential for rocks to fall onto the road surface below, thereby minimizing some potential for safety hazards and damage to the roadway. The area currently identified for rock fall mitigation is approximately 0.75 mile west of Sledgehammer Point at approximately milepost 118.6-228.8.

Because rock fall mitigation requires long lead time for set-up and is a slow process, there would be occasional 4-hour delays in all alternatives when this activity is being conducted. These delays would be well-publicized and signed and would occur outside of commute hours to the extent possible. A small number of moderate delays would reduce the overall length of the project.

- **Improve Sledgehammer Point**

The rock walls at Sledgehammer Point would be extended to reduce downslope impacts and interpretive exhibits would be improved. The parking area would also be delineated, including adding accessible parking, and re-landscaped.

A masonry seat wall could be constructed along the water's edge to connect with the existing rock walls around the point. The point rock walls could also be connected. Proposed modifications would improve the overlook and provide for accessibility. Existing guardrail would be replaced with concrete log curb stops in front of the seat wall adjacent to the parking area. Accessible parking stalls would be added and a new park entrance sign would be installed. Revegetation plans would be developed both to rehabilitate natural sections and to landscape the area with native plants. Overall, pedestrian areas would have accessibility improvements and would be re-landscaped to reduce visitor use impacts.

- **Construct Barnes Point Transit Stop**

In cooperation with Clallam Transit and funding obtained through the FHWA Federal Lands Access Program (FLAP), the proposed project would add formal Clallam Transit stop shelters near Barnes Point along Highway 101 (Figure 6). To facilitate use, shelters on both sides of the road would be constructed. Accessible trails would be constructed from the shelters to connect with existing trails. Trailside steps would also be constructed to facilitate non-accessible use of the trails, rather than short-cutting. The trail on the north side would be approximately 250 feet long by eight feet wide. Similarly, the trail on the west would be approximately 250 feet long and eight feet wide. No large trees would be removed, however placement of fill (approximately 450 cubic yards on the north and 250 cubic yards on the south would be required to meet accessibility grades.



Figure 5: Proposed Guardrail Design



Figure 6: Clallam County Bus Shelter

The existing trails accessing Barnes Creek; however would not be modified for accessibility in this project. Modifying these existing trails for accessibility would require additional planning and funding which is beyond the scope of the current road project.

Clallam Transit buses also currently stop near East Beach, La Poel, Fairholme and Camp David. As with the extension of existing trails, locating bus shelters at these locations is outside the scope of the current project.

- **Modify Turnouts along Lake Crescent**

There are approximately 45 turnouts between Fairholme and the park boundary on Highway 101 west of Port Angeles. Some are paved and some are gravel. Most are used for scenic driving, while a few are used for slow vehicle turnouts, but are not signed as such.

Under an inventory and assessment conducted by the park, most (approximately 23) of these would be retained, approximately 12 would be removed and restored and 11 would be modified by changing the size or type of paving. Two would be enhanced as Clallam Transit bus stops with shelters; and two would be enhanced as slow vehicle turnouts. Approximately 20 would not be removed or modified. The turnouts that would be retained would also be improved with new paving and many would include placement of concrete log curbing. Poor sight distance causing safety problems during use and inability for expansion are the primary reasons why some turnouts would be closed and restored. Because a very broad definition was used to identify turnouts, 11 of 12 turnouts identified for removal are actually informal pull-out areas (not designed or constructed as turnouts). The one formal turnout slated for removal is one that is approximately 500 feet from another turnout that itself is not heavily used.

Appendix 1 shows the inventory, station number and the proposed actions associated with each.

2. East Beach Road Modifications

Among the proposed rehabilitation actions for East Beach Road include:

- New asphalt pavement surfacing from milepost 3.9 to 7.2; from milepost 0 – 0.5 on the East Beach Road Extension (up to the Lyre River Bridge); and from milepost 0 – 0.2 on Waterline Road;
- Hanging culvert improvement (7-foot culvert near Log Cabin Resort);
- Replacement of approximately nine culverts in poor condition; and
- Striping and signing.

Actions would be taken to alleviate the underlying causes of pavement deterioration, including excavation of one or both lanes of the roadway and replacement of fill material (deep patches).

New Asphalt Concrete Pavement: East Beach Road is narrow, ranging from 16-20 feet in width. New pavement would match existing width (no widening would occur). New pavement on East Beach Road would also require placement of approximately 6-inches of base course rock.

- **Improve Drainage**

As on U.S. Highway 101, surface water is conveyed across East Beach Road. Culverts are concrete, plastic, and corrugated metal pipes. Drainage modifications would include replacing some culverts in-kind and increasing the diameter of others to improve water passage. Most replacement culverts would be corrugated metal pipes (CMP), however, when available cover is a concern reinforced concrete pipe

(RCP) is recommended. Some culvert replacement would be related to other road work, including constructing deep patches. At these locations the opportunity to dig out sections of roadway would include the opportunity to replace undersized culverts or other culverts in poor condition. Replacing culverts would consist of excavating on either side of the culvert to a depth of 6-8 feet. Larger culverts (see Log Cabin Creek culvert replacement below) would require additional excavation. Replacement would be done during dry conditions.

Log Cabin Creek Hanging Culvert: This 7-foot diameter culvert, located near the entrance to Log Cabin Resort, is proposed for replacement to improve fish passage. The existing culvert is perched approximately five feet above a plunge pool created by the culvert (Figure 7). Suitable trout habitat is located upstream, which could be accessed by fish from Lake Crescent if the culvert were located at the same elevation as the stream. Because the culvert is perched above the creek, it does not currently allow for fish passage. If the culvert is replaced, stream restoration in an area approximately 100 x 40 feet upstream and downstream of the culvert (approximately 8,000 square feet or 0.18 acres) would also occur. Because the culvert would need to be replaced “in-the-dry,” a bypass culvert or ditch for water would be created during replacement. Culvert replacement would not only benefit fish passage, but would also result in stream restoration above and below the roadway.

Lyre River Turnout Improvements: On East Beach Road near the Lyre River, water flows down and across the road toward a turnout just east of the Lyre River Bridge. This turnout is the source of a sediment plume that periodically affects the Lyre River near a Beardslee trout spawning area. As a result, this turnout would be rehabilitated to include a berm and revegetation to slow down and divert runoff through it.

Options Added, Depending on Funding: Depending on the cost of repaving and culvert replacement, there could be additional work included in the East Beach Road Modifications. This additional work could include:

- Adding up to 1,000 linear feet of subexcavation. The subexcavation would range between 1-5 feet deep and would be located directly under the existing paved surface.



Figure 7: East Beach Road Culvert

- Additional minor drainage modifications, including replacing more culverts.

- Enhancing turnouts, such as by paving of some existing pullouts (these would add up to five feet of additional width in locations where pullouts currently exist and are unpaved).

- Ditch cleaning.
- Guardrail replacement.



Figure 8: Proposed East Beach Road Modifications

3. Actions Applicable to Both U.S. Highway 101 and East Beach Road

- **Replace Asphalt Concrete Paving**

The project includes rehabilitation of 12.3 miles of asphaltic concrete pavement within the station limits, including subgrade and shoulder stabilization on U.S. Highway 101. On East Beach Road, approximately 3.3 miles of asphaltic concrete pavement would be rehabilitated. Pavement rehabilitation recommendations call for hot mix asphaltic concrete pavement that would be installed by milling off the top 7.5 inches of asphalt pavement and adding a minimum of 7.5-inches of new material to create a new asphaltic concrete pavement surface, over a 6-inch stabilized base course on Highway 101 and three inches on East Beach Road. Because East Beach Road is not used for high speed traffic, overall pavement depths would be less. Pavement markings would then be repainted with reflective paint to match existing center, fog and turnout lines on Highway 101 and added or replaced on East Beach Road.

- **Replace Roadway Signs**

Road signs, including speed limit signs, curve warning signs, park facility signs, etc., would be removed during the proposed project and deteriorated signs would be replaced in kind. Other signs would be revised and replaced. Among these include the signs related to the Clallam transit stops and bicycle travel warning lights at either end of the project area (near Fairholme) and near East Beach Road. The 45 mph sign west of the Fairholme store would also be moved further east to minimize the speed at which cars are accelerating down the hill to the Highway 101, Camp David Jr. Road intersection. Poor sight distance related to overhanging vegetation would also be improved.

- **Conduct Revegetation / Restoration in Disturbed Areas**

Based on the current scope of the Highway 101 project, approximately 28 acres of restoration would be conducted following rehabilitation activities. This includes approximately one acre of former turnouts, 2.7 acres associated with shoulder rehabilitation, and 25 acres at the Aurora quarry. East Beach Road would include approximately 0.3 acres of restoration along pavement edges. On East Beach Road, approximately 100 feet above and below East Beach Road of Log Cabin/Piedmont Creek would be restored if the hanging culvert is replaced. This area of restoration would encompass approximately 8,000 square feet (0.02 acres).

A seed increase plan was developed during the planning phase of the project to provide local, native seed and plants for restoration efforts.

Rehabilitation of the roadway would be used as an opportunity to reduce the incidence of nonnative invasive plants occurring along the pavement edges by removing and replacing 2-3 inches of weed-contaminated topsoil and duff (approximately 1,500 cubic yards) along and under the guardrail with clean fill and then reseeding this area. In some areas, existing shrubs that are attractive to deer browsing would be replaced with shrubs not favored by deer to reduce their incidence along the edges of this busy roadway and thereby to improve road safety conditions.

Among the revegetation techniques that would be used following construction activities would be hydroseeding, placement of a mat containing seeds (seed blanket) over exposed slopes, and inserting willow cuttings at the toe of riprapped slopes. Erosion control materials used in the project would include vegetative buffers (comprised of existing and restored area), and sediment wattles. A turbidity curtain would also be used where needed to protect water lobelia sites from sediment deposition during riprap placement. Currently, turbidity curtains are proposed near station 407+00 – 412+00.

Where materials to be disposed of consist of native but nonnative seed-contaminated materials, these could be salvaged and buried within the roadway or excavation areas as fill.

4. Actions to Facilitate Construction

- **Planning for Travel Delays/Maintaining Barnes Point Access**

Although road delays would vary among the alternatives, in all action alternatives, access to Barnes Point would be maintained from either the east or west portion of U.S. Highway 101.

- **Implementing Temporary Traffic Control Measures**

All alternatives would require temporary traffic control, including signs, detour signs, and flaggers. Needs for these would vary based on the length of delays and the length of the road construction projects.

Average daily traffic on this section of U.S. Highway 101 is approximately 2,500 cars per day, including approximately 500 trucks per day. Many of these are logging trucks, most of whom make the same run both full and empty.

Under Alternatives 2 and 3, during one lane closures, there would be a pilot vehicle to guide visitors through the construction area. Use of a pilot vehicle, in some areas or during some times, would reduce traffic speed adjacent to construction workers and minimize hazards associated with traffic control. Traffic lights may also be used to direct traffic through one-lane closures during nights/weekends.

- **Measures to Reduce Construction Period**

A series of construction contract clauses would be provided to minimize overall visitor and commuter use impacts during the construction project. Among these, as requested by public comments, would be a financial incentive for early completion of the work. Financial incentives could also be offered for minimizing the number of longer delays on the road and/or completing other tasks within less time than is projected by construction estimates. Similarly, if work is not substantially complete by the target completion date, there would likely be liquidated damages assessed.

- **Locating and Treating Staging Areas**

Staging areas are proposed at each of the Sledgehammer Point turnouts (station 543/545), one at a time, and at Wallace Point (station 340), as well as along the road (station 330), at the former Aurora quarry. The Barnes Point, La Poel, and Sledgehammer turnouts would be maintained for visitor use during the primary visitor use season; however, both Sledgehammer turnouts would be closed at the same time during the shoulder season to facilitate their rehabilitation, including for staging at one while constructing the other.

The staging area at the former Aurora quarry would be treated to remove Scotch broom and other nonnative invasive plants, such as herb-Robert prior to use. This staging area is approximately 220 x 100

feet (0.5 acres) and would be used for materials storage (wall materials, culverts, fabrics, equipment signs, etc.) and wasting of excavated materials. Following use, it would be graded and revegetated.

There are an additional three WSDOT maintenance yards (from west to east: Heckelsville at milepost 214.5, Useless Pit at milepost 231.5, and Elwha at milepost 238.5) that could also be used at the contractor's discretion. Spoils piles at Useless pit would need to be moved, but its location at the east end of the project may make it worthwhile to grade and use.

- **Creating a Fueling Plan**

A fueling plan would be developed that would specify the location of refueling activities for the project. Refueling would occur 100 feet or more from water sources. Throughout the project, vegetable-based hydraulic fluid would be used in heavy equipment.

- **Procuring Fill Material**

Fill for the project would be procured from both within the park and from commercial sources. FHWA and the park would evaluate commercial sources selected by the contractor to identify any possible contamination or invasive plant issues and areas would be treated before and/or during use as appropriate. Mitigation measures would specify procurement of clean fill.

- **Disposing of Materials that Cannot be Reused**

Materials disposal would occur within the park at the former Aurora quarry and outside the park at a commercial disposal facility. An estimated 80,000 tons of material and debris would be hauled out of the park and disposed of for the Highway 101 project and 10,000 tons for the East Beach Road project. This disposal would require approximately 4,000 truck trips. Most (approximately 3,500) would be for the Highway 101 project. Some asphalt milling material may be retained by the park at locations to be identified. Asphalt millings have commercial value and are often reused as roadway base or embankment material, or recycled as aggregate for new pavement.

- **Implementing Erosion Control Best Management Practices**

A wide array of erosion control best management practices would be implemented. These measures are listed in Chapter IV: *Environmental Consequences* in the Impacts to Soils, Impacts to Water Resources, and Impacts to Vegetation sections as well as in the proposed Special Contract Requirements (SCRs) for the project.

- **Conducting Public Outreach during Construction**

During construction, the park would work with the Washington State Department of Transportation (WSDOT), Clallam County, park concessioners, nearby towns and cities (including Port Angeles, Sequim and Forks), and others to ensure that motorists were informed of travel delays, road construction updates and other information.

Alternative 2: Rehabilitate Lake Crescent Segment of U.S. Highway 101 and East Beach Road.

To complete construction, there would be 30-minute delays throughout the duration of construction plus a small number of primarily shoulder season (September 10 to June 30) day-time delays of up to 4 hours for actions such as rock fall mitigation and culvert replacement.

Road rehabilitation actions and actions to facilitate construction would be the same as described in Actions Common to Alternatives 2-3. To facilitate this construction there would be maximum 30-minute delays on the Lake Crescent segment of U.S. Highway 101 and East Beach Road in Olympic National Park throughout the duration of road rehabilitation. There would be no night work in this alternative. Instead, work would occur from two hours after sunrise to two hours before sunset during marbled murrelet nesting season and could be extended to encompass these hours outside of that season. Where work

would be conducted near higher density residential areas or where there is existing overnight use, the park and FHWA would work to minimize the extent of early morning/late evening work and the potential for this would be well-publicized.

Because rock fall mitigation and other rehabilitation activities, such as large culvert replacement, require a long lead time for set-up and may be a slow process, there would also be a small number of 4-hour delays (approximately 15-20 in spring and fall in each of three seasons) on the roadway. These longer delays for rock fall mitigation and culvert replacement would be well-publicized and signed and, to the extent possible, would occur outside of primary commute hours.

Under Alternative 2, road rehabilitation is expected to last approximately three construction seasons (March through November in each of three years).

Alternative 3: Rehabilitate Lake Crescent Segment of U.S. Highway 101 and East Beach Road (including night work) (NPS and FHWA Preferred Alternative/Proposed Action).

To complete construction, there would be 30-minute daytime delays throughout the duration of construction, plus a small number of 4-hour delays to complete rock-fall mitigation and culvert replacement. To expedite construction, there would also be night work (up to 6-hour delays) between Labor Day and March 31 when it would be less likely to affect nesting marbled murrelets

Road rehabilitation actions and actions to facilitate construction would be the same as described in Actions Common to Alternatives 2-3.

During construction the Lake Crescent segment of U.S. Highway 101 and East Beach Road in Olympic National Park would be open during the day with maximum 30-minute delays (the same as in Alternative 2). To expedite construction, from Labor Day-March 31 (after the marbled murrelet early nesting season), there would also be night work on U.S. Highway 101. Night work could entail delays of up to 6-hours. Proposed night work would be scheduled by the contractor and announced via press releases upon approval by the superintendent. As in Alternative 2, there would also likely be a small number of 4-hour day-time delays when rock fall mitigation or culvert replacement is being conducted. These delays would be well-publicized and signed and would occur outside of primary commute hours to the extent possible.

Under Alternative 3 road rehabilitation is also expected to last approximately three construction seasons (March through November in each of three years), however because of the night work overall total number of construction days could be slightly shorter.

Mitigation Measures Incorporated into the Action Alternatives

Mitigation measures listed under each resource section in *Environmental Consequences* have been developed to lessen the potential adverse effects of the action alternatives. In addition, the following measures are among from the GMP are among those that would be incorporated into the implemented alternative (see resource impact sections in Chapter IV: *Environmental Consequences* for additional measures). Other measures in the GMP, such as for wilderness and historic buildings, are not specifically applicable to the proposed project to rehabilitate U.S. Highway 101.

Air Quality

- Implement a dust abatement program. Standard dust abatement measures could include the following elements: water or otherwise stabilize soils, cover haul trucks, employ speed limits on unpaved roads, minimize vegetation clearing, and revegetate with native species.

Soundscapes

- Implement standard noise abatement measures during the project, including: scheduling to minimize impacts in noise-sensitive areas, using the best available noise control techniques wherever feasible, using hydraulically or electrically powered impact tools when feasible, and locating stationary noise sources as far from sensitive uses as possible.
- Minimize idling of motors when power tools, equipment, and vehicles are not in use.
- Muffle above ambient noise whenever possible to reduce noise impacts.

Hydrologic Systems (including Wetlands)

- Conduct work in waterways to occur during the dry season (late summer).
- Implement erosion control measures, minimize discharge to water bodies, and regularly inspect construction equipment for leaks of petroleum and other chemicals to prevent water pollution.
- Minimize the use of heavy equipment in a waterway.
- Integrate runoff control systems into the designs of larger parking areas near water resources to minimize water pollution.
- Develop sediment control and prevention plans for projects that could impact water quality.
- Delineate wetlands and apply protection measures during projects. Perform project activities in a cautious manner to prevent damage caused by equipment, erosion, siltation, etc.

Soils

- : . . Minimize soil erosion by limiting the time that soil is left exposed and by applying other erosion control measures, such as erosion matting, silt fencing, and sedimentation basins in construction areas to reduce erosion, surface scouring, and discharge to water bodies. Once work is completed, revegetate construction areas with appropriate native plants in a timely period.

Vegetation

- Develop revegetation plans for disturbed areas and require the use of genetically appropriate native species. Revegetation plans should specify species to be used, seed/plant source, seed/plant mixes, site specific restoration conditions, soil preparation, erosion control, ongoing maintenance and monitoring requirements, etc. Salvaged vegetation should be used to the extent possible.
- Implement a noxious weed control program. Standard measures could include the following elements: use only weed-free materials for road and trail construction, repair, and maintenance; ensure equipment arrives on site free of mud or seed-bearing material; certify all seeds and straw material as weed-free; identify areas of noxious weeds pre-project; treat noxious weeds or noxious weed topsoil before construction (e.g., topsoil segregation, storage, herbicide treatment); when depositing ditch spoils along the roads, limit the movement of material to as close as possible to the excavation site; scrupulously and regularly clean areas that serve as introduction points for invasive plants (campgrounds, staging areas, maintenance areas, and corrals); revegetate with genetically appropriate native species; inspect rock and gravel sources to ensure these areas are free of noxious weed species; and monitor locations of ground-disturbing operations for at least three years following the completion of projects.

Fish and Wildlife

- Employ techniques to reduce impacts on fish and wildlife, including visitor education programs, restrictions on visitor and park activities, and law enforcement patrols.
- Implement a wildlife protection program. Standard measures would include project scheduling (season and/or time of day), project monitoring, erosion and sediment control, fencing or other means to protect sensitive resources adjacent to project areas, disposing of all food-related items or rubbish, salvaging topsoil, and revegetating.

Special Status Species

- Locate and design facilities/actions/ operations to avoid or minimize the removal of rare, threatened, and endangered species habitat. If avoidance is infeasible, minimize and compensate for adverse effects as appropriate and in consultation with the appropriate resource agencies.
- Plan work in areas in or near suitable threatened and endangered bird habitat as late as possible in the summer/fall.
- Conduct work outside of critical periods for the specific species when possible.
- Develop and implement restoration and/or monitoring plans as warranted. Plans should include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques.
- For projects in or near streams, employ appropriate best management practices.
- Implement measures to reduce adverse effects of nonnative plants and wildlife on rare, threatened, and endangered species.
- Carry out surveys and monitoring for special status species.
- Protect and preserve critical habitat features, such as nest trees, whenever possible.

Archeological Resources

- Known archeological resources would be avoided to the greatest extent possible. If national register-eligible or-listed archeological resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with the state historic preservation officer and associated American Indian tribes.
- If unknown archeological resources are discovered during project work, work in the immediate vicinity of the discovery would be halted until the resources could be identified, evaluated, and documented and an appropriate mitigation strategy could be developed, if necessary, in consultation with the state historic preservation office and associated American Indian tribes.

Sustainable Design and Aesthetics

- Design standards specific to the park would be developed in all repair, rehabilitation, and construction projects.
- Projects would use sustainable practices and resources whenever practicable by recycling and reusing materials, by minimizing materials, by minimizing energy consumption during the project, and by minimizing energy consumption throughout the lifespan of the project.

Alternatives and Actions Considered but Dismissed

Under the National Environmental Policy Act (NEPA) and NPS policy, alternatives may be eliminated from detailed study based on the following reasons [40 CFR 1502.14 (a)]:

- Technical or economic infeasibility;
- Inability to meet project objectives or resolve need for the project;
- Duplicate other less environmentally damaging alternatives;
- Conflict with an up-to-date valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement; and
- Environmental impacts too great.

The following alternatives were considered during the design phase of the project but because they met one of the above criteria they were dismissed from further consideration.

- Resurface U.S. Highway 101 and/or East Beach Road without Rehabilitation

This alternative was considered but dismissed because it would lengthen the road's service life by only a few years but would not fix pavement subsidence, failing guardrail, failing walls, etc. This alternative would not meet the purpose and need for the project.

- Close the Road to Facilitate Construction

Several closure alternatives were considered during the preliminary design phase of the project and in the preliminary alternatives presented to the public. They were rejected because closing the road (even during the shoulder season) would have more impacts than Alternatives 2 or 3. A range of impacts on park visitors, local communities and on and from the proposed reroute (State Highways 112/113) were identified during the public scoping period. These impacts would be greater than impacts from the alternatives considered in this environmental assessment.

Under the reroute proposed during preliminary alternative analysis, traffic from the west would have been directed onto Washington State Highway 113 and then onto Washington State Highway 112. For traffic from the east, the reroute would have been reversed.

Washington State Route 112 intersects U.S. Highway 101 approximately 3.5 miles west of the intersection of State Highway 117 and U.S. Highway 101 in Port Angeles. Highway 112 is part of the Strait of Juan de Fuca Scenic Byway and provides access to a variety of recreation sites, including Crescent Beach (off Camp Hayden Road), the Washington Department of Natural Resources (DNR) Lyre River Campground, and Clallam County's Salt Creek Recreation Area and Pillar Point Recreation Area before rejoining U.S. Highway 101 west of Lake Crescent. Highway 112 offers outstanding coastal views and access.

This reroute would have added approximately 9.5 miles, or 18 minutes, to trips around the proposed rehabilitation work at Lake Crescent. Although the road is generally in reasonably good condition, there are a few sections signed as "Rough Road" and "Slides and Washouts Next 39 miles." Because Highway 112 is also subject to tsunamis, it is possible that if one occurred, both routes could be closed to access. The speed limit varies on Highway 112 but is generally 55 m.p.h. The road is curvy and there are several hairpin turns and speed warning signs which indicate much lower speeds should be used.

- Locate Clallam Transit Bus Stop within the Barnes Point Developed Area Instead of on Highway 101

This alternative was considered but dismissed because it does not meet Clallam Transit's objective of a minimal stop for loading/unloading passengers, although it would have provided increased accessibility. The bus would have to pull into Barnes Point, which can be extremely congested in summer. If the stop was located elsewhere, there would not be enough sight distance or acceleration lane available for the bus to safely transition to the bus stop/roadway.

- End project at Sol Duc intersection

This alternative was incorporated into the design phase of the project, but because the road is in good condition within this part of the park boundary and because approximately half of this road (north side) is outside the park boundary, it was rejected. Project funding is only applicable to areas within the park.

- Reconstruct Camp David Jr. Road Intersection

Although this idea was initially considered, upon further examination of accident records and of the intersection, analysis indicates that the intersection has good visibility for sight distance and the smattering of problems that are known from it have occurred related to the speed with which vehicles are coming downhill from outside the park into a more congested area. As a result, Alternatives 2-3 propose to change the speed limit at the park boundary, instead of close to the intersection.

- Use Barnes Point as a Staging Area for Road Construction

Because there is a great deal of congestion in this area from existing operations and visitor use activities during the peak season at the NatureBridge learning center, Lake Crescent Lodge concession, Marymere Falls day use area, the Storm King Ranger Station, and the boat ramp, staging in this area was considered but dismissed because it would adversely affect these operations to a greater degree than if staging was not located there. In addition, a variety of other usable staging areas, including existing turnouts are located throughout the project area.

Chapter III: Affected Environment

Information in this section is derived from a comprehensive review of existing information pertaining to the project area within the park. It includes information from the General Management Plan (NPS 2008), Lake Crescent Management Plan (1998), Spruce Railroad Trail Environmental Assessment (NPSOLYM 2012), various natural and cultural resources management plans and other park planning documents, such as the Historic Resource Study (1983). Information in this section has been gained from management, research and analysis throughout the history of Olympic National Park.

The following resource topics that may be affected by actions in this plan are included in this section: geology, soils, acoustic environment and soundscapes, water resources (including hydrology, water quality, and wetlands), vegetation, wildlife, special status plants and wildlife, archeological resources, visitor experience (including visitor access, visitor use opportunities, and interpretation and education), human health and safety, park operations, and socioeconomics.

A. Geology

Lake Crescent is a deep, glacially carved lake that was formed when a massive landslide isolated it from Lake Sutherland approximately 7,000 years ago. The pristine waters of this lake are located in the northern foothills of the Olympic Mountains. Elevations within the study area range from 580 to 700 feet (DEA 2015:4).

Olympic National Park is located on the western edge of the North American continental plate, in an area of mountain building and glaciation. The scenic beauty of the Olympic Peninsula is derived from the forces that elevated the Olympic Mountains. Glaciation, earthquakes, subsidence, and erosion have further shaped the topography (NPS 2008:175). Glaciers created characteristic U-shaped valleys and left behind glacial deposits. The park's landscapes are continually being modified by landslides, river erosion, deposition, and uplift (NPS 2008: 175).

Geologically, the Olympic Mountains are made of a core of sedimentary and low-grade metamorphic rocks that are surrounded by volcanic rocks on the north, east, and south sides. The outer belts are comprised of basaltic flows and breccias of the Eocene age, as well as older altered basalts, pillow lavas, and flow breccias deposited in the Mesozoic era and Paleocene epoch. The lowlands are glacial outwashes, while the western and southern portions are marine terraces and glacial outwash fans (NPS 2008:176).

The Lake Crescent watershed is situated within a unique geologic formation called the Crescent Formation, so named because of the horseshoe-shaped band of marine basalt that comprises the northern and eastern perimeters of the Olympic mountain range. Inside the configuration, the predominant geologic materials are sedimentary in origin. The northwestern portion of the watershed is comprised mainly of basalt, with the southwestern portion comprised of sandstone, shale, and conglomerate (NPS 2012: 100).

Lake Crescent was originally covered by glaciers during the late Wisconsin Glaciation. Glacial retreat left a typical U-shaped valley with steep sides. Eocene basalt occurs along the northeast shore of the lake while the rest of the basin is comprised of sandstone, shale, and conglomerate (NPS 2012: 101).

After glaciers retreated from the area, modern day lakes Crescent and Sutherland were connected. Both lakes emptied into Indian Creek and then into the Elwha River. Several large landslides separated the two lakes, causing Lake Crescent to rise until it formed a new outlet via the Lyre River. The slide occurred near the northeast corner of Lake Crescent and originated from the north valley wall where Highway 101 now crosses from the Elwha to the Lyre watershed (NPS 2012: 101).

Along U.S. Highway 101, the park has conducted several rock scaling (selective removal) and bolting efforts. These occurred most recently in 1984 (see Chapter IV).

B. Soils

Soils have formed from a variety of geologic materials. No official soil classification or mapping has been conducted within Olympic National Park. Work is in progress and information may be available in 2016. Nonetheless, some generalizations about soil characteristics can be made based upon mapping and classification conducted by the Washington State Department of Natural Resources and the U.S. Department of Agriculture's Natural Resources Conservation Service for areas adjacent to Olympic National Park that contain the same parent material (NPS 2012: 102).

In general, area soils tend to be thin and poorly developed due to glacial scouring of the bedrock of the northern foothills belt (Brown and Grower 1960 in NPS 2012:102). Subsoils strongly resemble original bedrock material. Upland soils are typically well drained, with low to moderate water retention and very high infiltration rates. Soils along the lakeshore contain greater amounts of clay and are poorly drained.



Figure 9: Lake Crescent Soils

Sensitive soils are associated with steep slopes, incised stream channels, unstable bedrock, and water seepage areas. There is evidence of mass slope failure within the watershed; four areas of landslide deposits have been mapped by the U.S. Geological Survey. Additionally, rockfall along U.S. 101 occurs frequently during the wetter months. In fall 1995, a bridge on Camp David Junior Road (North Shore Road) washed out when a landslide occurred during a period of heavy rain. Based on this history, the potential for ongoing mass-wasting (slope failures) is high (NPS 2012: 102).

As shown in Figure 9, the two broadly defined soil groups comprising the U.S. Highway 101 corridor are Terbies-Louella-Elwha (WA171) and Solleks-Snahopish-Makah (WA 172).

Terbies-Louella-Elwha (WA171) is characterized as:

Deep and very deep, well drained, moderately steep to extremely steep soils; on mountainsides.

This map unit is in the southeastern and south-central parts of the survey area. Slope is 10 to 90 percent. The vegetation is mainly conifers and shrubs. Elevation is 200 to 2,000 feet. The average annual precipitation is 30 to 70 inches, the average annual air temperature is 46 to 48 degrees F, and the average growing season (at 28 degrees) is 210 to 260 days.

This unit makes up about 8 percent of the survey area. It is about 45 percent Terbies soils and 40 percent Louella soils. The remaining 15 percent is components of minor extent.

Terbies soils are deep. These soils are steep to extremely steep and are on mountainsides in the southcentral part of the survey area. The soils formed in residuum and colluvium derived from sandstone, siltstone, and conglomerate. The surface is covered with a mat of organic material. The surface layer is very gravelly sandy loam. The subsoil is very gravelly, extremely gravelly, and extremely channery [containing fragments of rock] sandy loam. The substratum is extremely channery sandy loam. Fractured sandstone is at a depth of 45 inches.

Louella soils are very deep. These soils are moderately steep to extremely steep and are on mountainsides in the southeastern part of the survey area. They formed in residuum and colluvium derived from basalt and flow breccia. The surface is covered with a mat of organic material. The surface layer is gravelly loam. The subsoil is gravelly clay loam and gravelly loam. The substratum is gravelly sandy loam.

Of minor extent in this unit are small areas of well drained Schnorbush soils on hills and somewhat excessively drained Dystric Xerorthents, bouldery, in hilly areas of landslide debris. Also of minor extent are small areas of Rock outcrop[s] consisting of basalt, conglomerate, and sandstone.

This unit is used mainly as woodland. Steepness of slope restricts access for other uses (Hallowin 1987: bracket comments added).

Elwha is characterized with other soils (Elwha-Clallam-Catla) as:

Shallow and moderately deep, moderately well drained, nearly level to steep soils; on hills.

This map unit is in the eastern part of the survey area. Slope is 0 to 35 percent. The vegetation is mainly conifers and shrubs. Elevation is 40 to 2,000 feet. The average annual precipitation is 16 to 45 inches, the average annual air temperature is about 48 degrees F, and the average growing season (at 28 degrees) is 210 to 260 days.

This unit makes up about 13 percent of the survey area. It is about 55 percent Elwha soils, 30 percent Clallam soils, and 10 percent Catla soils. The remaining 5 percent is components of minor extent.

Elwha soils are on hills. These soils are moderately deep. They formed in glacial till. The surface is covered with a mat of organic material. The surface layer is gravelly sandy loam. The subsoil is mottled gravelly sandy loam. Compact glacial till is at a depth of 33 inches. . .

. . . Of minor extent in this unit are moderately well drained Cassolary, Clallam Variant, and Yearly soils. Also of minor extent are small areas of poorly drained Bellingham, McKenna, and Mukilteo soils in depressional areas and drainageways.

This unit is used mainly as woodland. It is also used for homesite development. The Clallam soils are also used for hay and pasture.

The main limitations of this unit for homesite development and septic tank absorption fields are wetness, steepness of slope, and depth to compact glacial till. The main limitation of the Clallam soils for hay and pasture is droughtiness (Hallowin 1987:8).

Solleks-Snahopish-Makah (WA 172) is characterized as

Moderately deep and very deep, well drained, steep to extremely steep soils; on mountainsides.

This map unit is in the western part of the survey area. Slope is 35 to 90 percent. The vegetation is mainly conifers and shrubs. Elevation is 300 to 2,000 feet. The average annual precipitation is 90 to 140 inches, the average annual air temperature is 45 to 47 degrees F, and the average growing season (at 28 degrees) is 210 to 240 days.

This unit makes up about 14 percent of the survey area. It is about 45 percent Snahopish soils, 25 percent Solleks soils, and 20 percent Makah soils. The remaining 10 percent is components of minor extent.

Snahopish soils are on mountainsides. These soils are very deep. They formed in material derived from sandstone. The surface is covered with a mat of organic material. The surface layer is very gravelly loam. The subsoil is very cobbly loam. The substratum is extremely cobbly loam.

Solleks soils are on mountainsides. These soils are moderately deep. They formed in residuum and colluvium derived from sandstone and conglomerate. The surface is covered with a mat of organic material. The surface layer is very gravelly loam. The subsoil is very cobbly loam and extremely cobbly loam. Sandstone is at a depth of 33 inches.

Makah soils are on mountainsides. These soils are very deep. They formed in residuum and colluvium derived from basalt. The surface is covered with a mat of organic material. The surface layer and subsoil are gravelly loam. The substratum is very gravelly loam.

Of minor extent in this unit are well drained Hyas soils and small areas of well drained Palix soils on foothills. Also of minor extent are small areas of Rock outcrop consisting of basalt, conglomerate, and sandstone.

This unit is used as woodland. Steepness of slope limits access for other uses. Instability of the soils is a concern in areas of road cuts (Hallowin 1987:12).

C. Acoustic Environment and Soundscapes

The acoustic environment is a resource with intrinsic natural and cultural resources value. It is a critical component of wilderness character and plays an important role in wildlife communication, behavior, and other ecological processes. Results from surveys of the American public indicate that hearing the sounds of nature is an important reason for visiting national parks. Therefore, the value of acoustic environments and soundscapes is related to an array of park resources and has broad implications for park management. As described in the GMP, natural sounds characterize the park — the impossibly elaborate song of a winter wren, bugling bull elk declaring their dominance, the rhythm of waves over pebbles on a beach, the piercing whistle of an Olympic marmot, the crisp sound of wind through subalpine fir, the soft silence of falling snow, and the haunting flute-like call of a varied thrush. Even if the source is impossible to find, sounds inform visitors of what is around them (NPS PWR 2008: 174)¹.

¹ The NPS Natural Sounds and Night Skies Division (NSNSD) has defined *acoustic resources* as physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence). The *acoustic environment* is the combination of all the acoustic resources within a given area - natural sounds and

Sound researcher Gordon Hempton has conducted extensive sound studies in Olympic and other national park areas (Hempton, unpublished in NPS PWR 2008: 174). His measurements of sound pressure levels in the park are as follows (dB(A) = average decibels):

- alpine environment, 25 dB(A);
- rainforest, 30 dB(A);
- coastal beach, 65 dB(A);
- lakeshore, 45 dB(A).

These readings can vary by season because of water levels, number of birds, and insect activity. For comparison, a conversation between two people standing three feet apart averages 55-65 dB(A), and a typical outdoor urban setting is in the 70-85 dB(A) range (Hempton) (NPS PWR 2008: 174). Table 5 shows how to interpret the range of these natural sounds by providing reference decibel levels. *Note:* There is no information for natural ambient sound levels at Lake Crescent.

Some examples of natural sounds in Olympic include

- sounds produced by birds, frogs, and insects to define territories or attract mates;
- sounds received by animals to detect and avoid predators or other danger;
- sounds produced by physical processes such as falling rain, wind in the trees, ocean waves, flowing streams, or claps of thunder (rare); and
- sounds that humans may not hear but are nonetheless important to wildlife, such as ultrasonic sound used by bats for navigation or to locate prey (NPS PWR 2008: 174).

Sound pressure levels² in microphones can be adjusted according to a weighted scale (A-weighting) such that they resemble the response of the human ear (Harris 1998 in NPS NSNSD 2015a). This adjustment is typical and was made in the park monitoring described below.

The NPS Natural Sounds and Night Skies Division has identified the following park sound sources and their common sound source counterparts:

To determine environmental effects from noise, NSNSD examines whether existing sound levels exceed certain decibel (dBA) values that relate to human health and speech. At 35 dBA, human and wildlife sleep can be interrupted (Haralabidis, et al., 2008). The World Health Organization's recommends that noise levels inside bedrooms remain below 45 dBA (Berglund, et al., 1999). At 52 dBA, a listener wouldn't clearly hear another person speaking in a raised voice at 10 meters (Environmental Protection Agency 1974). At 60 dBA, normal voice communications can be interrupted at 1 meter. Visitors in the park would likely be conducting such conversations. Human responses can serve as a proxy for potential impacts to other vertebrates because humans have more sensitive hearing at low frequencies than most species (Dooling and Popper 2007: 5 in NSNSD 2015a).

At Olympic National Park, natural sounds generally predominate throughout the wilderness, and therefore through most of the park. There can also be human-caused noise in the wilderness, such as sounds related to visitor use, project activities and sounds from aircraft overflights, such as from airplanes and helicopters. Most human-caused sounds, other than overflights, are usually confined

human-caused sounds – as modified by the environment. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls. *Soundscape* is the component of the acoustic environment that can be perceived and comprehended by the humans. The character and quality of the soundscape influence human perceptions of an area, providing a sense of place that differentiates it from other regions. *Noise* refers to sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds. *Cultural soundscapes* include opportunities for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which the parks were established (Pipkin and Wood 2015).

² Sound Pressure Level is measured in decibels (dBA), a logarithmic scale where 0 dB represents the threshold of human hearing at 1 kHz.

to developed areas and along major roads. The sound of aircraft, however, may routinely be heard, even in wilderness due to the proximity of the Seattle-Tacoma International Airport and military training flights. For example, although engine-assisted (jake) brakes used by logging trucks are illegal within the park, including on Highway 101 at Lake Crescent, these were measured as a source of noise in the soundscape study. The level of noise in developed areas varies by location and time of year (relating to the number of visitors and seasonal park operations). In certain areas, such as on the beach or beside a major river, the natural sound level may mask to overcome some human sounds (NPS PWR 2008: 174).

Table 5: Sound Source Counterparts

Park Sound Sources	Common Sound Sources	dBA
Volcano crater (HALE)	Human breathing at 3m	10
Leaves rustling (CANY)	Whispering	20
Crickets at 5m (ZION)	Residential area at night	40
Conversation at 5m (WHMI)	Busy restaurant	60
Snowcoach at 30m (YELL)	Curbside of busy street	80
Thunder (ARCH)	Jackhammer at 2m	100
Military jet at 100m AGL (YUCH)	Train horn at 1m	120

Source: NSNSD 2015a

Table 6: Sample Effects of Sound Pressure Levels on Humans

SPL (dBA)	Relevance
35	Blood pressure and heart rate increase in sleeping humans (Haralabidis et al. 2008) Desired background sound level in classrooms (ANSI S12.60-2002)
45	World Health Organization's recommendation for maximum noise levels inside bedrooms (Berglund, Lindvall, and Schwela 1999)
52	Speech interference for interpretive programs (EPA 1974)
60	Speech interruption for normal conversation (EPA 1974)

Some threats to the acoustic environment originate in areas adjacent to the park boundaries such as noise from logging or adjacent construction activities, National Park Service project related aircraft, and non-National Park Service aircraft such as military, commercial, and private sector aircraft (NPS PWR 2008:175). Recently, the Whidbey Island Naval Air Station (NAS) has begun flying growler (Boeing EA-18G) aircraft in the San Juan Islands and along the coast of Washington, including within and adjacent to Olympic National Park. These aircraft are louder and more frequent (the number of training flights has increased) than the previous prowler (Boeing EA-6B) aircraft flights. A joint letter commenting on the adverse effects of this activity on park soundscapes was submitted to the NAS by the superintendents of San Juan Island National Historical Park, North Cascades National Park, and Olympic National Park.

During winter (January- March) 2010, the NPS collected baseline acoustic data at Olympic NP. Five sites were sampled for approximately 30 days each. Baseline data collected during this period is intended to help the park understand the effects of future noise impacts and inform future park planning, such as for the wilderness management plan (NPS 2010).

Daily median sound levels are described as L_{50} . The characteristic natural acoustic environment is described as L_{nat} . Natural ambient sound (L_{nat}) has not been defined for the Lake Crescent acoustic environment. L_{nat} would be the SPL in the area without the presence of human-caused sounds. The existing ambient measured in the report includes all noise sources in the area, both natural and human-caused. L_{50} represents the sound that is exceeded 50 percent of the time. L_{50} is the level that represents the existing ambient conditions at the site.

The 2010 data collection included a site (OLYM004) at Lake Crescent. Data collected at this site was summarized in the 2010 acoustic monitoring report for the park:

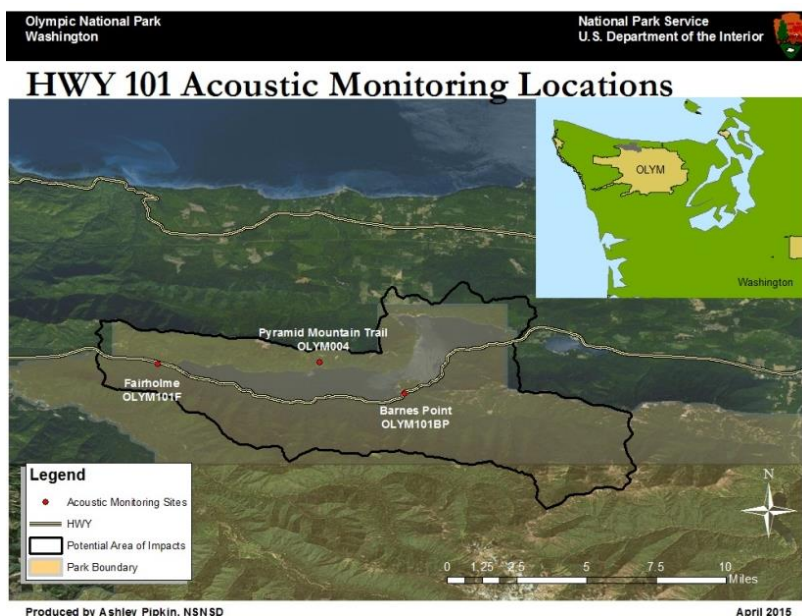


Figure 10: Project Area Acoustic Monitoring Locations

from traffic, especially logging trucks, are expected to lose less power (dBA) than high frequency sounds from traffic as they travel to the microphone. This creates more low frequency recorded sounds (disturbance).

The dates of January 25, January 30, and February 11 to February 13, 2010 were days with higher decibel measurements and were due to inclement, rainy weather conditions. Wind, rain and flowing water provide natural sounds that increase sound pressure levels.

The daily median existing sound levels (L50) varied from 30 to 54 dBA with several louder days (January 25, January 30, and February 11 to 13) due to inclement weather conditions. The hourly median existing sound levels were slightly diurnal with sound levels near 32 dBA in the evening and morning hours, and 36 dBA during the daytime hours. The frequency data indicate the low to mid frequency presence of heavy trucks and other vehicles operating on Olympic Highway across the lake and also the higher frequency presence of birds during the day.

The period of time where no human sounds were audible is called the “noise-free” component of the acoustic environment. Noise-free time periods accounted for 34.7% of the daytime experienced at this site (Figure 11). Natural sounds heard at this site were comprised of wind, water, and bird vocalizations. Fixed-wing aircraft and/or helicopters were audible less than 1% of the time; other aircraft (high altitude jets) were audible 7.2 % of the time. Other human sounds were primarily vehicular sounds from Olympic Highway (NPS 2010).

As shown in Figure 11, of the five sites where baseline data was collected, Lake Crescent had more human-caused sound (attributed to logging truck traffic as noted above) than other sites monitored (not shown in Figure 12 is Third Beach).

The OLYM004 acoustic monitoring site was a forested location near Lake Crescent about ¼ mile from the lakeshore. Measurements were conducted at this site from January 20 to February 14, 2010.

Logging trucks were audible at this location from highway noise on Olympic Highway 101 across the lake. Although the lake does not block sound in the same way as a forest or mountain, the distance from the road over the surface of the lake causes the sounds from the road corridor to attenuate.

During this process of attenuation the low frequencies

(from left to right: Hoh River Trail, Lake Crescent, and Lake Ozette)

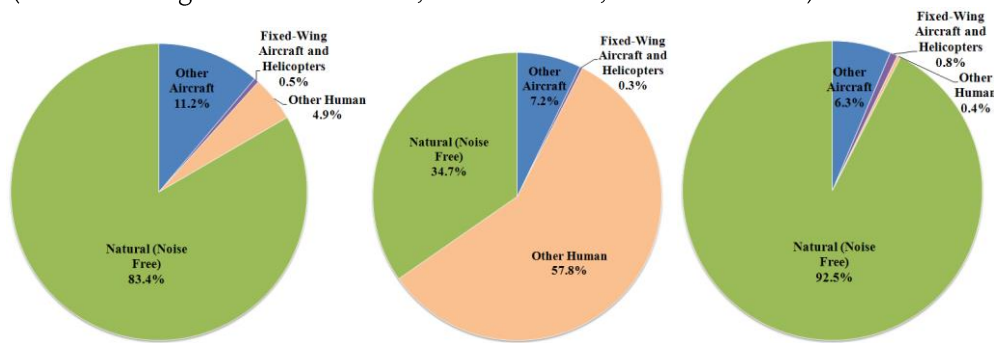


Figure 11: Acoustic Monitoring Baseline Comparison (NPS 2010)

To better understand the acoustic environment of the project area, baseline acoustical data was collected using, high-quality instrumentation, from three monitoring sites in the Lake Crescent area from January 2010 to January 2015 (Figure 12). One site was also deployed on the north side of the lake (Pyramid Mountain site OLYM004) during summer and winter 2010-2011 as part of the park's baseline soundscape monitoring program. Data from the Pyramid Mountain site, along with two additional sites south and adjacent to the Highway 101 road corridor project area (Barnes Point, OLYM101F, and Fairholme, OLYM101BP), were deployed summer 2014 and winter 2015 to characterize the acoustic environment of the 12.5 mile long U.S. Highway 101 rehabilitation project area. Data from the Pyramid Mountain site are also analogous to some acoustic conditions on East Beach Road, however no specific monitoring was conducted adjacent to East Beach Road. Soundscape monitoring data established ambient sound levels that included natural and human-caused sound sources. "Attended listening" also occurred at each site for a one hour interval in each season (from three to nine hours total per season). This involved one or two people sitting in a location adjacent to the monitoring site listening and recording the types and length of sounds heard.

In August - September 2014, constant low-level background road noise was recorded at all three sites. Occasionally at the Barnes Point Site, the wind was loud enough to mask the road noise and there were gaps in road noise during the monitoring because of road striping. Logging trucks, heavy equipment and Clallam County buses were also heard and identified. Despite a park prohibition against "jake" brakes, some logging trucks were heard using these compression brakes. Logging trucks could be heard downshifting and motorcycles were also distinguished. Notes were made when hearing squirrels, chipmunks and birds, though these were difficult to distinguish between for the observers. Moderate wind produced wind-related sounds, such as swaying limbs and rustling needles or leaves. Occasionally, groans, snaps and cracking limbs were also heard (NSNSD 2014). Winter (January – March 2015) monitoring found an acoustic environment similar to that described above (NSNSD 2015).

At each site, sound pressure level (SPL) measurements were taken, along with digital audio recordings and meteorological data. Results showed that 90 percent of the time during the day (7:00 a.m. to 7:00 p.m.) the sound level range was between 26.9 and 39.2 dBA, with an average of 32.62 dBA. At night (7:00 p.m. to 7:00 a.m.) the range of that sound level was between 19.4 and 38.0 dBA, with an average of 28.82 dBA.

Fifty percent of the time in summer and 50 percent of the time in winter during the day (L_{50}), decibel levels exceeded 43.6 dBA, with both summer and winter sounds over 62.5 dBA. Furthermore ten percent of the time (L_{10}) average SPL exceeded 50.4 dBA in summer and 60.4 dBA in winter (during the day) and 40.0 dBA in summer and 46.2 dBA at night (NSNSD 2015a: Table 5).

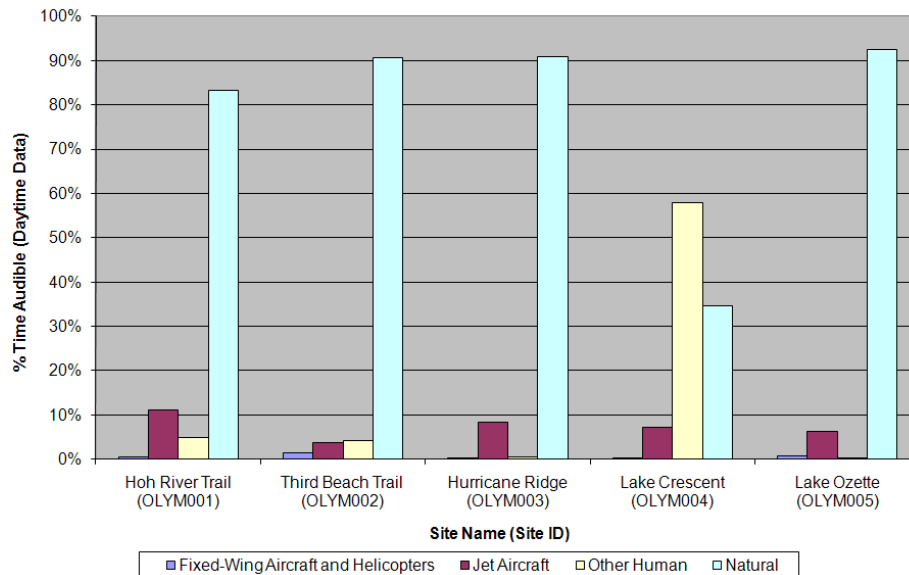


Figure 12: Summary of acoustic observer log data (in situ and office listening combined) for all sites for the winter season (NPS 2010)

There was also analysis of the overlap (masking) of natural sounds, such as bird calls, with human sounds, such as typical conversation, and transportation noise. Based on the experience of the project team, standing on the roadside observing road characteristics, such as failing walls and pavement, when logging trucks passed, typically all conversation had to cease before, during and after passage, so that the continued conversation could be heard. The team

interpreted the sound as being louder because of the often close proximity of the road to a cliff and the way sound was projected across the open waters of the lake. Approximately 25% of the 4,000 vehicles per day is estimated to be attributed to heavy truck traffic, primarily from logging trucks (NSNSD 2015a).

Two species (the endangered northern spotted owl and the threatened marbled murrelet) in the project area are considered sensitive to noise disturbance (USFWS 2008 in NSNSD 2015a). Monitoring sound levels is important with regard to impacts on these species and on visitor use. "Project generated noise in excess of 20-25 decibels above the current L_{50} can be considered harassment and loud noises should be minimized (USFW 2006 in NSNSD 2015a). Noises during nesting [April 1 to September 23] can lead to increases in chick mortality. In the presence of loud disturbances parents will not return to the nest to feed chicks" (NSNSD 2015a).

The current L_{50} for the roadway varies, but is over 43.6 dBA, with both summer and winter sounds occasionally (L_{10}) exceeding 62.5 and regularly (L_{50}) exceeding 35.3 during the day and 28.5 at night (Figure 15). According to the NSNSD snapshot, park transportation corridors, like the one surveyed in this study, have median ambient sound levels that are typically more than four orders of magnitude higher than the natural condition (Barber et al. 2009 in NSNSD 2015a). As with other roads studied, traffic along this corridor also follows a pattern. Traffic is generally heavier on this stretch of highway during the summer compared to winter and is heavier during the daytime compared to nighttime (NSNSD 2015a). Weather patterns also influence the distribution of sound near the roadway, with wetter periods experiencing more sounds and louder decibel levels than dry periods due to rain, thunder, presence of wildlife and other natural sounds.

Of the three sites monitored, two (Barnes Point and Fairholme) are more representative of the noise environment of Highway 101 because they are closer to the highway. The extent of noise impacts near the project site, however, is also represented by the Pyramid Mountain site, which is approximately 1.23 miles away, across the lake and highway from the proposed project area. Even at this distant site, heavy truck traffic is audible. This has been shown by both baseline and project-specific monitoring, as well as by personal observations of interdisciplinary team members.

Overall, however, more noise associated with truck traffic was heard at the two sites closest to the highway, while more noise associated with weather conditions was evident at the Pyramid Mountain site.

The Pyramid Mountain monitoring shows fewer impacts from traffic because of the distance separating it from the road compared to the other three sites. Data also show that at the Barnes Point site, some of the road noise was masked (and added to) by the creek noise, creating a louder overall ambient acoustic environment with both natural and human-caused components (NSNSD 2015a). Some natural sounds, however are masked at all three sites.

The following three figures show comparisons of the data obtained at each of the monitoring sites. The NPS Natural Sounds and Night Skies Division (NSNSD) provided the following interpretation of the figures [*Figure numbers modified, acronyms, and site names added in brackets*]:

In addition to seasonal variation we also see daily variations in SPL [sound pressure level] [Figure 13]. In all cases, sound levels were higher during the daytime than they were at night. This difference was more pronounced during the summer, and is likely a result of increased daytime traffic. The loudest 10 percent of noises at the highest daily peak of traffic are above 50dBA at OLYM101F [Fairholme] and 57 dBA at OLYM101BP [Barnes Point] (Figure 13). At the OLYM004 site this daily peak in traffic is much less noticeable in the winter than the summer, this is likely a result of decreased natural noise sources and increased anthropogenic noise sources during the summer. The noise levels during certain times of day will be important to consider when monitoring the effects of noise on a crepuscular species like the Marbled Murrelet. In [Figure 14] we see that the data from the OLYM101BP Winter 2015, the loudest site, exceeds 35 dBA 100% of the time but the loudest sounds that are higher than 45, 53 and 60 dBA are most common during the day. Exceedance levels were higher in the summer sites than the winter sites at OLYM101BP [Barnes Point] and OLYM101F [Fairholme] [Figure 13 & Figure 14], this suggests higher traffic noises during the summer days than the winter days. . .

While on-site listening session measurements do provide information on sound sources, these sessions aren't conducted frequently enough to give us the full acoustic picture. The Pyramid Mountain site had three seasons (9 hours) of data collected, two from winter (2010, 2015) and one from summer (2014). The OLYM101BP [Barnes Point] and OLYM101F [Fairholme] site each had two seasons (8 hours) of data collected in the summer of 2014 and winter of 2015. The OLYM101BP [Barnes Point] and OLYM101F [Fairholme] sites had a higher percent time audible from traffic related noise sources in the summer than in the winter. Non-natural sound-sources dominated the soundscape at OLYM101BP [Barnes Point] and OLYM101F [Fairholme] more noticeably than at OLYM004 [Pyramid Mountain] according to the attended listening sessions.

Figure 13 shows the exceedance levels from the loudest 10% of sound pressure levels over the course of a typical day at all three sites, during each monitoring season.

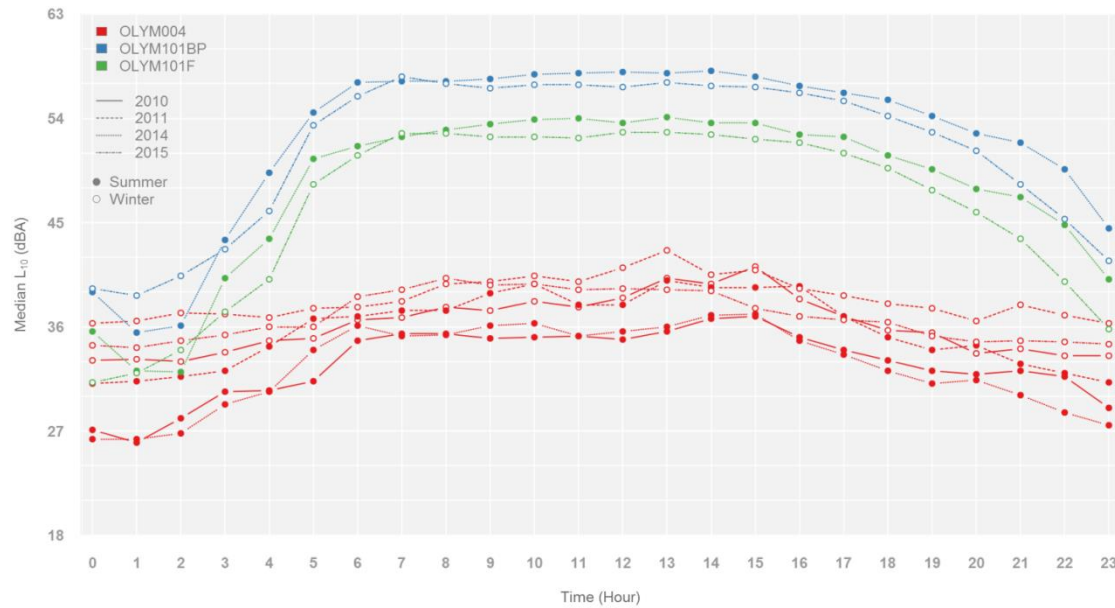


Figure 13: Exceedence Levels from the Loudest 10% Sound Pressure Levels
Source: Figure 16 NSNSD 2015a

Figure 14 shows the hourly ambient noise at all three sites.

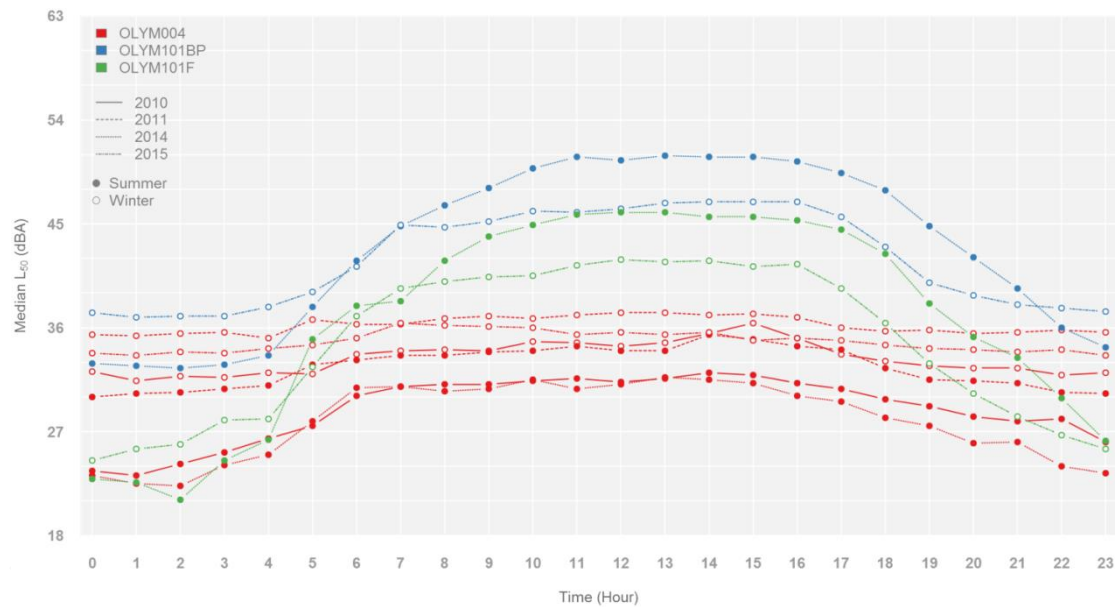


Figure 14: Hourly Ambient Noise at Monitoring Sites
Source: Figure 17 NSNSD 2015: The average sound pressure levels over the course of a typical day at all three sites, during each monitoring season. This can be considered the hourly ambient for each of the sites.

Figure 15 shows the day and night percent time above critical thresholds at each site.

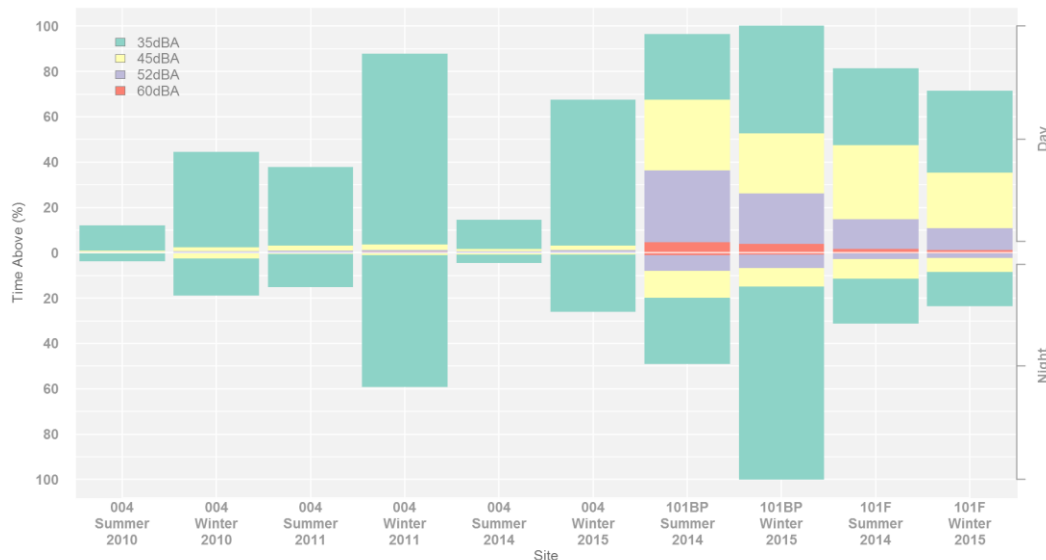


Figure 15: Day and Night Percent Time above Critical Thresholds for Monitoring Sites

D. Water Resources

Hydrology

The topography of the Lake Crescent watershed is one of extremes. Lake Crescent is enclosed by steep ridges on all sides. Elevations range from approximately 575 feet at lake level to roughly 1,500 feet on the northern ridge, and 4,500 feet on southerly ridges. Evidence of the underlying rock formations can be seen in the depth of the stream channels on the major north and south slopes and in the lake as well as in the drive along U.S. Highway 101. Streams on the north side of the watershed are underlain by harder basalt which is resilient to down cutting. Over time, this resistance to erosion has produced a fairly even slope with relatively shallow stream valleys. The south slope, which is formed in a softer sandstone base typically has much deeper and more numerous stream channels (NPS 2012: 101-2). There are approximately 22 intermittent and perennial streams that cross the 12.3-mile stretch of roadway. Barnes Creek is the largest tributary to Lake Crescent; however, additional inflows are also provided by La Poel, Piedmont, Eagle, Smith, Cross and Aurora creeks. Most of the streams are steep but stable and are not influenced by glacial runoff. Tributary flows depend on snowmelt and rainfall and therefore are subject to variable seasonal changes in discharge. The only outlet for the lake is the Lyre River, which drops approximately 576 feet over 5.5 miles en route to the Strait of Juan de Fuca.

The lake is 11 miles long with a surface area of eight square miles (5,119 acres). The watershed comprises 39 square miles or approximately 24,960 acres. Lake Crescent's elevation is approximately 579 feet, with a mean depth of 332 feet and a maximum depth of 624 feet (off La Poel Point) (NPS 2012: 103).

Both Highway 101 along the lake's south shore and the historic Spruce Railroad grade along the north shore bisect riparian areas (NPS 2012: 103).

Groundwater levels in the Lake Crescent vicinity approximate the lake level. This level varies with the seasons and is somewhat higher in the winter because of abundant rainfall (NPS DSC 1981:12).

Today, many of the park's developed areas contain main roads, visitor contact stations, employee housing, campgrounds, and trails that are in the floodplains of major drainages. In protecting these areas, the park has often used large rock (riprap) to harden river banks and protect facilities. These historic and

more recent channel modifications have resulted in unnatural conditions in several drainages throughout the park (NPS 2008: 179).

Riprap also lines much of the southern bank of Lake Crescent. It has been placed and/or replaced frequently in the more than 90 years since the road's construction. U.S. Highway 101 sits on a bench above Lake Crescent and is flanked on the other side with an often near vertical rise. As a result, there is little upstream fish habitat on the south side of the highway in most of the inlet creeks.

Water Quality

The deep clear waters of Lake Crescent originated from huge ice sheets that once covered the area. Because the lake is nitrogen poor, depths of up to 60 feet can be seen in some places. This clarity also gives the lake its deep blue-green color and its characteristic as an oligotrophic (low in nutrients) lake.

All streams within the park are classified as class AA (extraordinary) under the state implementation of the Clean Water Act. The Washington State Department of Ecology uses Lake Crescent as a reference lake in its ongoing study of freshwater lakes in Washington, due to its pristine water quality (NPS 2012: 103).

Several water quality studies (Lake Crescent Water Quality Status Report 1984-1989 and Trophic Status and Assessment of Non-Point Nutrient Enrichment of Lake Crescent, 1991) were conducted to establish a baseline for further water quality testing within the Lake Crescent watershed. Conclusions derived from these studies indicate that the lake is in extraordinary condition. Lake Crescent has been characterized as an oligotrophic lake with no problems requiring any form of mitigation (NPS 1991a). Oligotrophic lakes are low in nutrients, thereby limiting the growth of algae, and having very clear waters with high oxygen content.

Although drain fields and septic tanks close to the shoreline are at risk of exposure as a result of erosive forces associated with extreme winter storms, studies completed the late 1980s found no indication of pollution in the lake from septic systems (NPS 2012: 103). More recent work with the USGS in 2006-2007 found that diesel trucks are a contributor to nitrogen levels in the lake. . . "In contrast, contribution of nitrogen compounds from onsite septic systems appears to be relatively minor related to the other sources identified" (Moran et al. 2012). Other potential sources of water pollution include unburned fuel released from two-cycle engines, spills or leaks from gas pumps, and gas tanks on motorized watercraft. Runoff from parking lots is also a potential source of non-point pollution. The GMP notes that expansion or construction of parking facilities, unless adequately designed to treat and store surface runoff, may result in increased amounts of these pollutants into Lake Crescent. Unexpected events such as hazardous material spills from vehicles along U.S. Highway 101 are also a concern (NPS 2012: 103).

Some limnological (lake study) work has been conducted on Lake Crescent, including a sampling program, two studies on septic systems (one in draft) and another on the lake nutrient budget (Crain pers. comm. 2015). Most studies, however, have focused on fish, including of the landlocked kokanee, and the endemic cutthroat and rainbow trout. Only recently has attention turned toward long-term monitoring of water quality and acquisition of basic limnological data such as seasonal physical/chemical profiles in the deep basins, seasonal and inter-annual nutrient dynamics, and plankton and algal dynamics (Meyer and Fradkin 2002 in NPS 2012: 103). As a result, the GMP calls for a Lake Crescent shoreline protection/management plan to be developed that would focus on water quality and shoreline issues, including issues associated with wastewater treatment and development (NPS 2008: 153).

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Wetlands

The U.S. Fish and Wildlife Service defines wetlands as: “lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. Wetlands must have two or more of the following three attributes:

- 1) At least periodically, the land supports predominantly hydrophytes
- 2) The substrate is predominantly undrained hydric soil
- 3) The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year” (Cowardin et al. 1979).

Mottled and moist soils in conjunction with wetland vegetation are indicative of wetland sites. Marshes, swamps, and bogs are also termed wetlands.

In other words, wetlands include lands between terrestrial and deep-water habitats, and isolated areas, where the water is at or near the surface. The presence of certain soil types, plant species, and water define wetlands.

NPS Director’s Order 77-1: Wetland Protection and Procedural Manual established the agency procedures/requirements for implementing Executive Order 11990 (Protection of Wetlands). One requirement includes preparation of a Wetlands Statement of Findings if an action would have new adverse impacts on wetlands, and to compensate (minimum 1:1 ratio) for wetland impacts by restoring degraded wetlands.

For regulatory purposes under the Clean Water Act, the term wetlands means “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.”

Wetlands are found in the interior portions of the park and along the coast and serve important functions including flood protection, erosion protection, sediment filtration, and water storage for release during droughts. They also provide habitat and food for a variety of animals including mammals, fish, birds, insects, and microscopic organisms. They can provide other benefits such as recreational opportunities, education, and research.

Freshwater wetland ecosystems in the park include ponds, marshes, seasonally flooded meadows, and riparian areas (NPS 2008: 180). Lakes and wetlands are catalogued as water bodies in the park’s geographic information system (GIS) database. According to this database, there are about 650 lakes and wetlands, including more than 300 high mountain lakes, totaling 13,978 acres (5,657 hectares) in Olympic National Park. This number is derived from the National Wetlands Inventory, and is likely an underestimate because mapping did not include many of the forested wetland areas of the park (NPS 2008: 180). For instance, no wetlands, except for Lake Crescent, were mapped in the project area, based on NWI data (DEA 2015). Lake Crescent is mapped as a lacustrine, limnetic, unconsolidated bottom, permanently flooded water.

U.S. Highway 101 and East Beach Road

A wetlands delineation was conducted in the proposed project area to determine regulatory wetlands under the Clean Water Act as described in the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (David Evans and Associates [DEA] 2015: 2, USACE 1987). Regulatory wetlands are defined by the simultaneous presence of hydrophytic vegetation, hydric soils and positive wetland hydrology during the delineation. The study also noted that it assessed all wetlands and that even the two-criteria Cowardin classification system used by NPS would not change the number of wetlands identified (DEA 2015:2, Cowardin et al.1979). Because nonjurisdictional wetlands may also be regulated by the Washington State Department of Ecology (WDOE), these were also quantified. The survey also established the ordinary high water mark of the lake as 585 feet (DEA 2015).

The survey noted that throughout most of the project area soils were homogeneous and primarily dark brown silt loams, which were well-drained, even if saturated or inundated (DEA 2015). Near the end of

the project area (Govins Hill), more soils derived from sandstone weathering were observed. Because of the extent of inundation, most soils had to be dried before wetland soil mottling features were observed.

As described in the survey, wetland ditches were very similar in shape, with an average width of 1.5 feet at the bottom (DEA 2015). Some of these also contained seeps from cut-banks and were mapped as part of the same area. Most non-stream wetland resources in the project area occurred within ditches and were likely formed from road construction many decades ago (DEA 2015). Where the road intercepts groundwater, the study noted that “most, if not all, water that passed through the study area is naturally channeled into discrete cascades (and thereby directed to catch basins under the road) rather than moving through as groundwater. This is likely due to the geology of the area and steepness of the terrain” (DEA: 2015:5). Nonetheless, the roadside ditches were not included as jurisdictional wetlands, unless they met all three criteria (presence of water, wetland soils and water-dependent vegetation). Although it is typical to “clean” roadside ditches by clearing vegetation annually, the delineation found that most were fully vegetated and that many also contained small young shrubs or trees (DEA 2015:4).

According to the guidance (EPA and USACE 2008), “The following geographic features generally are not jurisdictional waters:

- swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow)
- ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water” (quoted in DEA 2015:7).

U.S. Highway 101

The Highway 101 survey recorded 29 stream-associated wetlands and 16 ditch-associated wetlands and classified most of these as palustrine emergent wetlands associated with the roadway. All but three of these were identified for both state and federal jurisdiction. The three that would not qualify for regulation under both do not have any connection to the lake and instead infiltrate the soil. Together jurisdictional wetlands comprise 0.1046 acres. State jurisdiction only ditch-associated wetlands comprise 0.0173 acres and state and federal jurisdictional ditch-associated wetlands comprise 0.0873 acres (DEA 2015: 14).

Of the stream-associated wetlands, seven were identified as large (often perennial) natural streams, while only four were identified as present because of the road construction (formed by outfalls from roadside ditches). All would meet USACOE jurisdiction because they are all connected with a surface water connection to other surface waters (Lake Crescent). A total of 0.3719 acres of wetlands were identified associated with these streams (DEA 2015: 19). A combined total of 0.4765 acres of wetlands were identified in the project area in the wetlands jurisdiction report.

East Beach Road

The East Beach Road survey found eight stream-associated wetlands, nine roadside ditch-associated wetlands, and four natural (category IV [small]) wetlands along a 3.3 mile stretch of East Beach Road (DEA 2015c: 8). Streams included the Lyre River and Log Cabin Creek. Others were very steep cascades that likely do not contain fish habitat. All except two (S-3 and S-6) were considered perennial. As with the ditch-associated wetlands, three of the four natural wetlands and most of the ditch-associated wetlands were classified as palustrine emergent. The other natural wetland is classified as a palustrine scrub-shrub wetland. Two of the ditches appeared to carry perennial water, but did not contain wetland vegetation and thus did not meet the wetland vegetation criterion. Numerous culverts are located in areas with no sign of flow and that also did not contain wetland vegetation (DEA 2015c: 10). A total of 0.123 wetlands were identified associated with these streams (DEA 2015c: 14).

There were 0.163 acres of ditch-associated areas and wetlands. Of this total, approximately 0.141 acres would likely be federal and state jurisdictional, while 0.022 would likely be state jurisdictional only (DEA 2015c: 12).

E. Vegetation

Native Plant Communities

Approximately 1,195 vascular plants occur in five major terrestrial plant communities within Olympic National Park (Certified Species List: NPSpecies - The National Park Service Biodiversity Database. IRMA Portal version. <https://irma.nps.gov/App/Species/Search> (certified species list - park status view; accessed September, 2015). and Buckingham 1995). These are the:

- Temperate Rain Forest Zone: Westside forests of Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*).
- Lowland Zone: Lower elevation forests of Douglas-fir (*Pseudotsuga menziesii*), western hemlock and western red cedar (*Thuja plicata*).
- Montane Zone: Mid-elevation to upper slope forests of Pacific silver fir (*Abies amabilis*) and western hemlock.
- Subalpine Zone: The area between continuous forest and timberline. Tree clumps of mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*) mixed with meadows.
- Alpine Zone: Areas above tree line, mainly in the northeastern section of the park and on higher peaks.

Lake Crescent is primarily located in the Temperate Rainforest Zone and the Lowland Zone.

Sitka Spruce / Temperate Rainforest Zone: This zone occurs on the wettest sites in the most humid regions in the west side of the park. The Hoh, Queets, Quinault, and Bogachiel rain forest valleys are included in this zone, as is the entire coastal strip. Common shrubs include salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), vine maple (*Acer circinatum*), red huckleberry (*Vaccinium parviflorum*) and Alaska huckleberry (*Vaccinium alaskaense*).

Western Hemlock / Lowland Forest Zone: This is the most widespread zone in the park. Located inland and at higher elevations than the Sitka spruce zone, climatic extremes are somewhat greater here. Western hemlock is the climax dominant; however, much of the area is populated by sub-climax Douglas-fir resulting from past fires or other disturbance. Common shrubs include salal, vine maple, Oregon grape (*Mahonia nervosa*), red huckleberry, Alaska huckleberry, salmonberry, and rhododendron (*Rhododendrom macrophyllum*).

Vegetation within the road prism includes the above species as well as a variety of nonnative species. Some of the nonnative species are invasive and are routinely treated by the park.

Nonnative Species

Approximately 313 nonnative plant species are found in the park. Some of the most commonly found nonnative plants include Scotch broom (*Cytisus scoparius*), English holly (*Ilex aquifolium*), English ivy (*Hedera helix*), reed canarygrass (*Phalaris arundinacea*), Canada thistle (*Cirsium arvense*), and herb-Robert (*Geranium robertianum*).

Most nonnative plants within the park are perennial species, which are the most persistent and difficult plants to control or eradicate. There have been some successful attempts to limit species invasion by hand-pulling, use of approved herbicides, and other techniques in some areas of the park. Most nonnative plants are found in disturbed frontcountry sites and near park roads, however, nonnative plants occur throughout the park (NPS 2008: 184-185). An invasive plant management plan has been identified as a park planning need.

Nonnative invasive plants are known to occur along most of the length of the highway in the project area (Chenoweth 2014). Based on analysis of nonnative plants in the proposed project area, the most abundant species are Scotch broom (*Cytisus scoparius*), tansy ragwort (*Senecio jacobaea/Jacobaea vulgaris*), and reed canarygrass (*Phalaris arundinacea*). Control of these species before, during, and after construction is

important to preclude them from recolonizing the project area. From July 14 through August 7, 2014, both sides of the highway were surveyed over a distance of more than 18 miles for invasive species and rare native plant species (Chenoweth 2014). More than 2.5 acres is estimated to be infested. Small everlasting peavine (*Lathyrus sylvestris*) was the most prevalent invasive species, covering nearly nine miles of road corridor. Altogether, there were 14 different invasive species identified, including two species new to the area: garden loosestrife (*Lysimachia vulgaris*) and orange hawkweed (*Hieracium aurantiacum*) (Chenoweth 2014).

Nonnative invasive species, including Scotch broom and reed canarygrass have historically been a problem along the highway on the south shore of Lake Crescent. Scotch broom is also located in the former quarry near Aurora Creek proposed as a staging area for the project.

Table 7: Primary Invasive Species of Concern Surveyed on Lake Crescent Segment of U.S. Highway 101

Species	Common Name	Washington State Noxious Weed List	Clallam County Noxious Weed List
<i>Bromus tectorum</i>	cheatgrass	NA	NA
* <i>Buddleja davidii</i>	Butterfly bush	Class B	Class B
<i>Centaurea jacea</i>	brown knapweed	Class B	Class B-des
<i>Cirsium arvense</i>	Canada thistle	Class C	Class C
<i>Cytisus scoparius</i>	Scotch broom	Class B	Class B-select
<i>Geranium robertianum</i>	herb-Robert	Class B	Class B-non
* <i>Hedera helix</i>	English ivy	Class C	NA
<i>Hieracium aurantiacum</i>	orange hawkweed	Class B	Class B-des
<i>Hypericum perforatum</i>	common St. John's wort	Class C	Class C
* <i>Ilex aquifolium</i>	English holly	NA	NA
<i>Lathyrus latifolius</i>	perennial pea	NA	NA
<i>Lathyrus sylvestris</i>	small everlasting peavine	NA	NA
* <i>Linaria vulgaris</i>	butter and eggs	Class C	Class C
<i>Phalaris arundinacea</i>	reed canarygrass	Class C	Class C
* <i>Polygonum cuspidatum</i>	Japanese knotweed	Class B	Class B-non
* <i>Polygonum sachalinense</i>	giant knotweed	Class B	Class B-non
* <i>Polygonum x bohemicum</i>	Bohemian knotweed	Class B	NA
* <i>Potentilla recta</i>	sulfur cinquefoil	Class B	Class B-des
* <i>Prunus laurocerasus</i>	Laurel cherry	NA	NA
<i>Rubus discolor</i>	Himalayan blackberry	NA	NA
<i>Rubus laciniatus</i>	evergreen blackberry	NA	NA
<i>Senecio jacobaea</i>	tansy ragwort	Class B	Class B-select

* Not found during 2014 survey (Chenoweth 2014)

Table 8: Observations and Areal Extent of the Primary Invasive Species Found

Species	Common Name	Area colonized (m ²)	Number of observations
<i>Bromus tectorum</i>	Cheatgrass	.01	1
<i>Centaurea jacobaea</i>	knapweed	2	11
<i>Cirsium arvense</i>	Canada thistle	10	20
<i>Cytisus scoparius</i>	Scotch Broom	771	158
<i>Geranium robertianum</i>	Herb-Robert	2,620	111

<i>Hieracium aurantiacum</i>	Orange hawkweed	>1	1
<i>Hypericum perforatum</i>	Common St. John's wort	223	73
<i>Lathyrus latifolius</i>	Perennial pea	1	1
<i>Lathyrus sylvestris</i>	Small everlasting peavine	5,552	207
<i>Lysimachia vulgaris</i>	Garden loosestrife	>1	1
<i>Phalaris arundinacea</i>	Reed canarygrass	612	70
<i>Rubus discolor</i>	Himalayan blackberry	66	3
<i>Rubus laciniatus</i>	Evergreen blackberry	27	4
<i>Senecio jacobea</i>		670	169
TOTAL		10,554	830

F. Fish and Wildlife

A very diverse wildlife population exists in Olympic National Park. There are an estimated 260 bird and 66 mammal species present or probably present in the park, 13 amphibians present, 24 freshwater fish species, 58 marine fish species and 13 anadromous fish species, and 4 reptilian species present in the park (Beirne pers. comm. 9-16-15 and NPSpecies database 9-14-15). The number of invertebrate species is unknown, but likely to be very large (NPS 2008: 185). In addition, the following numbers of nonnative vertebrates have been documented: five nonnative fish, five birds and 6-7 mammals (one pending). Three species of fish are considered endemic, however genetic analysis is pending (Certified Species List: NPSpecies - The National Park Service Biodiversity Database (IRMA Portal Version) <https://irma.nps.gov/App/Species/Search> [certified species list - park status view; accessed September 2015]).

Two species of trout, *Oncorhynchus mykiss* and *Oncorhynchus clarki*, found in the lake are considered unique populations which are reproductively and geographically isolated in Lake Crescent (see next section). In addition to these sensitive species, other fish in Lake Crescent include kokanee salmon (*Oncorhynchus nerka*), prickly sculpin (*Cottus asper*), pygmy whitefish (*Prosopium coulteri*), and perhaps Pacific lamprey (*Lampetra tridentata*) (Meyer and Fradkin 2002 in NPS OLYM 2012:112).

Kokanee salmon are the primary food source for both Beardslee and Crecenti trout. These fish form small schools which can be seen rippling the surface of the lake similar to herring in salt water. The kokanee appear to spawn primarily along the southern shoreline from late October through January. The exact location of spawning is unknown. Abundance is unknown.

Very little is known about the pygmy whitefish population in the lake. However, there is video of pygmy whitefish spawning at depths of over 100 feet along the south shore of the lake.

Eggs of the various species incubate in the gravel of the lakeshore or tributaries for several months after spawning. Therefore, any in water work should be carefully planned to not only avoid disturbing spawning fish but also incubating eggs.

Large native mammals found within the project area include Roosevelt elk, Columbia black-tailed deer, black bear, and cougar. Nonnative mountain goats, which were introduced into the park in 1925 and 1929, are commonly observed at higher elevations within the watershed. Columbia black-tailed deer are frequently seen in clearings and forest margins around the lake, while Roosevelt elk are rarely seen, and then only on the western and southern portions of the watershed. Black bear are common throughout the area. Cougar are occasionally seen near Lake Crescent, as they are throughout the park. River otters inhabit the lake and can sometimes be seen swimming and playing along the shore. Fishers were recently reintroduced in the park, and several have established home ranges around Lake Crescent (NPS OLYM 2012:110).

Douglas squirrels and chipmunks are frequently-seen residents along the lake, and Pacific Townsend's big-eared bats occupy the two Spruce Railroad tunnels. A variety of other smaller mammals, such as

snowshoe hares, mountain beaver, flying squirrels, spotted skunks, raccoons, voles, and mice are less readily noticed by visitors. Several species of amphibians and reptiles occur in the area, including the rarely seen rubber boa and alligator lizard (NPS OLYM 2012:110).

Resident bird species found in lake and riparian habitats of the Lake Crescent area include pied-billed and western grebes; great blue and green herons; wood duck; green-winged teal; mallard; northern shoveler; northern pintail; hooded, common, and red-breasted mergansers; American coot; osprey; and belted kingfisher (NPS OLYM 2012:111). Riparian habitat along Barnes Creek and other tributaries is used by a variety of wildlife species, including river otter and hooded mergansers. Rare harlequin ducks and the American Dipper, or water ouzel, nest along the banks of Barnes Creek each spring (NPS 2012: 103). A pair of mallards is resident at the Sledgehammer Point turnout.

Expected year-round woodland residents include sharp-shinned, Cooper's, and red-tailed hawks; northern goshawk; merlin; sooty and ruffed grouse; killdeer; band-tailed pigeon; western screech, barred, great horned, northern pygmy, and northern saw-whet owl; red-breasted sapsucker; downy, hairy, and pileated woodpecker; northern flicker; gray and Steller's jay; American crow; common raven; black-capped and chestnut-backed chickadee; bushtit; redbreasted nuthatch; brown creeper; Bewick's and winter wrens; American dipper; golden-crowned, savannah, and fox sparrows; red crossbill; pine siskin; and evening grosbeak (NPS OLYM 2012:111).

The European starling and house sparrow are introduced species, found in developed areas throughout the watershed, and domestic turkeys have been released near the area and are occasionally seen in or near the park (NPS OLYM 2012:111).

Migratory birds breeding in the Olympic lowlands, including Lake Crescent, include common nighthawk; rufous hummingbird; western wood-pewee; willow, Hammond's, Pacific-slope, and olive-sided flycatcher; tree, violet-green, northern rough-winged, cliff, and barn swallow; Swainson's thrush; solitary and warbling vireo; yellow, orange-crowned, yellow-rumped, Townsend's, black-throated gray, MacGillivray's, and Wilson's warbler; western tanager; blackheaded grosbeak; white-crowned sparrow; brown-headed cowbird; and American goldfinch (NPS OLYM 2012:111).

Non-breeding migrants coming through the Lake Crescent area include trumpeter swan; turkey vulture; solitary and spotted sandpipers; glaucous-winged gull; ruby-crowned kinglet; Townsend's solitaire; and hermit thrush (NPS OLYM 2012:111).

G. Special Status Plants

Based on information provided by the USFWS, there are no federally listed, proposed, or candidate plant species likely to occur within the project area. There are several federal species of concern and several state species listed by the Washington State Natural Heritage Program that were analyzed within the project area (Table 9). No other species listed by the Washington State Natural Heritage Program or identified as a federal species of concern are known to have habitat within the project area.

Although looking for rare plants was part of a survey conducted to identify and map nonnative invasive plants (July 14 – August 7, 2014), no rare terrestrial plants were found during a survey of the project area (Chenoweth 2014).

Table 9: Rare Plants with Potential Habitat in Project Area

<i>Species</i>	Common Name	Federal Status / State Status (Washington Natural Heritage Database)	Distribution
<i>Pinus albicaulis</i>	Whitebark Pine	Candidate	Not present in project area.
<i>Agoseris elata</i>	Tall agoseris	State sensitive	Present in Clallam

			County. Not known from project area
<i>Astragalus australis</i> var. <i>cottonii</i>	Cotton's milk-vetch	Federal species of concern State threatened	Present in Clallam County. Not known from project area
<i>Cimicifuga elata</i>	Tall bugbane	Federal species of concern State sensitive	Present in Clallam County. Not known from project area
<i>Montia diffusa</i>	Spreading miner's-lettuce Branching montia	State sensitive	Found outside the park a few miles from Lake Crescent but not within the project area. See more detailed information below.
<i>Polemonium carneum</i>	Royal Jacob's-ladder	State threatened	Present in Clallam County. Not known from project area
<i>Lobelia dortmanna</i>	Water Lobelia	State threatened	Found within/adjacent to the project area in Lake Crescent. See more detailed information below.

Water Lobelia (*Lobelia dortmanna*): Water lobelia is an evergreen, perennial aquatic plant which is usually submerged except for some flowering stalks. The leaves consist almost entirely of a basal rosette. The plant is found in shallow water on the edges of lakes and ponds. The species occurs in nutrient-poor water bodies with exceptionally clear water. The basal leaves of water lobelia may be harmed by sediment because they can't photosynthesize if they are covered. Water lobelia is also susceptible to damage from application of herbicides to control aquatic weeds, as well as from shoreline development, water pollution from recreational equipment, and trampling (Washington Natural Heritage Program Field Guide to Selected Rare Plants (<http://www1.dnr.wa.gov/nhp/refdesk/fguide/htm/fgmain.htm>, viewed June 22, 2011 in NPS OLYM 2012: 107).

Water lobelia is found along the shoreline of Lake Crescent within the project area, with the highest concentrations near Barnes Point. Surveys of the project area found a likely increase in water lobelia populations, particularly 13 new populations identified west of Barnes Point toward northwest Sledgehammer Point. Populations vary in distance from the shoreline, with most detected within 2-3 meters. A variety of mitigation measures have been identified to protect the plant and its habitat from potential impacts should one of the action alternatives be implemented (see Chapter IV: *Environmental Consequences*).

Giant Hellebore (*Epipactis gigantea*): This rare species found along the shoreline of Lake Crescent, is listed on the state "Watch list." Species on the watch list are no longer considered imperiled and are not the focus of conservation efforts. However, it is park and NPS policy to treat federal and state sensitive species with the same policies as species with a higher ranking. Surveys for giant hellebore were conducted in 2006, when three populations were present along the south shore, all east of Barnes Point. Surveys for this species were also conducted within the Highway 101 project area.



Figure 16: Water Lobelia



Figure 17: Giant Hellebore

Spreading Miner's Lettuce / Branching montia (*Montia diffusa*): This plant has been found within a few miles of the Lake Crescent watershed (outside of the park) but surveys for this species as part of the nonnative invasive plant survey conducted within the project area did not locate it. This species is listed by the Washington Natural Heritage Database as "sensitive" (i.e., vulnerable or declining with the potential to become endangered or threatened).

H. Special Status Wildlife

Several wildlife species listed by the U.S. Fish and Wildlife Service and/or the State of Washington as threatened or endangered inhabit the park (Table 10).

Table 10: Special Status Wildlife

Species	Federal Status	Washington State Status	Notes
Mammals			
Pacific Fisher <i>Martes pennanti</i>	Proposed Threatened	Endangered	Reintroduced to park in 2008 The USFWS reopened a public comment period on a proposal to list the fisher as threatened in 2015 (with a public comment deadline of May 14, 2015). The deadline for the USFWS to make a final decision is April 7, 2016. The deadline was extended to gather additional information about toxicants and rodenticides used at marijuana grow sites and other information. http://www.fws.gov/cno/es/fisher/ , http://www.nps.gov/olym/learn/nature/fisher-reintroduction.htm accessed 6-10-15.
Long-legged myotis <i>Myotis volans</i>	n/a	Monitored	
Western Long-eared bat <i>Myotis evotis</i>		Monitored	
Pacific Townsend's Big Eared Bat <i>Plecotus (=Corynorhinus) townsendii townsendii</i>	n/a	Candidate	Known from the Spruce Railroad tunnels
Birds			
Short-tailed Albatross	Endangered	Candidate	Known from coastal areas within the park.
Western Snowy Plover <i>Charadrius alexandrinus nivosus</i>	Threatened		
Marbled Murrelet <i>Brachyramphus marmoratus</i>	Threatened	Threatened	See detailed information below. Although critical habitat has been designated, none is in the park, however the park contains high-quality habitat considered vital for marbled murrelet recovery.
Northern Spotted Owl <i>Strix occidentalis caurina</i>	Threatened	Endangered	See detailed information below. Although critical habitat has been designated, none is in the park, however the park contains high-quality habitat considered vital for northern spotted owl recovery.
Streaked Horned Lark	Threatened	Endangered	See detailed information below.

<i>Eremophila alpestris strigata</i>			Although critical habitat has been designated, none is in the park.
Yellow-billed Cuckoo <i>Coccyzus americanus</i>	Threatened	Candidate	See detailed information below. There is a proposed critical habitat designation for this species that does not include the park.
Western Grebe <i>Aechmophorus occidentalis</i>	Bird of Conservation Concern	Candidate	
Short-eared Owl <i>Asio flammeus</i>	Bird of Conservation Concern	n/a	
Bald Eagle <i>Haliaeetus leucocephalus</i>	Delisted Bird of Conservation Concern	Sensitive	See detailed information below. Protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.
Peregrine Falcon <i>Falco peregrinus anatum</i>	Bird of Conservation Concern	Sensitive	
Black oystercatcher <i>Haematopus bachmani</i>	Bird of Conservation Concern	Monitored	
Caspian Tern <i>Hydroprogne caspia</i>	Bird of Conservation Concern	Monitored	
Short-billed Dowitcher <i>Limnodromus griseus</i>	Bird of Conservation Concern	n/a	
Black Swift <i>Cypseloides niger</i>	Bird of Conservation Concern	Monitored	Dependent on old-growth forests. Nest in the area.
Olive-sided flycatcher <i>Contopus cooperi</i>	Bird of Conservation Concern	n/a	
Willow flycatcher <i>Empidonax traillii</i>	Bird of Conservation Concern	n/a	
Rufous Hummingbird <i>Selasphorus rufus</i>	Bird of Conservation Concern	n/a	
Fox Sparrow <i>Passerella iliaca</i>	Bird of Conservation Concern	n/a	
Purple Finch <i>Carpodacus purpureus</i>	Bird of Conservation Concern	n/a	
Amphibians			
Olympic Torrent Salamander <i>Rhyacotriton olympicus</i>		Monitored	Found in swift, cold streams feeding into Lake Crescent
Van Dyke's Salamander <i>Plethodon vandykei</i>		Candidate	Terrestrial salamanders associated with springs and seeps
Tailed Frog <i>Ascaphus truei</i>		Monitored	Found in swift, cold streams feeding into Lake Crescent
Western T(= Bufo) Toad <i>Anaxyrus boreas</i>		Candidate	Found in shallow lakes and ponds
Fish			
Beardslee Rainbow Trout	n/a	n/a	Genetically distinct population

<i>Oncorhynchus mykiss</i>			geographically and reproductively isolated to Lake Crescent. See detailed information below.
Crescent Cutthroat Trout <i>Oncorhynchus clarkii</i>	n/a	n/a	Unique population geographically and reproductively isolated to Lake Crescent. See detailed information below.
Bull Trout <i>Salvelinus confluentus</i>	Threatened	Candidate	No bull trout occur in the Lake Crescent watershed (Crain pers. comm 2015).
Dolly Varden <i>Salvelinus malma</i>	Proposed Similarity of Appearance (Threatened)	n/a	This species is not known from the project area.
Invertebrates			
Western floater (freshwater mussel) <i>Anodonta kennerlyi</i>		Monitored	Found in Lake Crescent, including near the NPS house/boat dock and often associated with water lobelia locations (Cowles 2014). Also found all around the perimeter of the lake (Fradkin 2014).
Western pearlshell (freshwater mussel) <i>Margaritifera falcata</i>		Monitored	Found in the Lyre River and Lake Crescent, including near the NPS house/boat dock and often associated with water lobelia locations (Cowles 2014).

Detailed information about Selected Species in Table 10

Mammals

Pacific Fisher: The recently reintroduced fisher, which is a proposed federal threatened species, also resides in forested areas near the lake and in the adjoining slopes. All four species of special concern have habitat requirements that include the use of large trees.

Birds

Northern Spotted Owl

The northern spotted owl (spotted owl) was listed as a threatened species in 1990 because of widespread loss of suitable habitat across the species range and the inadequacy of existing regulatory mechanisms to conserve the species (USFWS 1990). Many populations of spotted owls continue to decline, especially in the northern parts of the species' range.

Range: The Olympic Peninsula comprises one of four Washington state provinces in the range of the northern spotted owl. The others are the eastern and western Cascades and the western Washington lowlands (USFWS 2008). There are also five provinces in Oregon and three in central/northern California.

Threats: There are numerous threats to the northern spotted owl, including low and declining populations, limited and declining habitat, poor habitat distribution, and predation. Because of extensive habitat loss throughout much of western Washington, the Olympic Peninsula population of northern spotted owls is isolated from those in the Cascade and Coast ranges (NPS OLYM 2004). Among the most disturbing trends, however, in low elevation areas is the increasing use by barred owls, rather than spotted owls. It has become apparent that competition from barred owls (*Strix varia*) poses a significant threat to northern spotted owls. Past and current habitat loss are also threats to the spotted owl, even though loss of habitat due to timber harvest has been greatly reduced on federal lands for the past two decades (USFWS 2008).

Description: Northern spotted owls are long-lived, non-migratory medium sized birds (approximately 18-19 inches tall) that form long-term monogamous pair bonds.

Suitable Habitat: Suitable northern spotted owl habitat is generally mature or old-growth forest that has a moderate to high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; numerous large snags and downed logs; and sufficient open space below the canopy for owls to fly through (Thomas et al. 1990). Forests with these characteristics provide nesting and roosting sites for northern spotted owls and support the highest densities of northern flying squirrels (Carey 1993). In western Washington, spotted owls prey almost entirely on northern flying squirrels and other small mammals (Forsman et al. 2001). Northern spotted owls are mostly nocturnal, although they also forage opportunistically during the day.

Territory: Spotted owls are territorial birds; however the home ranges of adjacent pairs may overlap. Northern spotted owl territories are large and encompass thousands of acres of forest habitat. In the Washington Cascades, an average spotted owl territory encompasses over 6,000 acres (USFWS 1992). Spotted owls defend their territories against other owls and avian predators, although they occasionally hybridize with barred owls. Northern spotted owls range across their territories over the course of the year hunting for prey. Northern spotted owl monitoring has indicated that established spotted owl territories are fairly stable, and that some territories may be occupied by different pairs of spotted owls over many years (Forsman et al. 1984: 19). The actual nest-tree used within a territory may change from year to year, but alternate nest trees are usually located within the same general core area (equal to a 0.7-mile radius around an established activity center) (Forsman et al. 1984: 32). For management purposes, a 1.8-mile radius circle is used to map spotted owl territories. Within the annual home range there is a core area of concentrated use during the nesting season (Bingham and Noon 1997). Home range increases from south to north and has been linked to habitat type, availability and abundance of prey (Zabel et al. 1995 in USFWS 2008).

Breeding Season: In Washington, for environmental impact analysis purposes, the northern spotted owl breeding season is broken into two periods: early breeding season is March 1 through July 15, and late breeding season is July 16 to September 30. For the purposes of analysis, different activities are permitted in each period.

Adult spotted owls begin territory establishment during the month of February and egg laying may begin as early as the second week of March and continue into April. Incubation may begin as early as late March and through the second week in April. Incubation takes approximately 30 days. Most fledglings on the Olympic Peninsula leave the nest, approximately 64-66 days after eggs are laid, during June. Fledglings throughout the range of the spotted owl normally remain within the nest stand through the month of September and begin dispersal in October (USFWS 2008).

Environmental Baseline

Status of Northern Spotted Owls in Olympic National Park

Extensive suitable habitat for northern spotted owls in the park is found in intact, relatively large, primarily low elevation major drainages. Many of these are naturally fragmented by high-elevation, non-forested areas of unsuitable habitat. Spotted owl habitat is also present in the coastal strip, and along the Queets River corridor, a habitat largely isolated by surrounding areas of managed forest lands. The park's interior (not including the Pacific coastal section and the Queets River corridor) contains about 494,000 acres of forested areas that are considered potential or suitable northern spotted owl habitat. This area represents approximately half of the total spotted owl habitat within the Olympic Peninsula physiographic province (Holthausen et al. 1995 in USFWS 2008).

The park encompasses the largest contiguous block of suitable nesting habitat remaining within the listed range of northern spotted owls. Although critical habitat was designated on January 15, 1992, there is no critical habitat formally designated in Olympic National Park. Critical habitat was not designated because the park's habitat is protected from adverse effects by virtue of its national park status.

Although some spotted owl habitat within the park has been lost due to the past development of roads, campgrounds, and other facilities, the greatest threat to spotted owl habitat within the park is from natural disturbances associated with windthrow or wildfire (USFWS 1992 in USFWS 2008). The park Wildland Fire Management Plan estimated that up to 800 acres of suitable spotted owl habitat could be lost due to wildfire in the park over a 5 year period. The Paradise fire in Queets in 2015 may have exceeded this. The most recent major windstorm resulted in scattered areas of windthrow in December 2007 (USFWS 2008).

In cooperation with National Biological Survey staff and others, northern spotted owl surveys have been conducted in the park since 1985. The most comprehensive inventories and surveys were performed from February 1992 - September 1995. These occurred in an area of over 72,600 acres or about 10% of the forested acreage in the park. The surveys indicated that northern spotted owls were seldom found above 3,000-foot elevation on the west side of the park, or above 4,000-foot elevation on the east side of the park. In 1995, the estimated number of northern spotted owl pairs within the forested, interior portion of the Olympic National Park was 229, while an additional 15 to 20 pairs were estimated to occur within the park coastal strip and the Queets corridor (Seaman et al. 1996 in NPS 2004a). It includes conifer forests below 3,000 feet elevation on the west side of the Park, and conifer forests below 4,000 feet on the east side of the Peninsula. Most of the owl habitat within the Park (95 percent) is located within designated wilderness areas (USFWS 2008).

As of 1995, surveys within Olympic National Park confirmed 63 sites occupied by pairs and 44 sites occupied by single owls or two owls with unknown pair status (Holthausen et al. 1995 in USFWS 2008). Additional owl sites were likely located within remote interior sections of the park, and a few sites were documented within the coastal strip and the Queets corridor (Holthausen et al. 1995 in USFWS 2008). As of 2001, only one spotted owl was known to remain in the coastal strip and none have been found in the Queets corridor since the early 1990's.

In 2007, monitoring of 54 spotted owl territories to determine their occupancy and reproductive status found that 10 sites in the park were occupied by spotted owl pairs and nine sites were occupied by single spotted owls (Gremel 2007). This showed a reduction of slightly more than 50 percent from the 21 sites with pairs observed in 2006. Most of the occupied sites occur in the northern and eastern portions of the park. Of the 21 territories monitored on the west side of the park, only five sites had single owls present, the other 16 sites were apparently unoccupied (Gremel 2007).

Northern spotted owl survey data collected in the park has been used to monitor spotted owl demographic trends on the Olympic Peninsula since 1985. The most recent demographic analysis (completed in 2003 by Anthony et al. 2006) indicates an average population decline of 4.4 percent per year. This has resulted in an apparent loss of over 40 percent of the territorial spotted owl pairs on the Peninsula over the past decade (USFWS 2008). This declining trend is linked to declines in the apparent survival rates for adult spotted owls (i.e., the probability that an adult spotted owl will survive from 1 year to the next has declined). According to Anthony et al. (2006 in USFWS 2008), the reasons for these declines in survival and populations are unknown but may include: (1) high density of barred owls, (2) loss of spotted owl habitat, and (3) poor weather conditions. This research also suggests that the Olympic Peninsula data indicate a negative effect of barred owl presence on the apparent spotted owl survival rates (USFWS 2008).

Although loss of spotted owl habitat due to timber harvest has continued to occur on the Olympic Peninsula over the past decade (Pierce et al. 2005 in USFWS 2008), no significant habitat loss has occurred within the park. Nonetheless, the number of barred owls observed in the park has continued to increase (Gremel 2007 in USFWS 2008). Eight new barred owl sites were found in 2007, bringing the total number of known barred owl sites in the park to 86. As of 2006, barred owls had been detected within 800 meters of 85 percent of the monitored owl sites in the park (Gremel 2007).

The same study noted that spotted owl territories that have remained occupied following detections of barred owls have moved farther away and increased in elevation, relative to sites where barred owls have been absent (Gremel 2007 in USFWS 2008). This movement away from areas of barred owl activity implies that a portion of the otherwise suitable spotted owl habitat in the park is now unavailable to spotted owls for nesting and daytime roosting (Gremel 2007 in USFWS 2008). This is also true in the project area.

Status of Northern Spotted Owls in the Project Action Area

Although structurally suitable habitat for northern spotted owls is found in immediate proximity of the project area, ongoing park surveys have indicated that much of this habitat is no longer used for nesting by northern spotted owls and is instead occupied by barred owls (Gremel pers. comm. 2015). Northern spotted owl surveys have been conducted in known sites in the project area an average of four times a year since 1992.

“Prior to the range expansion of barred owls into the Olympic Peninsula, spotted owls occurred close to Highway 101 around Lake Crescent, and were sometimes detected from the road on night surveys” (Gremel pers. comm. 2015). There are four former northern spotted owl territories in this vicinity that are part of the park’s long-term monitoring program. Between 2010 and 2014, no northern spotted owls were observed in areas within 500 meters of the highway near Lake Crescent (Gremel pers. comm. 2015). This decline has been documented both near Lake Crescent and throughout the park.

Surveys in 2015 were conducted between March 15 and August 17. One of the four sites within two miles of the project area was occupied by northern spotted owls in 2015. A pair was confirmed at the site and owls were found roosting between 1,700 and 2,100 meters from U.S. Highway 101, although not within line of sight from the Highway.

Marbled Murrelet

The marbled murrelet was listed as a threatened species in Washington, Oregon, and northern California in 1992. The primary reasons for listing included extensive loss and fragmentation of old-growth forests which serve as nesting habitat for murrelets and human-induced mortality in the marine environment from gillnets and oil spills (USFWS 1992). Although some threats such as gillnet mortality and loss of nesting habitat on Federal lands have been reduced since the 1992 listing, the primary threats to species continue (USFWS 2010). Surveys from 2000 to 2008 documented that murrelet populations throughout the listed range have continued to decline at a rate of 2.4 to 4.3 percent per year. This represents an overall population decline of 19 to 34 percent since 2000 (USFWS 2010). Since 2008, populations have continued to decline. The USFWS Recovery Plan for the marbled murrelet emphasizes maintaining and protecting occupied habitat and minimizing the loss of unoccupied suitable habitat (USFWS 1997a in USFWS 2008).

Range: The park is located in two marbled murrelet recovery zones (Puget Sound and Western Washington Coast Range). The line of demarcation between the two zones essentially bisects the park on a northwestern to southeastern diagonal. Other conservation zones are located in Oregon and California, and include the Oregon Coast Range, Siskiyou Coast Range, Mendocino, and Santa Cruz Mountains. Olympic National Park habitat is located in two of six conservation zones (Puget Sound and Western Washington Coast Range) identified in the Recovery Plan for the species (USFWS 2008). Conservation Zone 1 includes all the waters of Puget Sound and most waters of the Strait of Juan de Fuca south of the U.S.-Canadian border and extends inland 55 miles from the Puget Sound, including the north Cascade Mountains and the northern and eastern sections of the Olympic Peninsula.

Threats: The primary reasons for listing included extensive loss and fragmentation of old-growth forests which serve as nesting habitat for murrelets and human-induced mortality in the marine environment from gillnets and oil spills (USFWS 1992 in NPS MORA and USFWS 2010). Although some threats such as gillnet mortality and loss of nesting habitat on Federal lands have been reduced since the 1992 listing, the primary threats to species persistence continue (NPS MORA and USFWS 2010). Nest site predation is suspected to be the principal factor limiting marbled murrelet reproductive success. Losses of eggs and

chicks to avian predators have been determined to be the most important cause of nest failure (Nelson and Hamer 1995b; McShane et al. 2004). Nest failure rates of 68 to 100 percent have been reported in some areas (USFWS 2010). The risk of predation by avian predators appears to be highest in close proximity to forest edges and human activity, where many corvid species (e.g., jays, crows, ravens) are in highest abundance (McShane et al. 2004).

Description: Marbled murrelets are small, pigeon-sized, long-lived diving seabirds that spend most of their life in nearshore marine waters foraging on small fish and invertebrates, but use old-growth forests for nesting. They lay a single egg on the high, large branches of old growth trees. If egg failure occurs, a second may be laid. The egg is incubated all day, with the male and female exchanging incubation duties at dawn (USFWS 2008). Hatchlings appear to be brooded by an adult for one to two days and are then left alone at the nest for the remainder of the rearing period, except during feedings. Both parents feed the chick, which receives from one to eight meals per day (Nelson 1997 in USFWS 2008). Most meals are delivered early in the morning, although about a third of food deliveries occur at dusk and/or intermittently throughout the day (Nelson and Hamer 1995a in USFWS 2008). Chicks fledge 27 to 40 days after hatching. The initial flight of a fledgling appears to occur at dusk and parental care is thought to cease after fledging (Nelson 1997 in USFWS 2008). As noted in USFWS 2008, throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986; 57 FR 45328 [October 1, 1992]).

Breeding Season: In Washington, the marbled murrelet breeding season occurs between April 1 and September 15 (Hamer et al. 2003), but has recently been updated on the Olympic peninsula to extend until September 23 (Miller pers. comm. 2015). For management purposes, the USFWS defines the marbled murrelet early nesting season as April 1 through August 5. Early nesting season behaviors include egg laying, incubation, and brooding of nestlings. The late nesting season is defined as August 6 through September 23. During the late season, marbled murrelet chicks are left unattended at the nest site until they fledge, except during feedings by the adults, with all chicks fledging by mid-September (Hamer et al. 2003). Both parents feed the chick, which receives one to eight meals per day (Nelson 1997). Most meals are delivered at dawn, while about a third of the food deliveries occur at dusk and intermittently throughout the day (Nelson and Hamer 1995a). For the purpose of analyzing activities within suitable habitat, certain management activities may occur during the early and late seasons.

Suitable Habitat: Murrelets nest in forested areas up to 52 miles inland from their saltwater foraging areas (Hamer 1995, p. 167). Murrelets do not actually build a nest, but rather create a nest depression in moss or litter on large branches (Nelson 1997). Murrelets prefer high and broad platforms for landing and take-off, and surfaces which will support a nest cup (Hamer and Nelson 1995 in USFWS 2008).

The physical condition of a tree appears to be the important factor in determining tree suitability for nesting (Ralph et al. 1995 in USFWS 2008); therefore, presence of old-growth in an area does not assure the stand contains sufficient structures (i.e. platforms) for nesting. In Washington, murrelet nests have been found in conifers, including western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*) (Hamer and Nelson 1995; Hamer and Meekins 1999 in USFWS 2008). Nests have been found in trees as small as 2 feet, 7.2 inches in diameter at breast height on limbs at least 65 feet from the ground and 4.3 inches in diameter (Hamer and Meekins 1999 in USFWS 2008).

Critical Habitat: The USFWS designated critical habitat for the marbled murrelet in 1996 (USFWS 1996). Critical habitat was not designated in national parks. As noted for northern spotted owls above, critical habitat within the park is assumed to be protected by virtue of its presence in the park. The primary constituent elements identified in the marbled murrelet critical habitat rule include (1) individual trees with potential nesting platforms, and (2) forested areas within 0.5 mile of individual trees with potential nesting platforms, and a canopy height of at least one-half the site potential tree height. This includes all

such forests, regardless of whether or not they are contiguous (USFWS 1996). Critical habitat is designated near Olympic National Park.

Environmental Baseline

Status of Marbled Murrelets in Olympic National Park: Suitable nesting habitat for marbled murrelets consists of old-growth multilayered conifer stands with moderate to high canopy closure. This habitat type occurs along the major drainages in the park's lower elevations, overlapping most of the suitable habitat for the northern spotted owls. Marbled murrelets will occasionally nest in younger stands if remnant large trees or deformities provide large enough limbs (NPS 2008: 189).

Murrelets occur within all the major drainages below about 3,000 feet elevation in the park. Suitable habitat includes forests up to 3,500 feet elevation on the east side of the park, and forests up to 3,000 feet on the west side of the park. As a result, there is approximately 453,000 acres of suitable marbled murrelet habitat in the park.

The park is the largest contiguous block of suitable nesting habitat remaining within the range of marbled murrelets in the lower 48 states. Inland surveys have been conducted according to Pacific Seabird Group Inland Survey protocol in all developed areas and in a sampling of backcountry valleys. As a result, the presence of marbled murrelets was documented at every site surveyed. In addition, more than 80 percent of sites surveyed in the park were occupied. According to the Hurricane Ridge Road biological assessment, suitable habitat in the park is used more intensively than that surrounding the park (Hall 2000).

Although some marbled murrelets habitat within the park has been lost due to past development of roads, campgrounds and other facilities, within the park threats to marbled murrelets are now associated with natural disturbances, such as wildfire and windthrow. Additional threats include corvid predation associated with human activities near developed areas. As described above related to northern spotted owl habitat, loss of suitable habitat from a major windstorm in 2007 has occurred.

Status of Marbled Murrelets in the Project Action Area

Surveys of marbled murrelets in the project area have found that murrelets occur in suitable habitat adjacent to Lake Crescent. In addition, there has been at least one reliable occurrence of murrelets observed floating on the lake surface. Since most activity away from the nest occurs on saltwater, this was noted as unusual (Gremel pers.comm. 2015).

A survey of the Lake Crescent corridor along Highway 101 in February 2015, determined that much of that area should be considered suitable habitat. Similarly, the project area along East Beach Road is considered suitable habitat. The preliminary survey and analysis followed the guidelines published by the USFWS for western Washington, including: platforms greater than 4 inches across in coniferous trees, above 33 feet in height, with suitable vertical cover by limbs or foliage, and located within an area of contiguous forest. . . Although there was evidence of fire in probably the last 100 years, many large, older coniferous trees were present within nearly all the younger forest stands. Most trees in this older age class had structures that could potentially support murrelet nests, and these older trees were well distributed along the highway corridor (Gremel pers. comm. 2015).

Bald Eagle: Bald eagles are resident throughout much of the park. More than 50 nest territories on the park coast are routinely monitored. The number of territories has increased significantly since 1980, as have the numbers of fledglings produced by those nesting pairs. In the interior of the park, eagles are mainly observed foraging or as a winter migrant, although several nests are known along inland lakes and rivers (NPS 2008: 190).

Wintering habitat in the park is typically along the Pacific coast and some inland rivers. Olympic National Park is within two of the Washington bald eagle recovery zones: Washington Coast and interior Olympic. Bald eagles are listed as threatened but have been proposed for delisting due to population recovery. For

the purposes of analysis, bald eagle nesting season in Washington begins January 1 and concludes August 15. Wintering season is from October 31 through March 31.

There is one bald eagle nest near Lake Crescent in the vicinity of Eagle Creek. Since removal from the list of threatened and endangered species, park monitoring of bald eagle nests has generally been discontinued. Although the nest is no longer monitored, it has been observed to be active in recent years. During surveys of the road corridor for the proposed Highway 101 project, bald eagles were seen several times over the western part of Lake Crescent. None were seen from East Beach Road. Although bald eagles are no longer listed, their habitat remains important to protect under the Bald and Golden Eagle Act and as a formerly listed species. In spring, 2015 a park wildlife ecologist observed four adults and two sub-adults, including a return to the nest (Gremel, pers. comm. 2015).

Fish

WSDOT initially requested replacement of four culverts related to a tribal lawsuit and state law that requires fish passage culverts (primarily for anadromous fish) (Schueler 2015). All of these culverts, however were removed from a WSDOT list of culverts needing replacement because they provide only for resident trout, not anadromous fish <http://www.wsdot.wa.gov/NR/rdonlyres/B056189E-6326-40F5-AD2D-B76720B267F6/0/2015FishPassageReport.pdf#page=1&zoom=auto,-150,792>. Although there are no anadromous fish in Lake Crescent or in its feeder streams due to a natural barrier on the Lyre River downstream of the lake outlet, the following culverts are being assessed as part of the project to determine whether they should be improved:

- Eagle Creek (2 elliptical CMP culverts)
- Smith Creek (concrete box culvert)
- La Poel (concrete box culvert)
- Lyre River at Fairholme

Of these, the Eagle Creek culverts are undersized for bank full width stream flows (McKenna 2015). The park's fisheries biologist identified it as the highest priority for replacement due to these channel function issues, although fish passage issues were noted as not present (Crain pers. comm. 2015). In general, however, there is very limited fish habitat upstream of U.S. Highway 101 or East Beach Road, due to terrain barriers. Downstream fish habitat is also limited by the proximity of Lake Crescent to the roadways to up to several hundred feet and by high gradient terrain. Kokanee salmon also spawn nearby along the lakeshore, probably in sediment transported to the lake by Eagle Creek (Crain pers. comm. 2015).

Park Endemic Species: Beardslee Rainbow Trout (*Oncorhynchus mykiss*) and Crescenti Cutthroat Trout (*Oncorhynchus clarkii*): Lake Crescent supports a unique assemblage of fish populations that evolved in response to the distinctive geologic history of the region. The lake was historically connected to the Elwha River basin through an outlet draining to the east, through the Indian Creek valley. Anadromous fish occupied the area after the retreat of the Cordilleran ice sheet but a massive landslide within the last 10,000 years isolated the lake from the Elwha basin (Tabor 1987). As the water level rose, a new outlet formed down the Lyre River drainage. A waterfall a short distance downstream from the new outlet left the fish landlocked (NPS OLYM 2012: 111-112).

Both trout were originally considered separate species (Jordon 1896); however, genetic research has shown them to be rainbow and cutthroat trout. As a result of the above-described geologic processes, these trout are reproductively and geographically isolated to the Lake Crescent system and spawn in discrete, limited locations within the watershed.

According to the GMP, these populations are considered keystone species in the Lake Crescent ecosystem and must be protected to a level that not only ensures their existence in perpetuity, but also ensures that they thrive at levels required by the NPS's primary mandate (NPS PWR 2008). The GMP also called for an addition to the park which would protect the Lyre River and Lake Crescent outlet area.

These areas are critical to Beardslee trout spawning areas and rearing habitat. This is the only place in the world where the Beardslee trout spawn. The park addition would protect the Lyre River and the lake outlet, which provide critical spawning habitats for cutthroat and Beardslee trout and provide a migratory corridor for cutthroat moving to and from the lake (NPS 2008: 99, 344). The cutthroat also spawn in shallow areas of Lake Crescent, the Lyre River and likely in other Lake Crescent tributary streams (Crain pers. comm. 2015).

Kokanee salmon are believed to be the most abundant fish species in Lake Crescent and have been identified as the primary food source for the adult Beardslee and Crescenti trout (Scheffer 1935; Garlick 1949; Pierce 1984; Meyer and Fradkin 2002). Kokanee eggs are also a significant food source for the juvenile trout (Pierce 1984). Stomach content analyses of larger trout in the lake have found that nearly all prey items were kokanee (Garlick 1949). Little information exists on the status of pygmy whitefish, prickly sculpin, or Pacific lamprey, although whitefish spawning has been video documented at depths in excess of 100 feet (NPS OLYM 2012: 112).

In the early 1990s, both Beardslee trout and Crescenti trout appeared to be at risk of extirpation. Annual spawning ground surveys accounted for less than 100 individuals of each species (Meyer and Fradkin 2002). Beardslee trout in particular were at risk, because they are known to spawn solely in a one-acre section of gravel at the outlet of Lake Crescent. Crescenti trout, also in very low abundance, have developed a number of unique life history traits - including multiple spawning locations that include tributaries to the lake, the lakeshore, and downstream in the Lyre River. These several locations buffer the potential for a catastrophic event to decimate the population (NPS OLYM 2012:112).

Beardslee trout can reach a size of over 10 pounds. Genetic analysis indicates that they are genetically distinct from all other rainbow trout populations to the extent that they may qualify as a unique sub-species. These fish spawn only in the outlet of the lake. Spawn timing is from late-December through early-May. The annual abundance of spawning adults is approximately 500 fish.

Crescenti cutthroat trout spawn in shallow areas (to depths of 15-20 feet) in Lake Crescent along Highway 101. Several locations where riprap or walls are proposed are close to their spawning areas. Spawning, which mostly occurs at night, peaks between April and June and their eggs are within the gravel until August, when they hatch (Crain pers. comm. 2015). Although the proposed road rehabilitation under Alternatives 2-3 has been designed to avoid impacts to their habitat, a variety of mitigation measures would be included to ensure this (see Chapter IV: *Environmental Consequences*). Among these include protecting the lake from incidental fill related to road rehabilitation actions.

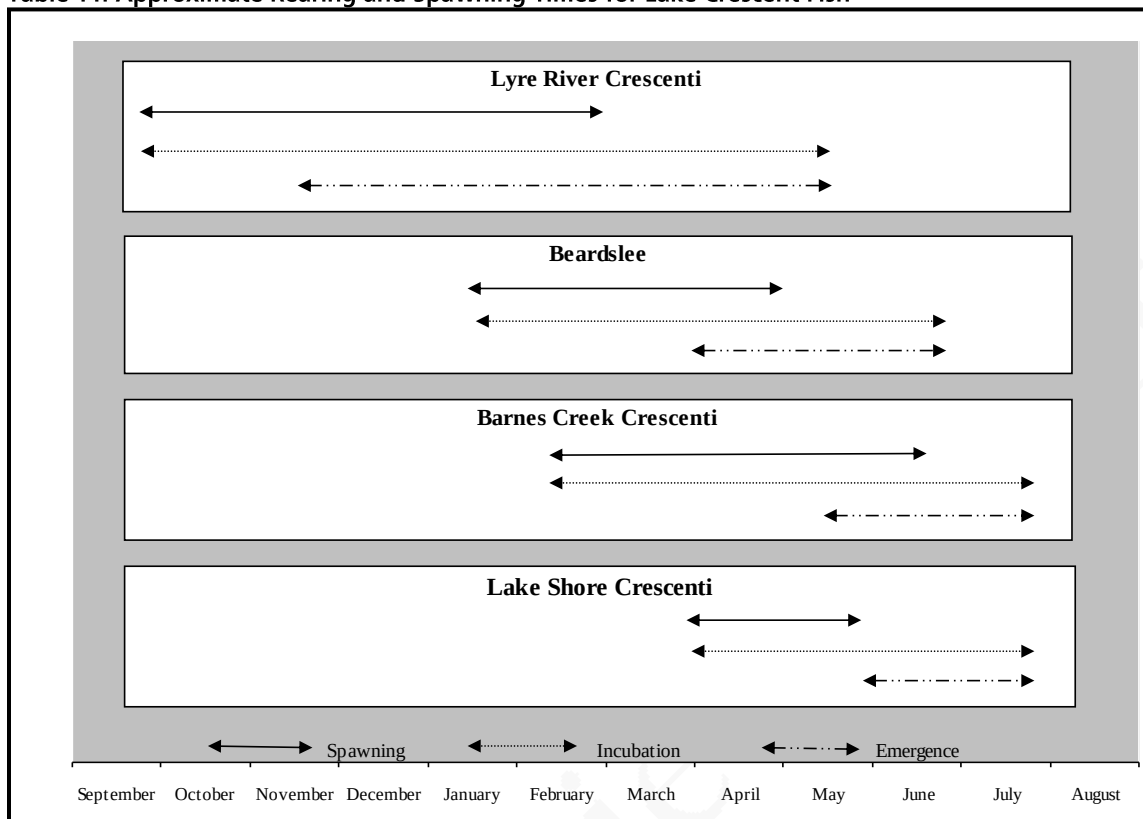
Crescenti trout can reach a size of 5 to 10 pounds. Crescenti appear to be a mixture of discrete spawning populations which spawn at different times and different locations throughout the watershed.

- A population of cutthroat swims downstream from the lake into the Lyre River to spawn. Not only does this population have a distinct migrational behavior, but they also spawn at a very different time of the year than other trout - from October through March.
- There may be limited cutthroat spawning occurring in LaPoel Creek, Eagle Creek, and Piedmont (Log Cabin) Creek, but surveys are limited.

Invertebrates

Mussels: There are two species of freshwater mussels of concern in Lake Crescent, *Anodonta kennerlyi* and *Margaritifera falcata*. They have been observed on the south shore of the lake in numerous areas and as deep as 90 feet, with the highest densities between 20 and 60 feet. One incidental survey found *Anodonta kennerlyi* along the perimeter of the lake, wherever they were looked for. *Anodonta kennerlyi* are found in soft sediments, including those interstitial areas between cobbles and gravels (although at lower densities), and are not limited by light reaching the bottom of the lake. *Margaritifera falcata* are also known from creeks and streams, including the Lyre River, just downstream of Lake Crescent.

Table 11: Approximate Rearing and Spawning Times for Lake Crescent Fish



I. Archeological Resources and Historic Structures

Archeological Resources

The Olympic Peninsula has had the potential for human occupation since the last glacial retreat about 14,000 years ago. Archeological evidence indicates that people used all of the area encompassed by Olympic National Park from the coastal margin to the subalpine and alpine areas. Prehistoric and historic American Indian populations of the Olympic Peninsula belong to the Northwest Coast culture area distinguished by features such as a very complex socioeconomic system, highly developed woodworking technology, twined basketry, woolen and vegetable-fiber textiles, large dugout canoes, and permanent villages or towns built of plank houses. Prehistoric economy included hunting, fishing, traveling throughout the area to trade materials, gathering resources, and practicing traditional spiritual activities (NPS 2008: 200).

Archeological resources are the remains of past human activity and records documenting the scientific analysis of these remains (NPS Director's Order 28). Archeological resources are often buried but may extend above ground. In this document the term "prehistoric" refers to archeological resources associated with Native Americans, particularly before contact with Euro-Americans. Prehistoric archeological resources also means cultural resources that predate the beginning of written records and include isolated artifacts, petroglyphs, pictographs, and shell middens (NPS 2008: 204-5).

In this document the term "historical" archeological resources refers to those that postdate Euro-American contact with Native Americans. Historical archeological resources may be terrestrial or submerged and include cemeteries, trails, building remnants, and a variety of other features. Archeological survey work has been conducted in Olympic National Park since the 1940s, and systematic archeological surveys in the park began in the 1950s with a survey along the coast. The coastal strip is one

of the best known archeological areas on the Olympic Peninsula. Beginning in the 1970s and continuing up to the present, archeological surveys have expanded to include areas other than the coast, such as river valleys and subalpine parklands. These projects have revealed a variety of archeological resources, including historic homesteads, mining sites, prehistoric lithic sites, and culturally modified trees.

Olympic National Park's Archeological Research Design (NPS 1988) and Ethnographic Overview and Assessment (NPS 1997) provide a general context and guidance for identifying and evaluating the park's archeological resources. In addition, Olympic National Park's cultural resource division has surveyed about 7,000 acres in conjunction with specific construction projects and in compliance with the NPS Systemwide Archeological Inventory Program (NPS 2008: 204-5).

More than 650 archeological sites documenting 10,000 years of human occupation are protected within Olympic National Park's boundaries. Archeological resources are found in every major physiographic province in the park and can be divided into broadly defined classes, including lithic scatters, shell middens, petroglyphs, homesteads, and mining, logging, and other industrial sites. Lithic sites represent the most abundant class of prehistoric archeological resource found in the park. Lithic sites in the park's mountain and subalpine areas are located within trail corridors and campsites. Recent research has identified lithic sites in river valleys and lowland prairies; however, dynamic geologic processes and dense vegetation inhibit site identification in these areas and have not yet yielded extensive archeological resources. None of the park's lithic sites have been evaluated for listing in the National Register of Historic Places (NPS 2008: 204-5).

Shell midden sites are the most visible of the site types in the park and are exposed along actively eroding beach terraces along the coastal strip. Current knowledge about this area comes mainly from the intensive investigations at the Ozette site carried out by Washington State University between 1966 and 1982. The Ozette Indian Village Archeological Site is listed in the National Register of Historic Places. Petroglyph sites are also known in the park. Wedding Rock Petroglyphs is listed in the National Register of Historic Places (NPS 2008: 204-5).

Approximately 300 historical archeological sites have been identified in the park from historic maps and documents, but most have not yet been formally documented or evaluated for their eligibility for listing in the National Register of Historic Places (NPS 2008: 204-5).

No prehistoric archeological resources have been identified within the project area. A single historic period archeological site is associated with the La Poel picnic area and falls partially within the project area.

Historic Resources Context: Early park development

Recreational development on the Olympic Peninsula began in the early 20th century. Natural hot springs of the Sol Duc and Elwha rivers prompted resort development at those locations in the early 1900s. An automobile road to Sol Duc Hot Springs was completed in 1910, and ferry service began the same year on Lake Crescent between Piedmont and Fairholme. Olympic Hot Springs (Boulder Creek Hot Springs) was the site of resort development in the early 1900s (NPS 2008: 201).

Between 1897 and 1907, trails and other structures were built in the Olympic Forest Reserve, including trails to Sol Duc Hot Springs and along the shore of Lake Crescent. The Storm King Information Station was also built at Lake Crescent (NPS PWR 2008:201). An automobile road to Sol Duc Hot Springs was completed in 1910, and ferry service began the same year on Lake Crescent between Piedmont and Fairholme (NPS PWR 2008:201).

Following World War I, tourists to the Olympic Peninsula began visiting the national monument in their cars. The south shore Lake Crescent road was completed in 1922, ending ferry service on Lake Crescent (NPS 2008: 202).



Figure 18: Viaduct Cribbing Near Sledgehammer Point c. 1930s

along the coastal strip. Resorts around Lake Crescent developed during the early 20th century include Ovington's, later known as Beardslee Bay Camp, on the north shore of the lake; Marymere, the earliest resort hotel on the south shore of the lake at Barnes Point; Hotel Crescent at Piedmont; and Fairholme at the western end of the lake. Singers Tavern (now Lake Crescent Lodge) was built at Barnes Point in 1915. Singers Tavern was the site of meetings conducted to discuss the creation of Olympic National Park in the 1930s. The wood frame structures of the Lake Crescent resorts were subject to fires, and several resorts rose from the ashes of former structures around the margins of Lake Crescent. Among these was the resort known as Rosemary, which was built near the meadow where Marymere formerly stood. By the mid-1930s there were 12 resorts around Lake Crescent (NPS 2008: 201).

Following World War I, tourists to the Olympic Peninsula began visiting the park in their cars.

The south shore Lake Crescent road was completed in 1922, ending ferry service on Lake Crescent (NPS PWR 2008: 202).

On June 29, 1938, President Franklin Delano Roosevelt signed legislation creating Olympic National Park. The boundaries of Olympic National Park were extended to include Lake Crescent in 1940 (NPS 2008: 203).

Railroads were constructed in the Pacific Northwest starting in the late 1800s. On the Olympic Peninsula, permanent and temporary railroads were constructed to transport spruce logs to mill sites for use in the production of airplanes for World War I. The most ambitious permanent rail route was the Lake Crescent Olympic Spruce Railroad No. 1. This route skirted the precipitous shoreline of Lake Crescent with 10 miles of deeply cut grade and two tunnels. The 36-mile railroad, an engineering feat, was constructed in less than four months - four times faster than usual for a comparable job. Eight thousand men were involved in the construction. However, the railroad was completed on November 30, 1918, nineteen days after the war was over. The line was eventually surplused and served as a branch line for hauling timber from the "Soleduc." It did not contribute to the military efforts until the 1940s when it hauled timber for military use during World War II. The line was abandoned and rails removed in 1954 (NPS 2008:202).

In 1931 the Olympic Loop Highway (U.S. Highway 101) was completed connecting the Lake Crescent segment with the rest of the road. A road was completed to Olympic Hot Springs in the 1930s. In 1940 resort buildings at the hot springs were destroyed by fire. Several successive efforts to rebuild a resort operation failed, and in late 1972 many of the resort structures were removed (NPS 2008: 202).

The development of the Sol Duc Highway and the Loop Highway led to more demand for recreational facilities and resort development at Lake Crescent and

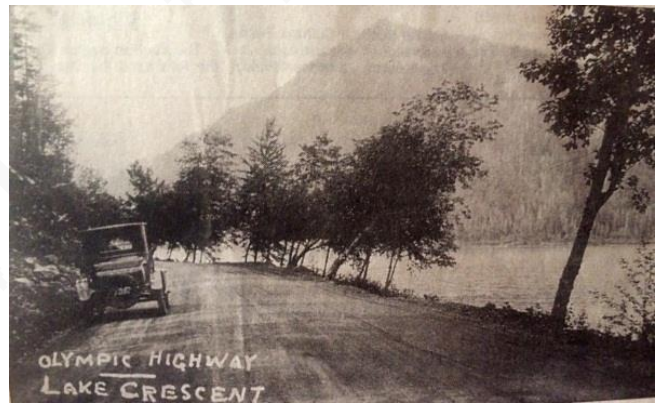


Figure 19: View from the Base of Govin's Hill c. 1930s

The Storm King Ranger Station (Morgenroth cabin) is near the project area on the south shore of Lake Crescent. It is on the National Register of Historic Places. It was built by Chris Morgenroth for the U.S. Forest Service around 1909 and remodeled in 1937. The cabin is 1 ½ stories with six rooms; it is a log-and-shake structure with a composition shingle roof. Morgenroth was one of the first rangers in the USFS, who worked for 23 years in the Olympic National Forest. He was instrumental in the establishment of the park, and he strongly supported the pulpwood industry. After creation of Olympic National Park in 1938, the cabin was used as a park facility. Until the early 1970s, the structure served as either a ranger station, patrol cabin, employee quarters, or lodging for seasonal personnel (NPS DSC 1981: 17).

The Washington State Department of Transportation (WSDOT) is in the process of examining the potential for areas it manages to determine whether these are eligible for the National Register of Historic Places. One of those places, because of the Memorandum of Agreement with the park, is U.S. Highway 101 along Lake Crescent. As demonstrated by historic photographs, this roadway was constructed in the early part of the 20th century and although actions to rehabilitate the road have occurred since then, its alignment, which is tightly wedged between Lake Crescent and the adjacent mountains, is except for some slight changes made in the 1984 rehabilitation project, in many areas exactly the same as when it was constructed.

J. Visitor Experience

Access and Transportation

U.S. Highway 101, known also as State Route 101, originates in Olympia, runs north along the east side of the peninsula, turns west and passes through the cities of Sequim and Port Angeles. It continues west south of Lake Crescent, through Forks and turns towards the coast at the Hoh River. It travels south for approximately 11 miles through the park in the Kalaloch area (10 miles along the coast), and then turns inland to Aberdeen. From here, State Route (S.R.) 12 and S.R. 8 run eastwards to connect to Olympia and Aberdeen. U.S. 101 provides connections into the park from state roadways and a number of city, county, tribal, and U.S. Forest Service roads.

Approximately one mile of highway at the east end of Lake Crescent is on a state-owned right-of-way. The approximately 12 miles of roadway in the park is maintained through a cooperative agreement between the park and Washington Department of Transportation (WSDOT). Law enforcement rangers patrol the highway segments within the park at Lake Crescent (NPS 2008: 228).

Lake Crescent Access West of Port Angeles the Lake Crescent area is one of only two park areas that are directly served by U.S. 101. The highway travels through the park for approximately 12 miles, skirting the southern edge of the lake for 10 miles, providing access to the facilities at Barnes Point, including the Storm King Information Station, Lake Crescent Lodge, the NatureBridge, and the Moments in Time, Marymere Falls, and Storm King trails. It also provides access to a number of overlooks, the La Poel picnic area, and Fairholme store. Monthly public use data from 2009 indicates that Lake Crescent is the most visited area of the park (1,895,748) (NPS OLYM 2011:8). Overall, approximately one-third of park visitors surveyed report going to Lake Crescent.

East Beach Road is a paved, secondary road at the east end of Lake Crescent that provides access from U.S. 101 to picnic areas and the Log Cabin resort. East Beach Road turns into Piedmont Road after the resort, where it turns north for 4 miles to the town of Joyce on S.R. 112. Near the start of the Piedmont Road, the Lyre River Road extends to the west 1 mile, provides access to the East Spruce Railroad trailhead, and is paved to the Lyre River Bridge.

At the west end of the lake, the Camp David Junior Road provides access from U.S. 101 to the north shore area of Lake Crescent. The facilities that can be accessed are the Fairholme campground, North Shore day use area, Pyramid Mountain Trail, and the west trailhead for the Spruce Railroad Trail. Camp David Junior Road is 5 miles in length, paved the first two miles, and gravel for the remaining three miles.

Accessibility: The Lake Crescent Lodge main building, including the common area, store, restaurant, and lounge, are accessible. The Log Cabin Resort's restaurant is accessible. The first 0.5 mile of the Marymere Falls Trail, as far as the Barnes Creek overlook, has a gravel and dirt surface and is accessible with assistance; however, the route to the falls is not accessible. Six miles of the Spruce Railroad Trail is accessible on the west end and 0.5 miles is accessible on the east end. There is an accessible vault toilet at the east end and at North Shore Picnic Area parking adjacent to the west end access. The Moments in Time loop nature trail is nearly 1 mile in length and has compacted crushed rock surface. It is accessible with assistance, and can be accessed from the NatureBridge, a parking lot north of Lake Crescent Lodge, or via a short trail from the parking lot at the Storm King Information Station. There are accessible comfort stations at the Storm King information station, at Loops A and C at the Fairholme campground, at North Shore Picnic Area, and at the East Beach picnic area (vault toilet) (NPS 2008: 233-234).

Highway Crowding

In 2001, a highway traffic study documented most major roads in the park as having the best traffic flow conditions, with a Level of Service A, which is defined as follows:

LOS A — free-flow traffic. Individual users are virtually unaffected by other vehicles on the road.

Nearly all drivers are free to select their desired speeds and to maneuver within the traffic stream. The general level of comfort and convenience for motorists, passengers, and pedestrians is excellent (NPS 2008: 240).

East of Lake Crescent (outside the park, Highway 101 was rated LOS D)

LOS D — the upper end of traffic volumes that can be accommodated while maintaining stable traffic flow. Vehicle speeds and the freedom to maneuver are severely restricted for nearly all users. Drivers and pedestrians experience a poor level of comfort and convenience. Other vehicles delay most drivers, and some visitors perceive conditions as crowded (NPS 2008: 240-241).

Traveler Information

Park information is available by telephone recording and on the park's website. The radio station provides information on weather and road conditions and other park information as appropriate. The Port Angeles site is broadcast on the AM bandwidth at a frequency of 530-kHz. Other traveler information stations are located at Ozette Lake and in the Quinault Valley.

Public Transportation

Clallam Transit provides service to Forks, La Push, Port Angeles and Sequim, and travels through Olympic National Park in the Lake Crescent area, with stops at Fairholme and East Beach Road (NPS 2008: 242). In cooperation with the park Clallam Transit has a transit stop at Barnes Point.

Private Residences

U.S. Highway 101, Lake Crescent Road, and Barnes Point roadways provide access to private residents who own property within the boundary of the park. There are an estimated 57 private property holders on East Beach Road, including three year round residents and two park seasonal residences. In the Barnes Point area, there are approximately 17 private residences, including two year round residents, three permanent and two seasonal park staff houses. In addition, the concession run Lake Crescent Lodge at Barnes Point provides seasonal lodging in the park. Camp David Jr. Road (at the west end of the project area) also has approximately 27 private property holders, including two year round residents and one park house used by NatureBridge staff year round.

Visitor Use Opportunities

Most development and recreational activity takes place in proximity to the lake. Lake Crescent Lodge, Log Cabin Resort, and Fairholme campground provide a variety of overnight accommodations. Some of the more popular recreational activities include fishing, canoeing, kayaking, motor boating, water skiing, swimming, picnicking, hiking, bicycling, environmental education, and sightseeing (NPS OLYM 1998:6).

Historical and archeological sites relate to a variety of themes including homesteading, transportation and industry, and recreation. While many of the cabins and resorts built by early settlers on the lake no longer remain, much has been documented about their existence. Important examples remain in the Barnes Point area. In many cases, historic sites lie on landforms where prehistoric sites are also expected (NPS OLYM 1998:6).

In the 2000 visitor use survey, approximately 33% of visitors reported going to Lake Crescent, while 25% reported going to Sol Duc. Because 88 % of visitors reported scenic driving as a primary objective, it is likely that many more drove Highway 101 along Lake Crescent. According to the Lake Crescent Management Plan, more than half of the park's visitors experience Lake Crescent (NPS OLYM 2012: 113). Average daily traffic along Highway 101 is approximately 2,400 vehicles per day.

The GMP characterizes road sightseeing along Lake Crescent as follows:

U.S. 101 travels through Olympic National Park along the south side of Lake Crescent. The dramatic setting offers ever-changing views of the lake, nestled among steep forested mountains. Variable weather conditions can add to the dramatic setting. The road is shared with commuter and highway traffic, trucks, and bicyclists. Recreational drivers, who may desire to focus on the scenery or wildlife, may feel less comfortable with the commuter and commercial drivers who use the same road corridors. Traffic noise can be heard at many visitor facilities such as the Lake Crescent Lodge, Storm King Information Station, La Poel picnic area, and in the Fairholme area (NPS PWR 2008: 219-220).

Camping: On Lake Crescent, camping is available at both Log Cabin Resort (concessioner-run) and at Fairholme Campground (NPS). There are 31 closely-spaced campsites at Log Cabin Resort and 87 campsites at Fairholme.

Lodging: Park concessioners offer lodging at Lake Crescent Lodge and the Log Cabin Resort. Lake Crescent Lodge is located at Barnes Point on Lake Crescent Road, off U.S. Highway 101. Log Cabin Resort is located on East Beach Road, north of U.S. Highway 101. Both are open from late spring until early fall.

Log Cabin Resort currently offers lodging in five camper cabins, six rustic cabins, 12 chalets, and four lodge guest rooms, as well as a 38-site camping area that contains tent and recreational vehicle sites, as well as two bike-in tent sites and a group tent site. The cabins contain one to two bedrooms and some include kitchenettes. They sleep from 4-6 people.

Hiking: There are numerous hiking trails in the vicinity of Lake Crescent, however most need to be accessed near the Storm King Ranger Station (open in summer) at Barnes Point. Some trails explore the surrounding mountains, while others traverse lowland forests and creeks. The short hike to Marymere Falls is popular. Also located nearby is the Spruce Railroad Trail, along the north shore of Lake Crescent. Other trails include the Mt. Storm King Trail, Barnes Creek Trail, Aurora Creek and Aurora Ridge trails and Pyramid Mountain Trail. The self-guided Moments in Time trail is also popular. Fairholme Campground offers access to the Fairholme Campground Loop.

Multiuse Trail: The Spruce Railroad Trail offers year-round hiking, mountain bicycling and horseback riding. The trailhead for this 10 mile unpaved multiple-use trail is located off East Beach Road near the outlet of Lake Crescent into the Lyre River. This trail connects to a Clallam County trail extension that provides an additional 6.5 miles of multiuse (nonmotorized) trail. The Spruce Railroad Trail is part of the Olympic Discovery Trail which may eventually connect Port Townsend and Forks. Currently sections are completed from Sequim Bay to Fairholme. A new section of trail continues west towards Fairholme (NPS OLYM 2011: 18).

Picnicking: Picnic tables are available at Fairholme, Bovee's Meadow, La Poel, and the North Shore.

Boating: Boat launches are available in three locations at Lake Crescent (Fairholme, Log Cabin, and the Storm King Information Station). Boating is popular in summer and fall. Nonmotorized boats, such as rowboats and canoes, can be rented at Lake Crescent at Fairholme, Lake Crescent Lodge and Log Cabin Resort. Whether it's kayaking, sailing, or simply relaxing on the beaches and shores, Lake Crescent is a great place to visit.

Bicycling: The 3.5-mile long Spruce Railroad Trail is currently the only trail in the park available for bicycling. To facilitate this visitor use opportunity, the Log Cabin Resort rented bicycles for the first time in summer 2014.

Lake Crescent Facilities

- The Lake Crescent area offers several types of facilities including the following:
- Lake Crescent Lodge offers a historic main lodge, cottages, rustic cabins, motel rooms, a restaurant, boat rentals, and a gift shop.
- Log Cabin Resort offers cabins, a motel, A-frames, dining room, a store, boat launch, boat rentals, campground, showers, RV sites with full hookups, and laundry facilities.
- Fairholme Store offers sandwiches, snack food, a gift shop, a boat launch, boat rentals, marine fuel, and camping and fishing supplies.
- NatureBridge (at historic Rosemary Inn) is a private, nonprofit educational organization that offers a wide variety of on-site and off-site educational programs.
- Camp David Jr. is a Clallam County outdoor resident recreation camp that
- offers cabins, a swimming beach, and large dining hall for groups with advance reservations (NPS 2008: 223).

Interpretation and Education

Interpretation

Interpretive programming is intended to be a catalyst for creating an opportunity for park visitors to form their own intellectual and emotional connections with the meanings and significance inherent in park resources (NPS 2014: 17). A range of interpretive experiences exist in and around Lake Crescent. Among these include opportunities for stopping at visitor information stations, interpretive trails and wayside exhibits located along U.S. Highway 101.

As noted in the GMP, the Storm King Information Station is designed to serve visitors to the Lake Crescent area. It attracts some visitors traveling along U.S. Highway 101 as well as guests/visitors to Lake Crescent Lodge; however, the center's primary audience is hikers going to the popular Marymere Falls (NPS 2008: 226). The Storm King Ranger Station contains a few interpretive displays, and includes a small cooperating association sales outlet. Opportunities to learn about the park themes and related resources in the area are limited primarily to interactions with park staff at the station or on guided interpretive walks.

Wayside exhibits, including one that features water lobelia and others that feature the historic or geologic story are located in several areas along the road, including at Barnes Point, Sledgehammer Point, and other areas along Lake Crescent. The Lake Crescent area near Barnes Point has a self-guided trail brochure (*Moments in Time*) and there is a plant identification guide/interpretive brochure to accompany hikers on the lowland forest trails, including the Marymere Falls Trail, Spruce Railroad Trail and Fairholme Campground Trail (*Ever changing, ever green: the low elevation forests Olympic National Park*). Ranger guided walks are offered on the Marymere Falls Near the project area, evening campfire programs are offered at Lake Crescent Lodge, and Log Cabin Resort, among other locations in the park.

Education

In addition to educational programs provided by park staff, education programs are presented for a fee through the NatureBridge, which is located on Barnes Point at Lake Crescent. NatureBridge provides a

variety of school programs, field seminars, summer youth adventures, Road Scholar programs, conferences, and teacher training courses, as well as hiking and backpacking adventures (NPS 2008: 227).

K. Human Health and Safety

The National Park Service is committed to providing a healthy and safe environment for visitors and employees; to protect human life and provide for injury-free visits and appropriate responses when accidents and injuries do occur (NPS 2006: 1.9.3). The goals of Olympic National Park include ensuring that basic visitor needs are met, while keeping with the park's purpose, and that visitor and employee safety and health are protected. To the extent feasible, facilities, programs, and services in the park are accessible to and usable by all people, including those with disabilities.

Weather conditions in the Lake Crescent area contribute to safety issues on U.S. Highway 101 and other roadways near the lake, including East Beach Road. Although summer temperatures are mild (high 60s to low 70s), particularly in July and August, the driest months, annual precipitation ranges from 55-60 inches (with the highest precipitation occurring in December and January) and winter temperatures average in the high 30s.

Although snowfall may be as much as five feet in the winter, the average is much less (6-11 inches/month) and little accumulation occurs on low elevation roadways. Because winter temperatures are generally above freezing, when snowfall does accumulate, it often dissipates rapidly. As noted in the 1981 EA, occasionally temperatures are cold enough to make road conditions on U.S. Highway 101 icy and dangerous. Winds along Lake Crescent are usually from the north or the west. Winter windstorms, with velocities of 60 mph may create waves up to three feet high, especially along the south shore (NPS 1981).

Road safety issues related to Highway 101 along Lake Crescent are varied. Among these are the speed of travel, wet conditions and conditions related to other motorists, including logging trucks (on Highway 101). Appendix 2 shows 41 accidents on Highway 101 between 2009 and 2013 (with an annual range of from 4-12). Additional similar safety issues are related to travel on East Beach Road. East Beach Road travel is also difficult because of the narrowness of the roadway (16-21 feet), compared to the width of U.S. Highway 101 (26-28 feet). In 1983, the road was widened where possible to 28 feet, with 11-foot travel lanes, 3-foot shoulders and a 1.5-foot ditch (NPS 1981: 18).

Other human health and safety issues are also known from the Lake Crescent area. Among these include a 2014 incident when a bat, that scratched a visitor, tested positive for rabies (The Oregonian 2014).

Most accidents occur because of high traffic speed (particularly when trucks are involved), inadequate sight distances, and poor road conditions during inclement weather. Analysis in 1981 showed that trucks were involved in about 30 percent of the accidents, and single vehicles in almost 50 percent of the accidents, approximately half of which occur at night (NPS 1981: 7). The highest accident rates generally occur during the peak visitor use season (NPS 1981: 7).

U.S. Highway 101

Average daily traffic (ADT) volumes along the Lake Crescent portion of U.S. Highway 101 were 2,313 in 1977, 2,565, in 1978, 2,414 in 1979, and 2,123 in 1980 (NPS 1981: 7). Comparatively, recent traffic volumes along the roadway have been approximately 4,000 ADT. Monthly traffic data shows peaks in June, July, and August from increased visitor use. In 1981, the FHWA estimated that commercial traffic in the area accounted for about 44 percent of the volume on weekdays and 12 percent on weekends. Then as now, each weekday many logging trucks (loaded and unloaded) passed through the area. In 1981, it was estimated that each weekday, there were 300 to 500 loaded logging trucks in the Lake Crescent area (NPS 1981: 7). The amount of logging truck traffic is related to what specific areas of the northern Olympic Peninsula are being logged. For instance, there may currently be far more logging activity to the north so logging truck traffic has shifted and is heavier on State Highway 112 compared to U.S. Highway 101 (Scott pers. comm. 2015).

Safety issues on the roadways, especially U.S. Highway 101 are related to the mix of personal and commercial traffic. On Highway 101, that includes a high number of logging and chip trucks (measured to comprise about 25 percent of the total traffic on the roadway). Overall volumes of traffic on Highway 101 are approximately 4,000 vehicles per day, without a strong daily difference. Seasonal travel on the roadway increases during the visitor use season for the park (generally from May through October).

Periodic rehabilitation of both roadways improves safety conditions for a time, generally these are expected to last 25 years. On U.S. Highway 101, following past repairs, including in 1983, the pavement surface was also modified to increase its resistance to sliding during wet and icy weather.

There was heavy logging traffic on the road following completion of the paving project in 1983 which caused the pavement to fail in many of the sharp turns along the lake (pavement was shoving and rutting). FHWA repaved in about 1987 using a new mix design with a polymer component meant to withstand the heavy truck traffic through the sharp turns. The asphalt became extremely slippery when wet in the curves and on super elevations which caused numerous accidents and lawsuits (the rangers complained that they were unable to stand on the superelevations because it was so slippery when wet). One lawsuit settlement required WSDOT and FHWA to coordinate the surface maintenance on the road by WSDOT performing annual skid resistance testing and FHWA contracting thin rotomilling projects in the areas that had inadequate skid resistance. The rotomilling and subsequent chipseals have resolved the skid resistance issues (McKenna pers. comm. 2015b).

East Beach Road

There have been several recorded accidents along East Beach Road, but in general the speeds are slow because of the very narrow roadway and the corridor has fewer accidents overall.

Safety Associated with Road Construction Projects

Road construction projects are by nature inherently hazardous to workers involved in the project and to park visitors. Workers must have adequate training and knowledge, particularly in traffic safety operations as well as those associated with their individual areas of expertise, to effectively carry out their job. In a national park this knowledge must include familiarity with the terrain and park resources affected by the project and how these resources might respond to disturbance (including tree felling, rock fall, slumping, etc.). Although park visitors must be aware of road hazards on a continuous basis, road construction areas are particularly hazardous, especially when implemented in scenic terrain. Visitors may be unaware of the road construction project and may come upon it suddenly, while focused on viewing scenery or wildlife. They may be unprepared for or become bothered by long delays during one-lane closures. Some are unfamiliar with the nature of historic, winding park roads, which often contain few of the traffic devices normally encountered in steep mountainous terrain, such as guard walls, reflectors and sudden or sharp curve signage.

L. Park Operations

Park headquarters is located in Port Angeles, with satellite operations at other areas throughout the park. Management of the park is organized into several functional divisions: Administration, Natural and Cultural Resources Management, Resource and Visitor Protection, Resource Education, and Maintenance. Staff in each division is stationed at park headquarters and at developed areas throughout the park. Along with permanent staff, many seasonal employees are employed during the summer to supplement permanent division staff and to provide for improved visitor services during the busy season.

In 2015, there were 181 permanent, full-time employees (FTEs). One FTE represents a full year of work, whether performed by one full-time employee or multiple part-time or seasonal employees.

The administration division is responsible for the park budget, fiscal and real property management activities, revenue and fee management, contracting, information technology services, concessions management, and human resources. These employees are housed in the headquarters area complex.

The natural resources management division is responsible for preserving and managing the natural resources of the park and coordinating scientific research. They are responsible for resource inventory, monitoring and evaluation, impacts restoration and mitigation, fish and wildlife management, and wilderness preservation and monitoring. These employees are housed in a headquarters complex and there is a field office at Lake Crescent.

The cultural resources management branch is responsible for preserving and managing the park's cultural resources. They are responsible for cultural resources inventory and identification, monitoring, mitigation, preservation, research, maintaining the museum collections, and coordination with the state historic preservation office and area tribes.

The resource and visitor protection division manages for resource protection and visitor safety and experience. Responsibilities include various visitor management and resource protection duties, including enforcing laws, providing emergency medical services, fighting wildland fires, management visitor use in the park, performing search and rescue activities, and wilderness management and permitting. Some employees are housed at the headquarters area, at the Wilderness Information Center, and there are field offices for employees in developed areas around the park.

The resource interpretation and education division facilitates the connections between park resources and the public through the operation of the park visitor centers, programs, exhibits, written materials, off-site programs, and the park's website.

The maintenance division conducts periodic maintenance on the park's infrastructure and equipment. The primary maintenance facilities are at the headquarters complex, though there are additional maintenance functions and facilities associated with the park developed areas. Approximately 1% of the park consists of road accessible frontcountry developed areas with various infrastructure, including water, wastewater treatment facilities, electric utilities, phone and radio operations, trails, roads, parking lots, campgrounds, and administrative and public use buildings and structures within the park. In addition, some infrastructure exists within the park wilderness area. The maintenance division also manages the park housing program. (NPS PWR 2008: 263).

Olympic National Park contains and is responsible for managing 114 miles of paved park roads, 64 miles of unpaved roads, 60 parking lots, an unknown number of road signs and 59 road bridges, including the pair of viaduct bridges along U.S. Highway 101 near Sledgehammer Point.

The park runs a complex road maintenance operation, which includes vegetation maintenance, snow management, road repair and a variety of other activities in season on the above system of developed roads and roadway structures. The road maintenance operation comprises approximately 20 percent of the park budget, not including rehabilitation projects discussed in this Environmental Assessment. The road maintenance program includes the array of activities described in the Alternative 1 (No Action: Continue Current Management) (see Chapter II: *Alternatives*).

As mentioned in the Background section (see Chapter I), U.S. Highway 101 through Olympic National Park is currently maintained through a cooperative agreement between the park and the Washington State Department of Transportation (WSDOT). Because the road is within Olympic National Park, proposed rehabilitation would be planned and managed in cooperation with the Federal Highway Administration (FHWA). See the description of Alternative 1 (No Action: Continue Current Management) for more information about how the roadway is maintained.

Similarly, East Beach Road, which had been cooperatively management by Clallam County and the park and is now maintained entirely by Clallam County through an agreement with the park.

Additional work on both roadways is performed by the park. This additional work includes, but is not limited to, nonnative invasive plant and rare plant surveys and treatment; aquatic, vegetation, wildlife, and special status species resources inventory and monitoring; vista clearing, ditch cleaning, etc.

M. Socioeconomics

Regional Socioeconomic Setting: Located on the Olympic Peninsula (adjacent to the Puget Sound), the park is west of the Seattle-Tacoma metropolitan area. The portion of U.S. Highway 101, adjacent to Lake Crescent, proposed for rehabilitation is in Clallam County. Other portions of the park are also in nearby Grays Harbor, Jefferson and Mason counties and close to the nine American Indian reservations in the region. Collectively, this economic region (the Olympic Peninsula) provides a wide range of services that support park operations, including visitors to the park. These services include numerous entrances to the park on local, county, state and federal roadways, retail shopping, groceries, accommodations, and other recreational opportunities.

Within Clallam County, Port Angeles and Forks are the towns that flank either end of U.S. Highway 101 outside of the project area, though there are many smaller enclaves, including small, private housing areas adjacent to Highway 101 and East Beach roads, which may be affected by the proposed rehabilitation described in this Environmental Assessment.

Population: In general, except for the small cities near the park, the area is predominantly rural. Clallam County had a population of 71,404 in the 2010 census <http://www.census.gov/search-results.html?q=Clallam+County%2C+WA&page=1&stateGeo=none&searchtype=web&cssp=Typeahead> accessed 11-16-15). There were approximately 41.4 residents per square mile (<https://fortress.wa.gov/esd/employmentdata/reports-publications/regional-reports/county-profiles/Clallam-county-profile> accessed 11-16-15).

The Olympic Peninsula region has been growing in population, with a 24.8 percent increase over nearly four decades. The four-county population was more than 227,000 residents in 2006 (NPS 2008: 243). In comparison, Washington State had a higher overall rate of growth (29.2 percent) during the same period (NPS 2008:243, 245). Clallam County grew at a faster rate and had a population of more than 69,000 people in 2006, nearly equal to Grays Harbor County at approximately 71,000 (NPS 2008: 244, 245). Its largest city, Port Angeles, had approximately 19,000 residents at that time.

Demographics: The Olympic Peninsula region is predominantly white (87 percent in 2010), however it also has a high percentage of American Indians (5.1 percent in 2010). Asians comprised 1.4 percent of the population and African Americans 0.8 percent in 2010. Residents of Hispanic ethnicity comprised 5.1 percent of the population of Clallam County in 2010. Clallam and Grays Harbor counties account for most of the American Indian population because of area reservations.

Personal Income: In 2005, the four-county area had a total personal income of more than \$6.2 billion, which was 2.8 percent of the state's total personal income of \$223.2 billion (NPS 2008: 248). As noted in the GMP, the region's income share was slightly smaller than its share of the state's population (3.6 percent). At the same time, Clallam County personal income comprised approximately \$2 billion of that within the region.

Earnings/Employment: The local economy is supported by a wide range of manufacturing, industrial (primarily forestry, timber harvest and wood products processing), construction, retail trade, food services, education, recreation and local, state and federal government employment. In 2005, the five most important sectors in the region were local government (19.7 percent), manufacturing (13.8 percent), retail trade (9.2 percent), construction (8.4 percent), and state government (5.3 percent), providing nearly half of the area's total earnings (NPS 2008: 250).

In 2005, Clallam County employment was dominated by private employment (78.8 percent), most notably retail trade (14.3 percent), health care and social services (9.5 percent), accommodation and food services (7.7 percent), and construction (7.9 percent), with additional contributions from real estate, rental and leasing (4.8 percent); forestry, fishing and related activities (3.1 percent); and professional and technical services (5.2 percent) as well as many other occupations. Government and government enterprises were also important (20.0 percent) and were dominated by local government (13.7 percent). Federal civilian employment in Clallam County comprised just 1.3 percent of employees and arts, entertainment and recreation another two percent. In 2005, Clallam County supported more than 35,000 jobs (NPS 2008: 254).

As described in the GMP, the above employment percentages were broken down into the number of employees in each area as follows:

The industries with the most employees in Clallam County were retail trade (5,140), local government (4,907), health care and social assistance (3,419) and construction (2,823). Manufacturing and forestry, fishing and related industries had a combined employment of 2,895 — jobs that are important to the local economic base as a source of well-paying jobs linked to national and global markets. The local construction, retail trade, and health care and social services industries have each added more than 500 jobs since 2001. Most of the other sectors also added jobs. Net job losses occurred in the transportation and warehousing, federal civilian, state government, and information sectors, although the losses were less than 100 jobs in each case (NPS 2008: 256).

Parks: There are an estimated 533,565 acres of park land and 71,404 residents in Clallam County or approximately 7.47 acres per person (<https://suburbanstats.org/population/washington/how-many-people-live-in-clallam-county> accessed 11-24-15, http://wdfw.wa.gov/webmaps/aimcommon/layer_desc/major_lands.html accessed 1-28-16). Federal areas include part of the Pacific Northwest National Scenic Trail, Dungeness National Wildlife Refuge (NWR), Flattery Rocks NWR, a large portion of the Olympic National Forest (managed by the U.S. Forest Service), part of Quillayute Needles NWR, and Olympic National Park. There are also several state parks, including Bogachiel and Sequim Bay and numerous county parks, including overnight use at the Salt Creek and Dungeness recreation areas, Camp Hayden and Camp David Jr and day use at approximately another 15 areas.

Economic Benefits Related to Visitors to Olympic National Park: Visitors to NPS units yield economic benefits generated by visitor spending within the park and nearby gateway communities. When visitors are satisfied with their overall experiences, they are more likely to revisit the same NPS unit and/or a different unit (NPS 2014: 13). Over time, this may increase visitation and result in additional visitor spending, not only within the park, but also in neighboring gateway communities, that provide food, lodging, shopping, and other services for NPS visitors.

As a major tourism and recreational destination, the park, the visitors and residents it hosts, and its annual operating expenditures play a substantial role in the regional economy. In the NPS visitor use is measured through “recreation visits.” A recreation visit is one person entering the park for any part of a day for the purpose of recreation. One person may be counted as a “visit” more than once if he/she enters the park at more than one location.

Olympic National Park hosted 3.3 million recreation visits in 2000, with Lake Crescent being a popular destination (33% of park visitation in 2000). Park visitors spent \$90 million dollars in the local area, generating \$29 million in direct personal income (wages and salaries) for local residents and supporting 1,900 jobs in area tourism businesses. Tourism accounts for approximately 10 percent of area employment and park visitors account for 62% of tourism spending in Clallam and Jefferson Counties and 28 percent in the four county region that includes Grays Harbor and Mason counties (Stynes et al. 2011).

In 2014, park visitors spent \$264 million dollars in the local area, generating \$128 million in direct personal income (wages and salaries) for local residents and supporting 3,592 jobs in area tourism businesses.

The NPS has also conducted Visitor Services Project (VSP) surveys since 1988. These surveys measure visitor characteristics, evaluations of importance and quality for services and facilities, and a subset of the surveys also includes questions on visitor spending (Cullinane et al. 2015). The following information was derived from the report: “2014 National Park Visitor Spending Effects: Economic Contributions to Local Communities, States, and the Nation.”

In the VSP surveys, visitor spending data are reported as spending per party per night for overnight trips, and spending per party per day for day trips. The VSP data is also used to segment visitors by type of trip. NPS recreation visitors are split into the following seven distinct visitor segments to help explain the differences in spending across user groups:

- Local day trip: local visitors who visit the park for a single day and leave the area or return home;
- Non-local day trip: non-local visitors who visit the park for a single day and leave the area or return home;
- NPS Lodge: non-local visitors who stay at a lodge or motel within the park;
- NPS Campground: non-local visitors who stay at campgrounds or at back country camping sites within the park;
- Motel Outside Park: non-local visitors who stay at motels, hotels, or bed and breakfasts located outside of the park;
- Camp Outside Park: non-local visitors who camp outside of the park; and
- Other: non-local visitors who stay overnight in the local region but do not have any lodging expenses. This segment includes visitors staying in private homes, with friends or relatives, or in other unpaid lodging.

Spending is further broken into the following eight spending categories derived from the VSP survey data:

1. Hotels, motels and bed and breakfasts,
2. Camping fees,
3. Restaurants and bars,
4. Groceries and takeout food,
5. Gas and oil,
6. Local transportation,
7. Admission and fees, and
8. Souvenirs and other expenses.

The economic effects of visitor spending are estimated by multiplying visitor spending estimates by local area multipliers. Local area multipliers are developed using county-level IMPLAN models comprised of all counties contained within the local gateway regions. For this analysis, the local gateway region for each park unit is defined as all counties contained within or intersecting a 60-mile radius around each park boundary. This method results in some relatively large local gateway regions, especially in some western states where counties are large. Because of this, there is the potential for including some areas that are not intrinsically linked to the local economies surrounding each park, however future data is expected to improve local gateway region definitions (Cullinane et al. 2015).

Table 12 is a summary of visitor spending and effects on local economies for Olympic National Park.

Table 12: Visitor Spending and Economic Contributions to Local Economy

Total Recreation Visits	Total Visitor Spending (\$000s, \$2014)	Jobs	Labor Income (\$000s, \$2014)	Value Added (\$000s, \$2014)	Output (\$000s, \$2014)

3,243,873	\$263,953.3	3,592	\$128,149.7	\$227,305.2	\$365,559.9
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Source: (Cullinane et al. 2014)

Note that the park covers nearly one million acres and all gateway communities are represented in this data, not just those surrounding Crescent Lake.

Similarly, in 2010, the Olympic National Forest had 707,000 total visits. Based on this, the USFS estimates that each person visiting the area on a day trip spent \$51 per day while overnight visitors spent \$167 on average per day—and that an average visitor spent \$92 per day (<http://headwaterseconomics.org/wphw/wp-content/uploads/olympic-peninsula-report.pdf> accessed 11-23-15).

Based on public comments during alternatives scoping, the Olympic Peninsula Visitors Bureau (OPVB), the tourism marketing arm for unincorporated Clallam County, reported that in 2013 visitor spending in Clallam County exceeded \$219 million and generated \$21 million in state and local taxes (OPVB 2015).

Park Operations: The park has an annual operating budget of approximately \$11 million. Approximately \$25,000 is paid to the Washington State Department of Transportation (WSDOT) for maintenance of U.S. Highway 101. This is for work beyond what the state would normally do, such as mowing, rather than herbicide application near Lake Crescent, replacing wood guardrail posts, etc. Between 2012 and 2014 an additional \$185,000 of FLHP funds were transferred to WSDOT for asphalt surface repairs along Lake Crescent (pers. comm. R. McKenna 2015).

Chapter IV: Environmental Consequences

This chapter describes the impacts, including cumulative impacts, of each alternative on Olympic National Park resources. Methods used for the analysis are presented below and further explained under each impact topic. To compare the differences in projected impacts among the alternatives, an *Impact Comparison Summary* (Table 21) is included.

Methodology

The environmental consequences for each impact topic were defined based on the following information regarding context, type of impact, duration of impact, area of impact and the cumulative context. Unless otherwise stated in the resource section in *Environmental Consequences*, analysis is based on a qualitative assessment of impacts.

Impacts are described in terms of context, type and duration.

a. Context of Impact

The context is the setting within which impacts are analyzed – such as the project area or region, or for cultural resources – the area of potential effects (APE).

b. Type of Impact

The type of impact is a measure of whether the impact will improve or harm the resource and whether that harm occurs immediately or at some later point in time.

- **Beneficial:** Reduces or improves impact being discussed.
- **Adverse:** Increases or results in impact being discussed.
- **Direct:** Caused by and occurring at the same time and place as the action, including such impacts as animal and plant mortality, damage to cultural resources, etc.
- **Indirect:** Caused by the action, but occurring later in time at another place or to another resource, including changes in species composition, vegetation structure, range of wildlife, offsite erosion or changes in general economic conditions tied to park activities.

c. Duration of Impact

Duration is a measure of the time period over which the effects of an impact persist. The duration of impacts evaluated in this EA may be one of the following:

- **Short-term:** Often quickly reversible and associated with a specific event, and lasting one to five years.
- **Long-term:** Reversible over a much longer period, or may occur continuously based on normal activity, or for more than five years.

d. Area of Impact

The area of impacts may be detectable in nearby or surrounding areas as defined below:

- **Localized:** Detectable only in the vicinity of the activity.
- **Widespread:** Detectable on a landscape or regional scale.

e. Impact Mitigation

Impacts may be reduced in the following ways. Projects can:

- **Avoid** conducting management activities in an area of the affected resource
- **Minimize** the type, duration or intensity of the impact to an affected resource

Impacts may also be reduced by additional actions such as by:

- **Repairing** localized damage to the affected resource immediately after an adverse impact.
- **Rehabilitating** an affected resource with a combination of additional management activities.

- **Compensating** a major long-term adverse direct impact through additional strategies designed to improve an affected resource to the degree practicable.

f. Impact Analysis

Impacts on various resource topics are compared among alternatives by describing qualitative or quantitative differences. Special Status Species and Cultural Resources impact determinations are formally determined under the Endangered Species Act (Section 7) and the National Historic Preservation Act (Section 106), respectively. In accordance with *Management Policies* (NPS 2006), the analysis in this Environmental Assessment fulfills the responsibilities of the NPS under Section 106 of the National Historic Preservation Act.

Special Status Species

Conclusions drawn for impacts to special status species adhere to the following definitions:

- **No Effect:** The project (or action) is located outside suitable habitat and there would be no disturbance or other direct or indirect impacts on the species. The action will not affect the listed species or its designated critical habitat (USFWS 1998).
- **May Affect, Not Likely to Adversely Affect:** The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely beneficial. Insignificant effects would not result in take. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur (USFWS 1998).
- **May Affect, Likely to Adversely Affect:** The project (or action) would have an adverse effect on a listed species as a result of direct, indirect, interrelated, or interdependent actions. An adverse effect on a listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions and the effect is not: discountable, insignificant, or beneficial (USFWS 1998).

Cultural Resources

Conclusions drawn for impacts to cultural resources adhere to the following definitions:

- **No effect:** There are no historic properties in the Area of Potential Effect (APE); or, there are historic properties in the APE, but the undertaking will have no impact on them.
- **No adverse effect:** There will be an effect on the historic property by the undertaking, but the effect does not meet the criteria in 36 CFR Part 800.5(a)(1) and will not alter characteristics that make it eligible for listing on the National Register. The undertaking is modified or conditions are imposed to avoid or minimize adverse effects. This category of effects is encumbered with effects that may be considered beneficial under NEPA, such as restoration, stabilization, rehabilitation, and preservation projects. Under the terms of the 2008 PA, data recovery can mitigate affect to archaeological properties that are eligible for listing on the NR under criterion D. However, some archaeological sites are eligible as traditional cultural places under criterion A, and such mitigation may not be sufficient or appropriate.
- **Adverse effect:** The undertaking will alter, directly or indirectly, the characteristics of the property making it eligible for listing on the National Register. An adverse effect may be resolved in accordance with the Stipulation VIII of the 2008 Programmatic Agreement, or by developing a memorandum or program agreement in consultation with the SHPO, ACHP, American Indian tribes, other consulting parties, and the public to avoid, minimize, or mitigate the adverse effects (36 CFR Part 800.6(a)).
- **Significant Impact:** An impact to a National Register historic property would be considered significant when an adverse effect cannot be resolved by agreement among SHPO, ACHP, American Indian tribes, other consulting and interested parties, and the public. The impact will diminish the integrity of location, design, setting, materials, workmanship, feeling or association

characteristics that make the historic property eligible for inclusion in the National Register Historic Places. The resolution must be documented in a memorandum or programmatic agreement or the FONSI.

Cumulative Impacts

The Council on Environmental Quality (CEQ) describes a cumulative impact as follows (Regulation 40 CFR 1508.7):

A cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Cumulative actions are evaluated in conjunction with the impacts of an alternative (including existing conditions) to determine if they have any additive effects on a particular resource. Because most of the cumulative projects are in the early planning stages, the evaluation of cumulative impacts was based on a general description of the project.

Projects Included in the Cumulative Effects Analysis for the Rehabilitation of the Lake Crescent Section of U.S. Highway 101 and East Beach Road

The following projects were identified for the purpose of conducting the cumulative effects analysis.

Past Projects

- Lake Crescent Alternatives Analysis

The Lake Crescent Alternatives Analysis (1997) was prepared by the Department of Transportation to assess the safe alternatives for nonmotorized travel along the length of Lake Crescent. The analysis area included approximately 11 miles of U.S. Highway 101 to the south of Lake Crescent, and up to 15 miles of trails and roads on the north side of the lake. The findings of this plan were considered in the formulation of alternatives in the General Management Plan.

- Lake Crescent Management Plan

See description of this plan in Chapter 1: *Purpose and Need*

- Olympic National Park General Management Plan (NPS 2008)

See description of this plan below.

- Spruce Railroad Trail Expansion and Improvement (SRRT) Environmental Assessment (2011) and Spruce Railroad Trail Improvement Environmental Assessment (2012), FONSI 2013

See description of this plan in Chapter 1: *Purpose and Need*.

- U.S. Highway 101 Geotechnical Drilling

Geotechnical drilling was conducted for the proposed project under the action alternatives. It involved taking core samples of the roadway and areas just beyond it from several locations within the proposed project area.

Current Planning Projects

- Lake Crescent Log Cabin Resort Cabin Replacement (January 2016)

This environmental assessment examines the environmental impacts associated with the proposal to replace cabins and improve Log Cabin Resort within Olympic National Park.

Proposed Road Projects

- Resurfacing and Rehabilitation of Park Roadways

The Federal Highway Administration (FHWA) has a series of road resurfacing projects on schedule for completion at the park, including Sol Duc Road, Heart of the Hills Road, Mora Road, Quinalt North Shore Road, Ozette area, and the Hoh River Road. In addition several road rehabilitation projects (in addition to the above-mentioned Highway 101 project) are slated within the next twenty years. These include the Elwha Road, a small portion of the Staircase Road, and Heart of the Hills Road.

- Lower Elwha Valley Road rehabilitation proposed for 2018-2019. Repave approximately 3.5 miles and change 4.5 miles from pavement to aggregate. This project is located approximately 15 miles from the proposed Highway 101 project area. *Note:* This project will be modified based on the changes in the Elwha River that occurred in fall/winter 2015.
- Heart of the Hills road rehabilitation proposed for 2019. Repave approximately five miles, including guardrail and drainage improvements. This project is located approximately 30 miles from the proposed Highway 101 project area.
- Sol Duc Hot Springs Campground Bridge. This project would consist of proposed replacement of a culvert with a larger structure for an overflow channel and is proposed for 2015-2016.
- Hoh River Road. This proposed project calls for stabilizing the Hoh River bank to protect the road on the Jefferson County section in three locations. The project would also provide a new bridge at milepost 7.5. It is proposed for construction in 2017-2018 and is located approximately 40 miles from the proposed Highway 101 project area.

Proposed Implementation of Park Management Plans

Olympic National Park Final General Management Plan (GMP) and Environmental Impact Statement (2008).

The GMP provides park managers with long-term direction for achieving the resource protection and visitor experience goals of ONP and establishes broad direction for managing Lake Crescent, including the Log Cabin Resort. The proposed project is consistent with the GMP. Among the provisions in plan applicable to this project include:

- Trails, campgrounds and related facilities will be kept at approximately their current levels, but may be modified for resource protection, restoration, management of hazardous tree conditions, or enhancing visitor experience, or to address increased visitation (NPS OLYM Presentation Plan 2008: 37)
- Retain park facilities, including visitor centers, campgrounds and concessioner-operated facilities; some facilities and campgrounds may be modified or relocated to protect resources, minimize adverse effects on river processes and aquatic and riparian habitats to the extent possible, or for improved sustainability. Some facilities will be improved (NPS OLYM Presentation Plan 2008:41).
- Retain existing facilities at Lake Crescent at Barnes Point, Log Cabin and Fairholme. Improve or modify these facilities as necessary to enhance shoreline protection. Encourage a longer lodging season (NPS OLYM Presentation Plan 2008:43, 70 -- Map 5: Lake Crescent Area).
- The existing frontcountry trail system at Lake Crescent will be retained and could be improved.
- A universally accessible frontcountry trail will be developed and maintained.
- When complete, the Olympic Discovery Trail will lead from Port Townsend to Port Angeles and then west to the Pacific Coast.

Lake Crescent Management Plan (LCMP) and Environmental Impact Statement (1998)

The LCMP identified resource protection and visitor experience goals for the Lake Crescent area of the park. Among the provisions of the LCMP include:

- Develop an overall site design and trail plan for each Lake Crescent management area (Fairholm, Barnes Point, Log Cabin, La Poel, East Beach, North Shore).
- Relocate the picnic area at Bovee's Meadow away from the shoreline.
- Obliterate/revegetate the social trails between Bovee's Meadow and Barnes Creek.
- Establish an interpretation/orientation focus at the Storm King Ranger Station; relocate park administrative functions to the NPS-owned Carter House.

Rock Scaling and Bolting

Rock scaling is the description given to technical climbing over a rock face to dislodge loose and unstable rocks using a rock hammer and/or pneumatic (air) drill. Rock scaling dislodges rocks that would otherwise be dislodged intermittently onto the roadway through natural weathering (freeze-thaw cracking and gravity-induced erosion). In rock bolting, holes are drilled into the rock face and bolts inserted, to provide another contact surface for stabilizing unstable rocks.

Typically rock scaling and bolting should occur every 5-7 years in affected areas and serves to manage rock fall incidents, that have the potential to cause property damage or injury, that would otherwise occur on the roadway.

Rock scaling predominately uses hand tools (pry bars/rock bars). Rocks that are too large to dislodge with hand tools may be dislodged with hammers, drills and/or inflatable bags or jacks to scale the loose rock.

- Erect attractive entry signs at the eastern and western entrances to Olympic National Park at Lake Crescent.
- Install park entrance signs along East Beach Road.

The Lake Crescent Management Plan also calls for development of a Lake Crescent shoreline protection/management plan to focus on water quality and shoreline issues, including issues associated with wastewater treatment and development.

Fairholm: Among the projects identified in the LCMP for this area include relocating the store and adding parking, reconfiguring the campground, removing campsites along the shoreline and revegetating the area, providing concession boat and bike rental services, retaining the designated swimming area, and reconstructing the boat dock.

Log Cabin Resort: Among the projects proposed include providing additional parking, removing the A-frame units and locating replacement units away from the shoreline (no longer planned), replacing some RV camping with cabins, providing public boat fueling, and improving interpretive programming. Other currently proposed improvements are detailed in the Log Cabin Resort Cabin Replacement Environmental Assessment.

La Poel actions identified in the LCMP, such as closing the area to camping and retaining day use and picnicking away from the creek, have generally been implemented.

East Beach modifications in the LCMP include installing new accessible toilets, redesigning the parking area to better protect the shoreline, and constructing an upper parking area with beach trail access, and possibly constructing a new trail/scenic overlook on the Fisher parcel.

North Shore improvements identified in the LCMP but not yet implemented include improving the picnic area.

Actions pertaining to the U.S. Highway 101 project area include:

- Establish U.S. 101 within Olympic National Park as a parkway emphasizing the human and natural history of the lake.
- Investigate the feasibility of establishing an information/orientation facility on U.S. 101 east of the intersection with East Beach Road.
- Provide additional restroom facilities throughout the Lake Crescent area.

Other transportation/circulation improvements identified in the LCMP included potentially improving safety and accommodating bicycles by investigating the feasibility of widening East Beach Road, Piedmont Road, and Lyre River Road to provide four-foot wide paved shoulders, and supporting the operation of a commercial educational tour boat; explore the feasibility of adding tour boat stops around the lake.

Environmental Impacts

A. Impacts to Geology

Impacts from Alternative 1

There would be no additional impacts to geologic resources under Alternative 1 (No Action/Continue Current Management). Existing impacts would continue, including the potential for periodic rock fall from cliffs above U.S. Highway 101. At the base of Storm King, an unstable rock cliff rises above U.S. Highway 101. This cliff has been the scene of numerous attempts to manage the amount of unstable rock that falls unexpectedly onto the roadway. Most recently, in 2012, approximately 320 hours of rock scaling and bolting (see sidebar) of the unstable slope took place.

Rocks were both physically removed (dislodged) and altered (drilled) to insert stability bolts. Although no systematic scaling or bolting would occur under Alternative 1, it is likely that this type of work would continue to be needed over the long-term on U.S. Highway 101. As noted in the sidebar, the work is needed approximately every five to seven years in unstable areas. As a result, there would continue to be long-term adverse effects that would generally be undetectable on the geologic formation (cliff) adjacent to the roadway.

Impacts from Alternatives 2 and 3

Impacts would be similar to Alternative 1; however, under Alternatives 2 and 3, systematic rock scaling and rock bolting would take place and would affect geology.

As in 2012, rocks would be both physically removed (dislodged) and altered (drilled) to insert stability bolts. As in 2012, no blasting would occur. In 2012 approximately 20 bolts were installed and areas of unstable rocks were dislodged. This rock scaling resulted in periodic rock fall onto the intermittently closed roadway (30 minute to 3 hour delays). It also resulted in numerous instances when rocks and trees or other vegetation were dislodged, but hung up in other rocks or trees before hitting the roadway. In one instance, a rockslide dislodged by the effort that could not immediately be cleared away closed the road for a period of approximately 36 hours. Overall, there would be adverse effects on an existing cliff-face that has previously been affected, although these would be unlikely to be noticeable to most visitors. Although the process mimics the natural weathering that would otherwise (and still does) occur, there would be impacts from inserting a relatively small number of bolts and from causing rock fall from the cliff to accelerate over the approximately 158,000 square feet that overhangs the roadway.

As in 2012, rock scaling may result in periodic rock fall onto Highway 101, causing delays of up to four hours for approximately 10 days.

Rehabilitation of U.S. Highway 101 would also result in effects on subsurface rock and bedrock present in the project area. Dig-outs for constructing deep patches and MSE walls would likely affect underlying rock. There would also be the sourcing and placement of approximately 1,555 cubic yards of rock alongside the lake edge to stabilize the roadway in approximately 33 places (4,500 linear feet). This would add a small degree of additional rock to the edge of Lake Crescent, where a large portion of the bank has been armored since original construction of the road. Scattered boulders in turnouts would also be reset or removed to other locations in the project area, resulting in slight additional adverse effects.

B. Impacts to Soils and Vegetation

Because actions that impact soils would also affect vegetation, to minimize repetition, these topics have been combined in the impact analysis.

Types of Soil Impacts

Soils are susceptible to several types of physical and chemical impacts including erosion, compaction, contamination, and direct removal.

- **Soil Removal.** Paving and construction remove and cover the soil surface and can result in changes to basic soil properties, including altering the ability of water to penetrate the soil. Excavation and removal of the soil surface result in a long-term impact because basic soil properties (such as compaction, texture, and physical and chemical composition) which may have

taken from tens to hundreds or thousands of years to develop are removed. Covering the surface reduces water movement and minimizes the opportunity for the normal physical and chemical soil processes.

- **Soil Profile Mixing.** Soil excavation and redistribution causes removal or mixing of the soil profile and disrupts soil structural characteristics, interrupting the chemical, physical, and biological processes that naturally occur in the soil. The level of change is dependent on the level of the alteration. It may take decades to redevelop the soil profile.
- **Soil Compaction.** Soil compaction may occur as a result of construction activities or in areas of intensive use such as trails, campgrounds and picnic areas. Wetland soils are very susceptible to compaction effects. Soil compaction reduces infiltration rates and decreases pore spaces within soils, thereby increasing surface runoff and the potential for erosion. Deep compaction of soils may impede subsurface water movement. In turn, these effects can alter soil chemical processes such as nutrient transfer, biological processes such as root development and microbial patterns, and physical processes such as soil structure. Vegetation growth on compacted soils is often limited due to low infiltration and poor root penetration.
- **Soil Erosion.** Removal of vegetation through grading or pedestrian use may result in accelerated erosion of the soil surface. Soils on steep slopes and along watercourses are especially susceptible to erosion.
- **Soil Contamination.** The addition of chemical constituents into the soils as a result of paving, untreated runoff from paved surfaces, or from incidental spills, may alter micro- or macro-organism populations, diversity, and dynamics. Machinery involved with construction activities may deposit small amounts of natural and synthetic petro-hydrocarbons onto soils through equipment failure or normal operations.
- **Soil Restoration.** Ecological restoration that would minimize erosion potential and increase organic matter in the soil is considered a beneficial effect. Short-term adverse effects may occur during site restoration activities where construction equipment may compact soils, temporarily eliminate groundcover vegetation, and cause potential erosion from surface water runoff over the exposed soils, however, over the long-term, restoration will restore the soil profile, eliminate erosion, and increase continuity with adjacent areas.

Types of Vegetation Impacts

Actions that reduce the size of or disrupt the continuity and/or integrity of native plant communities are considered adverse impacts. Ground disturbance provides opportunities for nonnative plants to adversely impact native plant communities, because, without mitigation measures, nonnative plants are often the first species to grow back. Restoration of disturbed areas using native seeds and reusing topsoil and plants, mulch, or other stabilizing materials accelerates site recovery and reduces opportunities for exotic plants to become established. Actions that preserve and/or restore essential qualities of native plant communities constitute beneficial impacts. New development within an otherwise intact and undisturbed area may fragment or disassociate plant communities. Small areas of restoration surrounded by existing or new development may result in fewer beneficial impacts on plant communities than restoration of a small area adjacent to a larger intact community. In general, reducing and limiting fragmentation and maintaining connections within and among plant communities can minimize adverse effects on plant communities.

Impacts from Alternative 1

Under Alternative 1, there would be few new impacts to soils except in the event of road failure and/or continued deterioration of Highway 101 and East Beach Road. Routine, ongoing maintenance of the road surfaces would involve the range of actions described in Alternative 1, including pavement patching, mowing, shoulder work, and ditch maintenance, and would continue to adversely affect soils by affecting the types of plants that would grow and by creating bare areas (such as from ditch cleaning). Overall, soils within and adjacent to roadways are heavily compacted. Other adverse impacts to soils would continue to occur from mixing, removal, and replacing some surface and subsurface material with other materials, such as from asphalt patching. In addition, the potential for soil contamination would continue to occur

from roadway use, runoff and from parking and driving on the road and unpaved turnouts. Except for routine and annual maintenance, these actions would likely occur widely spaced over time and affect separate areas along the roadways, or one type of area systematically, such as ditches or the area beneath and adjacent to the guardrail (primarily Highway 101). In the event of catastrophic road failure, soils would be disturbed and erosion and sedimentation could occur and affect areas down slope from the road, including Lake Crescent, resulting in additional adverse effects, depending on the severity and extent of the road failure.

Under Alternative 1, continued minor repairs and maintenance to Highway 101 and East Beach Road would be necessary and would increase over time, as the road condition increasingly deteriorated. Minor repair activities, including of minor rockslides, asphalt patching, shoulder slumping and drainage ditches would result in the removal or disturbance of vegetation intermittently along the roadway. In the event of a catastrophic road failure, depending on the location and severity of the failure, adverse impacts to soils and vegetation could range widely from a few grasses, forbs, shrubs and trees to loss of vegetation over a much wider area. Revegetation needs would likely be localized, but could be extensive, depending on the type of repair.

There would also be ongoing encroachment on vegetation (trampling and running over plants) and compaction of soils through the continued establishment and use of informal roadside turnouts, some of which have been established or grown larger over time. Other impacts to vegetation would continue to result from vegetation maintenance activities alongside the road, including the periodic trimming and removal of vegetation from within approximately ten feet of the edge of pavement on both sides of the road, a long-term adverse effect.

Combined there would continue to be localized, long-term adverse impacts on soils and vegetation alongside Highway 101 and East Beach Road due to ongoing maintenance and repair activities, and from continued deterioration of the roadways.

Impacts from Alternatives 2 and 3

Under Alternatives 2 and 3, the following actions are among those that would affect soils and vegetation on U.S. Highway 101. Those marked by an asterisk (*) would also occur on East Beach Road, albeit to a lesser degree.

- Removing some native and nonnative vegetation* (including native trees, shrubs and forbs) and topsoil in preparation for specific actions along the roadway, such as deep patches, walls, and guardrails, and for staging areas;
- Actions to repair pavement deterioration, including excavating under the roadway and replacing materials within and adjacent to it (deep patches* and subexcavation);
- Constructing MSE walls;
- Removing and replacing guardrail;
- Cleaning and replacing culverts* (approximately 32 on Highway 101 and nine on East Beach Road) and culvert grates;
- Rehabilitating informal, unused or unsafe turnouts*, while retaining and/or narrowing others.
- Clearing ditch-lines* and reinstalling some concrete curb and gutter;
- Constructing the Barnes Point transit stop; and
- Reconstructing the Sledgehammer Point turnouts.

Roadway Modifications

General Impacts from Construction: Soils would be affected over the length of the road rehabilitation project, wherever excavation and/or fill are called for. Equipment and workers in the construction zone (road prism from cut-slope to fill-slope) would undertake actions that would trample, remove, cover, and compact soils. Most proposed work would occur in areas previously disturbed by road-related development activities (e.g., maintenance and construction) and visitor use activities. There would be no

road widening or changes in the alignment of the roadway. Actions would primarily take place on the road and road shoulders, including the fill-slope in some areas.

Where additional compaction occurred, it would temporarily or permanently decrease soil permeability, change soil moisture content, and lessen its water storage capacity. Because of planned scarifying in exposed areas following construction, such as restored turnouts, the long-term effects of compaction in new areas would be minimal. Similarly, paving some new areas would change the way water enters them and affect whether they hold water. Although some currently gravel turnouts would be paved, the road would remain the same width. As a result, there would be no major increases in surface area covered by impermeable materials.

Aggregate, asphalt and soil fill material would primarily come from commercial sources, resulting in a need to ensure clean fill materials to prevent contamination of the park soils through weed seed or other unwelcome additives. Quarry areas proposed for use in the project would be inspected for the species identified in Table 13 to determine whether there are propagules of these species present in the quarry material or vicinity. A determination of weed-free status is based on this information, the time since materials were excavated and storage time (if any) during or outside of the growing season.

Table 13: Olympic National Park Priority Invasive Species of Concern

Scientific name	Common name	Scientific name	Common name
<i>Bromus tectorum</i>	cheatgrass	<i>Lathyrus latifolius</i>	everlasting peavine
<i>Centaurea biebersteinii</i>	spotted knapweed	<i>Lathyrus sylvestris</i>	small everlasting peavine
<i>Centaurea jacea</i>	brown knapweed	<i>Phalaris arundinacea</i>	reed canarygrass
<i>Centaurea diffusa</i>	tumble knapweed	<i>Polygonum cuspidatum</i>	Japanese knotweed
<i>Cirsium arvense</i>	Canada thistle	<i>Polygonum polystachyum</i>	Himalayan knotweed
<i>Cytisus scoparius</i>	Scotch broom	<i>Polygonum sachalinense</i>	giant knotweed
<i>Geranium robertianum</i>	Herb-Robert	<i>Polygonum x bohemicum</i>	Bohemian knotweed
<i>Hedera helix</i>	English ivy	<i>Potentilla recta</i>	sulphur cinquefoil
<i>Hieracium aurantiacum</i>	orange hawkweed	<i>Prunus laurocerasus</i>	laurel cherry
<i>Hypericum perforatum</i>	common St. John's-wort	<i>Rubus discolor</i>	Himalayan blackberry
<i>Ilex aquifolium</i>	English holly	<i>Rubus laciniatus</i>	evergreen blackberry
<i>Iris pseudacorus</i>	yellow iris	<i>Senecio jacobaea</i>	tansy ragwort

Staging Areas: Using the former Aurora quarry in the park for staging materials, such as soil, rock, and new guardrail (no asphalt or hazardous materials would be stored), would require clearing an area of approximately 130,000 square feet (three acres) and treating it to remove nonnative broom. To avoid impacts to Aurora Creek, areas near the creek where runoff could occur would be protected by silt fencing or other measures and stockpiles of loose materials would be covered to prevent contamination from weed seed. Using the quarry would result in loss of primarily nonnative forbs, such as herb-Robert, shrubs such as Scotch broom, and native forbs and seedling trees that have grown on the old roadbed leading up to the quarry. A berm constructed of waste or imported soil which now blocks the road entrance would be removed, affecting approximately 100 cubic yards of soil fill placed to prohibit vehicles from entering the old road. Use of the quarry would occur throughout the duration of construction. Following disturbance, the area would be reseeded with a native mixture and the barrier to the former road reconstructed.

Deep Patches: Approximately 23 deep patches of three different types (11 Type I half width, four Type I full width, six Type II (half width daylighted, and two Type III full width) would occur to repair pavement deterioration on U.S. Highway 101. Deep patches consist of excavation within the roadway (and in the case of Type II patches alongside the shoulder leading down to Lake Crescent). Deep patches would occur over approximately 5,045 linear feet (0.96 mile) of the roadway (an estimated 2,755 linear feet for Type I half, 910 feet for Type I full, 855 feet for Type II half and 525 feet for Type III full). On East Beach Road, there would be another approximately 20 within-road deep patches (an estimated 1,180 linear feet).

For the most part, the areas under the road consist of compacted fill material used in the original construction or subsequent repair of the roadway; however some deep patches would likely affect deep seated native soils not previously disturbed by roadway construction. These areas would be layered with select borrow (rock) and geogrid/geotextile fabric underneath the roadway and then overlaid with approximately 7 ½ inches of asphalt concrete pavement. As a result, remaining soils would be removed, trucked away and replaced with nonnative fill materials. The estimated amount of nonnative fill materials (select borrow) that would be used for the combined deep patches is approximately 10,600 cubic yards, which would, in turn, be overlain by road base and asphalt concrete pavement. During the work there would be a potential for contamination from heavy equipment spills, which could affect soils and vegetation, but which would be minimized by using biodiesel and vegetable-based hydraulic fluid and by other measures (see below). Excavation entirely within the roadway, including the road shoulders, for the Type I (both kinds) and Type III deep patches would result in the loss of native and exotic low-growing herbaceous plants such as sword fern, sticky willy (*Galium aparine*), creeping buttercup (*Ranunculus repens*), sweet vernal grass (*Anthoxanthum odoratum*), and Kentucky bluegrass (*Poa pratensis*), along the road shoulder (a total of approximately 67,000 square feet) in an estimated 17 different areas.

A Type II deep patch would affect not only the roadbed, but also adjacent soils and vegetation. Of the approximately six Type II (daylighted) deep patches and three MSE walls now planned for the roadway (see below), two or three would also potentially affect several conifers greater than 15-inches in diameter at breast height (dbh) and other deciduous trees of that size, numerous smaller trees, as well as shrubs, and forbs. The following trees species would be affected: Douglas-fir, western red cedar, western hemlock, grand fir, big-leaf maple, vine maple, red alder, and willow. Affected shrubs would include: dogwood, Himalayan blackberry, salmonberry, oceanspray, elderberry, and salal. A variety of other species, including sword, licorice and bracken ferns, coltsfoot, horsetail, and a wide variety of native and exotic grasses and small flowering plants, such as sticky willy, buttercup, and herb-Robert, as well as mosses would also be removed. Most areas would affect seedling trees and shrubs; however, a small number of larger trees (sizes approximate), including a 36-inch cedar near Eagle Creek; a 40-inch Douglas-fir near one of the MSE walls; two 16-inch Douglas-firs adjacent to proposed deep patches; and two cedars (28 and 30-inches), two Douglas-firs (20 and 24-inches), and several very large (up to 36-inches) big leaf maples within a Type II deep patch area may be removed. In addition, there are other large alders and big-leaf maples within areas proposed to be excavated along Highway 101. In these and other areas, there are hundreds of very small trees in the 1-4 inch range, dozens of trees in the 6-12-inch range and a few slightly larger trees that could be removed. Most of these are in the smallest category. There would also be a limited number of trees between 12 and 16 inches affected. Most of those are big-leaf maple and alder and a few Douglas-firs. Where possible, efforts would be made to avoid impacts to the largest trees, especially those present when the road was constructed. For instance the largest Douglas-fir and cedar are in areas on the edge of proposed road treatments and although there is a possibility that they would not need to be removed, they have been included in this list.

Subexcavation: One area of approximately 500 linear feet of subexcavation (16 inches deep) is currently proposed near Fairholme. East Beach Road would also have approximately 3,250 linear feet (0.62 mile) of subexcavation. The subexcavation would be similar to the in-road deep patches, affecting soils, but very little vegetation, except to provide access. The area of subexcavation on Highway 101, for example, would require approximately 593 cubic yards of excavation of native and nonnative road base materials, which would be replaced with approximately 16 inches of select borrow (quarry-derived rock) over a layer of geotextile fabric, and covered with roadway aggregate and asphalt concrete pavement. Because the excavation would be entirely within the roadway, including the road shoulders, only vegetation (forbs) along the road shoulder would be removed. Forbs in these roadside areas are comprised of the same types of species noted above under deep patches and others.

Underdrains: Approximately 4,690 feet (0.88 mile) of underdrain construction on Highway 101 and 1,180 feet (0.22 mile) on East Beach Road would require excavation of road base, fill and native soil to form trenches approximately 30-inches wide by 5-feet deep. These areas would be lined with geotextile fabric and backfilled with rock and imported fill (soil). These underdrain pipes continue until they outlet in an

excavated ditchline. Underdrain construction would affect soils and vegetation (forbs) on one side of the road in approximately 15 areas (8,800 square feet). Forbs in these roadside areas are comprised of the same species noted above.

MSE Walls: Approximately three mechanically stabilized earthen (MSE) walls are planned for areas where the roadway edge is failing (subsiding into Lake Crescent) along a near vertical gradient (500 linear feet). These would be constructed in a similar manner to the deep patches; however, these would rise vertically rather than slope toward Lake Crescent. In these areas, impacts to roadside soil and vegetation resources, such as large trees, could be minimized by excavating closer to/within the roadway, rather than the lake. Nonetheless, native soils and a variety of vegetation would be removed to construct them. An estimated 1,500 cubic yards of soil would be removed and replaced with fill (the lake side would be comprised of a rock face), and areas of approximately 500 square feet, 2,500 square feet, and 3,500 square feet, up to and including the edge of the road would lose native and nonnative vegetation cover, such as the following species: Douglas-fir, western red cedar, big-leaf maple, red alder, salal, salmonberry, wild rose, trailing raspberry, kinnickinnick, pearly everlasting, sword fern, licorice fern, and a variety of grasses and mosses. Construction of MSE walls would generally prevent the growth of trees within the wall adjacent to the shoreline. Other plants, such as small shrubs and forbs could become established.

Guardrail Removal/Replacement: To remove and replace all of the existing guardrail, including adding short sections near the edges of turnouts, native and nonnative vegetation beneath the guardrail would be removed, along with some topsoil, then guardrail posts pounded into the ground using a pile driver or auger to a depth of seven feet approximately every 6.25 feet and the guardrail attached to the posts. As a result, the topsoil (including vegetation) between the edge of pavement and the guardrail would be removed and trucked away and replaced with imported clean topsoil. Because approximately 46,990 feet (8.9 miles) of guardrail would be replaced, in an area approximately three feet wide (edge of pavement to guardrail), there would be a loss of native topsoil and vegetation (primarily grasses and forbs, but also including some small shrubs and seedling trees) over approximately 3.5 acres. Although this loss would be somewhat extensive, this area, which is mowed regularly, is heavily infested with nonnative plants, including some invasive species such as Scotch broom, reed canary-grass, and herb-Robert. The opportunity to reseed this area with a native, locally sourced seed mixture would have long-term beneficial effects. Because it is mowed, grasses would continue to dominate.

Culvert Cleaning/Repair/Replacement: Replacing approximately 17 culverts in-kind (same size) and upgrading approximately 15 culverts (from 18-inches to 24-inches) on Highway 101 would improve sediment delivery to Lake Crescent as well as fish passage under the highway, but would have a range of adverse effects on soils and vegetation, including from excavation, removal and loss, especially where this loss occurred in wetlands (see that section in this document). Similarly, the replacement of approximately ten culverts on East Beach Road would also affect intermittent streams and ditch relief areas, and result in soil disturbance, removal and replacement with fill, as well as loss of vegetation.

In both areas, an estimated 70-350 square feet would be affected at each location, depending on the size of the culvert and the need for adjacent rehabilitation work on the roadway. Culvert replacement for upsizing the approximately 15 culverts from 18- to 24-inches would result in a potential for additional disturbance of previously unaffected areas, including an average of approximately 40 cubic yards of soil excavation for each culvert (an estimated 2,000 cubic yards total). Many (23) of the culverts also have drop-inlet covers (grates) that screen large rock, while allowing the passage of sand and gravel toward Lake Crescent to be part of water runoff. These areas allow natural sediment discharge from higher elevations to reach the lake, resulting in long-term beneficial effects on lake bottom soils from natural erosion and on lake nutrient enrichment, which also benefits fish habitat (see Fish and Wildlife section).

In addition to the variably-sized ditch-relief and stream culverts (18, 24, 30, 36, and 48-inches) replaced on Highway 101 and on East Beach Road (18, 24 and 72 inches), there would be replacement of several larger culverts, including a 50 x 40-inch culvert at Aurora Creek, and a double set of 36-inch culverts

replaced with a single box culvert at Eagle Creek on Highway 101 and a 84-inch culvert beneath East Beach Road replaced with a culvert approximately 19.5 feet wide, 9.5-feet tall and 65 feet long.

Replacement of these larger culverts would have more temporary adverse effects on vegetation and soils (including adjacent areas from rerouting the flow of water, if needed, during replacement). Depending on water flow, this may or may not be necessary for Aurora and Eagle creeks on Highway 101, but it would be necessary for Log Cabin Creek on East Beach Road.

Replacement of the 84-inch culvert which is hanging over, rather than being located within Log Cabin Creek, would also have much greater effects because it would require excavating the approximately 10 feet of road fill built up over it, removing the existing culvert, then excavating deeper to reach the streambed below it. Because of the need for access and because the new culvert would be longer, this replacement would also affect up to 40 feet upstream and 50 feet downstream, with a variable width of approximately 30 feet, resulting in the loss of native soils and vegetation over an area of approximately 0.10 acres. Although the area of fill above and slightly below the culvert has previously been disturbed by road construction, all of the area beneath the culvert likely has not. To access the area and to complete the culvert replacement to permit fish passage into areas above the road, a range of vegetation would be affected, including the following: a 12-inch cedar, numerous large big-leaf maples and alders, as well as a variety of shrubs, grasses, forbs, ferns and mosses. In addition, large woody debris, such as the approximately 36-inch diameter cedar log, adjacent to and across the stream (Log Cabin Creek) would also be removed. Although there would be a range of localized short- and long-term adverse effects on soils and vegetation in this area, after work was completed, stream restoration would commence and result in the seeding and planting of riparian vegetation, including any that might be salvaged from the area before work is initiated.

Riprap Placement: Placement of riprap would occur at the edge of Lake Crescent and would be from a barge to the extent possible, thus minimizing onshore attendant impacts on soils and vegetation from use of an excavator. Riprap placement of large (boulder-size) rock with an excavator equipped with a tong-like attachment would affect approximately 33 locations along Lake Crescent and some turnouts. In these areas, soils and vegetation along the shoreline would be affected in an area comprising approximately 87,000 square feet (two acres). Excavation would be needed to anchor the placed rock. Soils and vegetation removed from the area would be placed in a container on the barge. Temporarily anchoring the barge using barge pilings (12-inch diameter circular steel poles) would also disturb lake sediments. Several of these would be used in each location. As a result, riprap placement would cause removal and compaction of soils, as well as placement of large rock obtained from outside the project area in concert with geotextile fabric. Plant species affected would include those common along the shoreline, including red alder, big leaf maple, a variety of shrubs, and forbs. Excavated material would periodically be moved to the shoreline and trucked to staging areas and/or removed from the park. Access for the barge would be from an existing disturbed turnout providing lake access along Highway 101 (Wallace Point), where a new gate is proposed to maintain this administrative access (near station 345+00).

Turnout rehabilitation, retention and modifications: Of the approximately 45 turnouts along the Lake Crescent portion of U.S. Highway 101, approximately 20 would be retained without modifications, approximately 12 would be revegetated, 11 of which are informal pullouts not designed or constructed for vehicle turnouts or parking, and 11 would be modified to continue to provide a safe location for slow vehicles to pullover and allow others to pass, but would no longer provide perpendicular parking at sites which do not offer visitor attractions (see Appendix 1). Turnout modifications would primarily affect unvegetated areas, but some vegetation would likely be affected as areas to be paved were graded and reconditioned to improve drainage. Similarly, installation of short sections of parking bumpers, log-rail fence and guardrail would affect some of these areas. Revegetation of approximately 0.7 acres within 13 turnouts would result in long-term beneficial effects from reestablishing roadside vegetation, and minimizing the extent of disturbed soils. Similarly, paving would reduce the contribution of potentially contaminated sediment to Lake Crescent and narrowing of other turnouts would provide additional opportunities for soil rehabilitation through seeding and possibly supplemental planting.

Ditch cleaning, reconditioning, and limited curb and gutter installation: Soils and vegetation that has grown up in the ditches since they were last cleaned out would be removed and the ditches reshaped to provide capacity for water flow during stormwater runoff. Although ditches are typically maintained at least annually, the wetlands survey noted that seedling trees were found in the ditches and that some likely had not been maintained as regularly (DEA 2015). Therefore, there would be a higher degree of vegetation removal from the ditches than would otherwise be expected as they were reshaped where needed to accommodate the standard design (one foot deep by three feet wide) in approximately 21 locations of varying length (approximately 51,785 linear feet total).

Pavement rehabilitation: Upon completion of roadway fixes, such as deep patches, culvert replacement, ditch reconditioning, turnout modifications and other work, the road would be repaved. Repaving, which would occur entirely on the roadway would not extend the overall impacts on soils and vegetation beyond the shoulder in most areas, however paving of formerly gravel turnouts could affect nearby soils and vegetation from faster runoff and from excavation to layer a top course before overlaying the asphalt. During pavement rehabilitation, soils would be excavated, mixed and replaced with fill materials, including aggregate base added where needed to ensure a long-lasting surface. Paving would include asphalt milling and compaction, base and sub-base excavation (as needed), fill placement and compaction, and surfacing as appropriate to ensure a smooth, finished road surface. This would constitute a long-term negligible localized adverse effect on soils, much of which has been previously disturbed by original road construction and other repaving efforts since park establishment. Approximately six inches of road base (aggregate with a diameter of 0.5 to 0.75 would be layered and covered with approximately 7.5 inches of asphalt concrete pavement on the roadway, with turnouts having slightly less (approximately 8-inches of road base and four inches of asphalt concrete pavement).

Sign replacement/installation: All regulatory signs needing replacement would be reinstalled as part of the project. In addition, park information signs on the roadway would also be replaced. There are an estimated 40 regulatory and 201 informational signs on the roadway, each of which would require one or two post-type holes to reinstall. This would result in a small amount of additional disturbance (approximately 480 cubic feet), including loss of native and nonnative forbs surrounding each signpost.

Visitor Improvements

Sledgehammer Point Modifications: Approximately 6,000 square feet of existing mowed lawn (nonnative grasses and forbs) would be removed and replaced with a combination of a pathway and parking.

Barnes Point Transit Stop Construction: Approximately 6,000 square feet (0.2 acre) of soils and vegetation would be disturbed to construct an accessible trail to link to the existing trails to Barnes Point on the south side of the road and approximately 12,000 square feet (0.3 acres) on the north side of the road. Excavation (approximately 450 cubic yards) and fill placement (approximately 530 cubic yards) would occur to create a trail that meets ADA/ABA recommendations (with a five percent average maximum slope, including some areas (with turnouts) that may be steeper (up to eight percent). On both sides, the accessible portion of the trail would slope down toward the existing trail. The accessible trails would be approximately six feet wide, with the trail on the north side, approximately 250 feet long and the trail on the south side, approximately 240 feet long. On the north side, this would require placing approximately eight feet of fill adjacent to the existing turnout. This fill would consist of a mixture of soil and rock and would be placed so as to avoid covering the root zones of hemlocks, which would otherwise be adversely affected by placement of fill within this area. To minimize trail cutting by those not needing the accessibility, trail steps similar to those on other park trails (using stone or wood) would also be cut into the slope down to the trail on the north side, and if needed, on the south side as well. The trails would avoid the large (50-inch+) old growth Douglas-fir, western hemlock and western red cedars, and their driplines, in the vicinity of the transit stop, however more than 30 small (0-4-inch) trees would be removed. In addition, a range of other plants, such as sword fern would be removed. If construction within the driplines was unavoidable, tree wells or other protection measures would be used to minimize potential adverse effects.

Rehabilitation Actions

Nonnative Invasive Plant Treatment: Control of these species before, during, and after construction will be necessary to preclude them from colonizing renovated road shoulders and other open areas resulting from the project. A comprehensive treatment of the entire road corridor began in September of 2014 (Chenoweth 2014).

Disturbance to the road shoulders will extend a few feet into the vegetation. Other possible rehabilitation activities include guard rail replacement, Culvert repairs and replacement, ditch cleaning, slope stabilization and erosion protection, pullout enhancement and some tree removal. The disturbance caused by road rehabilitation will require revegetation. Successful revegetation requires controlling nonnative invasive species populations along the road corridor before and after road construction (Chenoweth 2014).

Restoration: Following construction on Highway 101, obliterated turnouts and disturbed areas along the roadsides would be seeded with a native grass and forb seed mix within a hydromulch. Because the roadsides are heavily infested with nonnative and noxious weeds, they would also be treated with an application of weed-free topsoil prior to the seeding. This would improve these marginal habitats for a variety of native plants and small mammals. To minimize the likelihood that deer would continue to want to cross the road to be in some of the larger areas, native species preferred by deer would be avoided in the seed mix. Although hydroseeding would be included in the contract, the park would provide the locally sourced native seed mix. Seeding would result in restoration of approximately 0.7 acres of obliterated turnouts and approximately 3.3 acres between the edge of pavement and the guardrail clearing limits. To stabilize the out-slopes of the Type II deep patches (where these daylight toward Lake Crescent), these areas could also include seeding and planting.

As noted above, there would be reuse of some large woody debris in the project, including along the shoreline of Lake Crescent. A small number of conifers are proposed for removal near the MSE walls and Type II deep patches. These trees removed from the roadsides would be evaluated to determine if they had large enough rootwads to anchor them to the bank near where they were felled. If so, they would be felled in such a way to remain along the shoreline to provide cover for fish and other aquatic species.

On East Beach Road, disturbed areas along the roadside would also be hydromulched with a native seed mixture. In addition, areas (an estimated 0.19 acres) upstream and downstream of the Log Cabin/Piedmont Creek culvert replacement would be revegetated. Although a revegetation plan has yet to be developed, this area would be restored with native riparian vegetation, such as that now found in the area.

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to soils include:

- Locating staging areas where they will minimize new disturbance of area soils and vegetation.
- Minimizing ground disturbance to the extent possible.
- Minimizing driving over or compacting root-zones.
- Reusing excavated soil, where possible in the project area, such as in rehabilitation of some turnouts.
- Not piling excavated soil alongside trees to remain.
- Adjusting trenches and other excavation to preserve the dripline soils of trees to remain.
- Revegetating project areas through native seeding or planting of appropriate areas along the road and obliterated turnouts.
- Importing of weed-free specified clean fill and topsoil (if used).

- Employing careful excavation where tree roots might be encountered. Where roots two inches and larger are encountered, hand excavation would be used as appropriate to prevent damage to roots.

Measures to minimize impacts to vegetation:

- Preserving vegetation within the project area by clearly identifying it through marking, fencing, or another appropriate technique. In other words, removing vegetation would be done in a manner that would not affect vegetation not proposed for removal.
- Erecting temporary barriers (e.g., orange construction fence) to protect existing large trees, plants and critical root zones designated to remain but which are within or just outside the clearing limits.
- Where larger roots need to be removed, they are cut with a sharp tool rather than torn by an excavator.
- Including a contractor damage clause for impacts to trees / vegetation not within the project area as part of the contract for road rehabilitation.
- Taking measures to prevent the introduction of exotic species in the project area and staging areas. All earth moving equipment and hand tools would be required to enter the park free of dirt, dust, mud, seeds, or other potential contaminants.
- Cleaning equipment exhibiting any dirt or other material attached to frame, tires, beds, wheels, or other parts, thoroughly. The contractor would use pressure washing and/or steam cleaning before entering the park.
- Preventing the introduction of nonnative aquatic species, on all barges or any other vessels entering the lake by pressure washing the vehicles and inspecting them prior to entering the water.
- Certifying as weed free or clean, all fill, rock, or additional topsoil used in the project, including ensuring that the park has approved the source of this material in advance-approved-source.
- Requiring all workers to check boots, backpacks, tools, equipment, and vehicles for weed seeds, such as mud that could harbor weed seeds, and plant parts, before first entering the park or after use in another area outside the park.
- Protecting staging areas from spillover impacts by the placement of silt fencing or other barriers as appropriate and returning these areas to pre-construction conditions upon completion of the proposed project.
- Using only native species, appropriate to the site, in revegetation (seeding or planting).
- Using existing roadways or travel paths whenever reasonable, including minimizing the number of new access paths to reduce impacts to vegetation and functions.
- Ceasing project operations under high flow conditions that inundate the project area, except for efforts to avoid or minimize resource damage.
- Rehabilitating disturbed areas in a manner that results in similar or better than pre-work conditions through spreading of stockpiled materials, seeding, and/or planting with locally native seed mixes or plants. Planting shall be completed no later than fall planting season of the year following construction.

Measures to prevent additional impacts from nonnative invasive plants:

- Controlling undesirable plant species in high-priority areas and controlling other undesirable species as necessary. To prevent the introduction of, and minimize the spread of nonnative vegetation and noxious weeds, the following measures would be implemented during construction:
 - Minimize soil disturbance.
 - Pressure wash and/ or steam clean all construction equipment, except hauling vehicles, before entering the park to ensure that all equipment, machinery, rocks, gravel, or other materials are cleaned and weed free before entering the park.

- Pressure wash hauling vehicles before entering the park for the first time; subsequent entries would not require pressure washing unless the vehicle shows signs of mud, plant material, or other substances which could be considered harmful.
- Cover all haul trucks bringing asphalt or other fill materials from outside the park to prevent seed transport.
- Limit vehicle parking to within construction limits, existing roadways, parking lots, or the access routes.
- Limit disturbance to roadsides and culvert areas, including limiting equipment to the roadbed area-no machinery or equipment should access areas outside the construction zone.
- Obtain all fill, rock, or additional topsoil from the project area, if possible. If not possible, then obtaining weed-free fill, rock, or additional topsoil from NPS approved sources outside the park would be required.
- Initiate revegetation of disturbed sites as soon as practicable following construction activities.
- Monitor disturbed areas for up to three years following construction to identify growth of noxious weeds or nonnative vegetation. Treatment of nonnative vegetation would be completed in accordance with NPS-13, *Integrated Pest Management Guidelines*.

Measures to Improve Opportunities for Restoration:

- Maximizing vegetation restoration efforts after completion of construction activities would include implementing the following measures:
 - Salvage topsoil, as well as incidental native vegetation (as feasible), from construction areas for reuse during restoration in disturbed areas.
 - Monitor revegetation success for up to three years following construction, implementing remedial and control measures as needed.

Cumulative Impacts

Habitat modification within and near Olympic National Park includes some areas where broad-scale changes in vegetation characteristics have occurred due to fire suppression, visitor use, administrative, and private development. In addition, large areas around the park are used for timber production and a range of successional forests is present. Loss of vegetation and impacts on soils have occurred where land has been developed for facilities, trails, and roads, and for private homes and businesses. Development, including roads, private property, and recreation area administrative facilities, in the park currently affects less than one percent of the land within the boundary. Combined, past actions have had localized but long-term adverse impacts on soils and vegetation due to the increased impervious surfaces, decreased infiltration, soil compaction, loss of soil moisture, and loss of organic soil horizon when areas are converted to development. Elsewhere in the park changes in river channel migration zones have also affected soils and vegetation, especially in low elevation valleys. Within the project area, previous bank stabilization work has occurred regularly along the shoreline of Lake Crescent, since the construction of U.S. Highway 101. Most recently, this stabilization occurred in 2011, resulting in placement of an additional approximately 2,000 cubic yards of riprap along the shoreline and affecting soils and vegetation in the same ways as described herein. Of this, approximately 300 cubic yards was placed below the ordinary high water mark. In addition, several roadways within the park are proposed for rehabilitation in the next few years. Although most of the effects on soils and vegetation that have occurred within the park in recent years are from actions like these—rehabilitation in previously disturbed areas, the park has also been engaged in a major river restoration project on the Elwha River.

When the actions in Alternative 1 are added to past, present and reasonably foreseeable future actions, there would continue to be little contribution to cumulative effects. Similarly, the action alternatives (2-3) would result in rehabilitation of an existing roadway in areas previously impacted by its construction. Although some new placement of riprap would occur in areas long-undisturbed by development along Lake Crescent, some of these areas have also likely been affected by past construction of the roadway. When overall impacts are considered, it is evident that the narrow roads along the shoreline of Lake Crescent, including U.S. Highway 101 and East Beach Road have had relatively confined cumulative

impacts on soils and vegetation, especially since they remain narrow and largely unaltered from their original alignments.

Conclusion

There would be a range of short-term adverse impacts on soils and vegetation from the rehabilitation of U.S. Highway 101 and East Beach Road. These impacts would predominantly occur in areas that have been previously affected by road construction. No actions would take place outside the road prism (cut-bank to fill-slope) and only a small number of rehabilitation actions (such as the construction of MSE walls, Type II deep patches and riprap placement) would take place close to the edge of the road corridor. After construction, areas disturbed by rehabilitation actions would be reseeded with native species. Imported topsoil between the edge of the road and the guardrail combined with seeding native species would improve the composition of vegetation and soil along Highway 101. Similar reseeded would also take place on East Beach Road. As a result, although a range of short-term adverse impacts would occur that would affect soils and vegetation, these would be minimized by beneficial effects associated with restoration following construction.

C. Impacts to the Acoustic Environment and Soundscapes

Alternative 1

There would be no additional impacts on the acoustic environment or soundscapes. Existing impacts would continue. Under existing conditions, the roadway is very loud, especially when trucks pass (see Acoustic Environment and Soundscapes section in Chapter III: *Affected Environment*). Although no natural ambient condition for Highway 101 has been determined, about 50 percent (L_{50}) of the time, the roadway has been determined to be above 43.6 dBA, including above 38.0 dBA at night. Conditions on East Beach Road are unknown.

Normal traffic on the roadway would therefore continue to rise above existing background noise under Alternative 1 during routine use of the road. This traffic noise would increase during occasional periods of congestion caused by routine road maintenance or repairs, accidents or congestion. During routine and cyclic maintenance operations, there would be a commensurate increase in noise in the vicinity of the work, which could include operation of heavy equipment such as loaders, a backhoe, chainsaws, or other machinery. Noise generated by road maintenance activities would rise and fall, depending on the location of the work, the number of staff, the type of equipment and the time of day.

Alternatives 2-3

In addition to sounds from typical day-to-day use of the roadway as described in Alternative 1 and in the corresponding section in Chapter III: *Affected Environment*, sounds above the typical range for the area would be expected to additionally disturb wildlife and people in the vicinity of the project area. Noise levels generated during construction vary depending on the type of equipment and the nature of the work. Noise generation during most construction is the result of diesel engine operated equipment plus activity that occurs associated with workers and equipment in the project area. Stationary and mobile construction equipment both generate noise. This noise can also be continuous or intermittent. For example, intermittent back-up beeps from construction equipment would occur, as well as intermittent to continuous chainsaw work as the project area was prepared (possibly one crew for two days). The low rumble or hum of diesel engines associated with excavators, graders and pavers would also be audible in the project area. Stationary sounds (from one place) would come, for example from the intermittent lifting of large riprap from a barge on the lake onto the shoreline. This work would also move systematically along the shoreline, as needed work was accomplished in one area. As a result, multiple sources of noise could be occurring in several areas at once during the road construction or pulsing up and down the roadway.

Table 14 shows typical sound pressure levels associated with noisy activities typical of road construction. Depending on where these sounds occur, they may affect visitors and wildlife differently. For example, if

the sounds are occurring immediately adjacent to a creek or waterfall with substantial flow, they would add to the overall acoustic environment, but may be perceived as not very noisy due to the existing noise in the area. For people, the expectation of sound has a lot to do with how obtrusive noise is in an environment. For example, visitors to the Hoh Rain Forest in the park anticipate hearing the sounds of nature, including from physical resources, such as rain and biological resources, such as birds. Similarly people in wilderness expect to hear primarily natural sounds. On Highway 101, adjacent to Lake Crescent, the perception of sound would also be different for those in vehicles, compared to those on the lake, fishing from the water's edge, or picnicking at LaPoel. People taking part in louder recreational activities, such as motor boating, would generally have a higher tolerance for noise, than people taking part in quieter activities, such as bird watching. Similarly people warned of construction activities may also have a somewhat higher tolerance because it is part of their expectation.

Table 14: Sound Pressure Levels Associated with Typical Road Construction Noise Sources

Equipment	Typical Noise Level (dBA) 50 feet from source	Equipment	Typical Noise Level (dBA) 50 feet from source
Air Compressor	81 -85	Loader	80- 87
Backhoe	80 - 84	Paver	80 - 89
Compactor	80 -82	Pneumatic Tool	85
Concrete Mixer	85	Pump	77 - 85
Bulldozer	84 - 88	Rock Drill	85 - 98
Generator	78 - 84	Roller	74 - 80
Grader	85	Saw	76
Jack Hammer	85 - 89	Scraper	85 - 89

Source: In 1994 and 1995 Harris Miller, Miller & Hanson Inc. performed noise studies for the Central Artery/Tunnel project in Boston. The results of this study are summarized in FHWA Work Zone Report (nd) FHWA website 2004 (*in* NPS YOSE 2008).

According to research, sound becomes noise when:

- It is too loud;
- It is unexpected;
- It cannot be controlled uncontrollable; and/or
- It has pure tone components.

As a result, there would be varied effects on wildlife and people from road construction noise generation during proposed rehabilitation work on U.S. Highway 101.

As shown in Table 14, noises from construction are generally in the range of approximately 70 dBA, about 10 dBA louder than typical ambient (natural and human-caused) sounds on the roadway. (As discussed in the corresponding Affected Environment section, fifty percent of the time in summer and 50 percent of the time in winter during the day (L_{50}), decibel levels exceeded 43.6 dBA, with both summer and winter sounds over 62.5 dBA.) Although the study that measured the typical construction noise sources was conducted on a busy roadway (tunnel) in Boston, a poor acoustic environment that would likely have exacerbated noises, it is clear that the noise impacts from construction are generally loud and would likely be obtrusive even on a busy roadway like U.S. Highway 101, where noises can exceed 62.5 decibels under normal conditions during the day 10 percent of the time. These noise impacts would occur fairly regularly over the period of construction, however, their intensity and duration would vary widely, depending on the number and type of vehicles or equipment in operation, the level of background noise, the distance from the receptor and the type of work being done. In general, some of the loudest noises (chain saws) would have the shortest duration, whereas others would occur throughout the duration of the project (heavy equipment use). It is likely therefore, that construction noise would result in short-term disruption of visitor experience, similar to that when a large truck passes by and that this would be felt as visitors passed through the construction area, embarked on trails, or participated in other activities nearby. Most noise would likely dissipate fairly rapidly but would also be audible some distance from the source, depending on the type of equipment being operated, and similar to the way trucks can be heard from across the lake, slightly more than one mile away.

Noise Reduction: Source Control and Path Control

According to an excerpt from the FHWA website report on nighttime noise (2004), two methods of controlling construction noise are available: source control and path control. Source control mitigates noise at the source of the problem, specifying modern equipment (containing engine insulation and mufflers) and effective noise emissions limits. Path control includes the provision of barriers or modifying project implementation to reduce noise. Equipment can be moved farther from the receiver, transported at a different time of day, enclosed using noise barriers or curtains or landscaping.

Effects on wildlife from noise generation in the project area would vary widely. Most wildlife would likely be startled by sudden loud noises, just as people are. Other wildlife, like people, may become acclimated to noises that occur with higher frequency and/or constantly, such as low intensity rumbles or constant whirring or motors or beeping. Because the project would have a short-term duration, during the construction season for approximately three years, it is likely that a range of impacts would occur and that some of these would be more disruptive to both people and wildlife than others.

Differences between Alternatives 2 and 3

In Alternative 2, construction noises would end in the early evening and would not be present at night, allowing drivers on the roadway and wildlife in the vicinity to experience a naturally quieter time and respite from the daytime construction activities. In addition, during the marbled murrelet nesting season under both action alternatives, work on the project would cease from two hours before sunset to two hours after sunrise, extending this period of relative quiet, with natural sounds predominating, in the project area (but with ongoing traffic noise from nighttime travel on U.S. Highway 101).

In Alternative 3, construction noises could continue at night, primarily outside of the marbled murrelet nesting season. In other words, from Labor Day through March 31, work could continue on the roadway. There could also be additional work during the late nesting season to replace some large culverts, while avoiding impacts to fish. Generally, night work would likely result in less disturbance to people and more to wildlife because although there would typically be fewer people on the roadway at night, especially early evening is a natural movement period for wildlife, many species of which are crepuscular (active at dawn and dusk) or nocturnal (active at night). The night work, which is not likely to be quieter than daytime work, would also be accompanied by lighting, which would intensify the effects on some species, causing them to avoid the area during work and potentially during other periods as well.

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to the acoustic environment and soundscapes include:

- Data will continue to be collected to measure the impacts of construction and after improvements to the road are made.
- Mitigation of sounds at their source and on their path is possible. Therefore, efforts will be made to mitigate the sounds at their source, by specifying the use of modern equipment (containing engine insulation and mufflers). Efforts to mitigate sounds via their path would likely be limited, but could include relocating noisy work to a louder acoustic environment, conducting the work during a different time of day, or considering noise barriers for extraordinarily loud work.
- Work in the vicinity of residences, especially near private residences near Barnes Point and on East Beach Road would be limited to daytime working hours, for example from 7:00 a.m. to 7:00 p.m.

Cumulative Impacts

Existing noise conditions associated with the location of Highway 101 would likely remain. Although the road is currently very noisy, particularly because of its setting, with much of it adjacent to a steep-sided mountain and/or rocky cliff, if area logging occurred in another area, overall traffic on the road from the noisiest vehicles could decrease. Recent anecdotal evidence has noted a slight decrease in the number of logging trucks passing along the roadway, with a concomitant increase on nearby state highways.

Because noise impacts associated with road construction would be temporary, there would be no contribution to cumulative impacts from actions to rehabilitate U.S. Highway 101 or East Beach Road. No new long-term sources of noise would be added. In fact, repaving these roads would result in a smooth, travel way, which could reduce road noise, while the pavement remained in good condition, resulting in some cumulative beneficial effects.

Conclusion

Because of the use of Highway 101 as a relatively high speed commuter and commercial route in addition to its use as a park roadway, the road would likely remain as a fairly loud acoustic environment. Although there would be short-term adverse effects that would contribute to noise on the roadways during rehabilitation, these impacts would have no lasting consequences and could reduce overall noise on both Highway 101 and East Beach Road, contributing some short-term beneficial effects that would last until the roads began to deteriorate again.

D. Impacts to Water Resources (Hydrology, Water Quality and Wetlands)

Types of Impacts

Hydrology: Adverse impacts would change the amount or type or means of water flow, including from intermittent and perennial streams, and runoff through the project area. Beneficial impacts would improve or restore these.

Water Quality: Chemical, physical and biological impacts to water quality include changes in temperature, dissolved oxygen, suspended sediment, nutrients, and chemical pollutants. The concentrations and interactions of these elements not only affect the ability of organisms to survive, but exhibit a great degree of natural variation among water resources.

Wetlands: Adverse impacts would degrade the size, integrity, or connectivity of wetlands. Beneficial impacts would enlarge the size or enhance the integrity and connectivity of wetlands.

Alternative 1

Hydrology

There would be no additional impacts to hydrology from implementation of Alternative 1. On Highway 101, water flow would continue to be altered by existing underdrains, side ditches, and stream and ditch relief culverts beneath the highway and the flow would continue to be directed toward Lake Crescent. Similarly, on East Beach Road, water would continue to flow under the roadway through ditch and stream culverts toward Lake Crescent. Lake Crescent, itself, would continue to be modified slightly by the presence of riprap along much of its south shore, where U.S. Highway 101 is located on a bench above the lake. Combined, these modifications to drainage and Lake Crescent have resulted in long-term adverse effects from changing the way water reaches the lake and from modification of the shoreline, which in areas not modified by riprap placement is naturally sandy or covered with vegetation down to the water's edge. A large extent of the south shore of Lake Crescent is currently covered by riprap.

Water Quality

There would be no additional adverse effects on water quality from Alternative 1. Existing impacts, however, would continue. Among these include faster water runoff from area roadways and parking areas

alongside the road and into drainage ditches and culverts from paved or compacted gravel surfaces. To a large degree, most runoff from the roadway is directed into unpaved ditches on the south or variable widths of road shoulder, including steeply sloped banks and walls on roadside edges on the north (on Highway 101) and south (East Beach Road) which allows for some filtration of contaminants resulting from vehicle use of the road, before entering Lake Crescent. Concentrating the flow of water, instead of allowing sheet flow across open areas, however, results in higher pollutant concentrations not being dissipated through soil filtration. In addition, where water runs off directly into culverts from the road edge, there is little or no opportunity for infiltration, and it is likely that some contaminants (such as brake dust and petroleum products) enter the lake unfiltered, a long-term adverse effect, especially during dry periods and immediately following the first rains of the season.

Contaminants in stormwater from hardened or surfaced and gravel roads can adversely affect several water quality conditions, including the amount of dissolved oxygen in the water, turbidity, and pH, which in turn can adversely affect biological resources. Gravel roads and parking areas also generate dust during dry periods and the dust coats vegetation next to the roads and washes away into the surrounding area, including nearby streams and the lake, during storms. Although there is moderate to heavy traffic on U.S. Highway 101 (and comparatively lighter traffic on East Beach Road), both roads are separated in most areas by areas where the fill area of the road slopes down toward the lake. In addition, there is an extremely high volume of water in the lake; therefore, it is likely that contaminants would have long-term but generally undetectable impacts on water quality in Lake Crescent as has been shown by recent studies of the lake (NPS 1991a) (see also corresponding section in Affected Environment).

Localized flooding due to undersized, damaged, or clogged culverts and poor drainage conditions under U.S. Highway 101 and East Beach Road would also cause sedimentation. Poorly located or plugged culverts could cause rapid erosion of road fill during storms and contribute to road failure resulting in disturbed soil being carried into nearby streams, which could adversely impact water quality. Because sediment discharge into streams and the lake is a natural process and because of the large size of Lake Crescent, there would continue to be minimal adverse effects from this sediment input.

Wetlands

There would be no additional impacts to wetlands under Alternative 1. Existing impacts would continue. Roadside wetlands (0.3719 acres of U.S. Army Corps of Engineers (ACOE) jurisdictional wetlands³, and 0.0173 acres of other wetlands), considered important by the State of Washington and the NPS) were identified by DEA (2015) as occurring in the U.S. Highway 101 project area. Another 1.65 acres of wetlands, including streams, ditch-related wetlands and other wet areas, were identified by DEA (2015c) as occurring in the East Beach Road project area. Lake Crescent and its shoreline are also considered wetlands; however, most of the area likely does not meet the ACOE definition because the shoreline generally lacks vegetation dependent on wet areas for growth along most of its shoreline. Nonetheless, it is also considered a lacustrine open water and lacustrine forested wetland under the more broad USFWS (Cowardin et al. 1979) classification system. All of these areas have been affected over time by the locations of U.S. Highway 101 and East Beach Road and there would continue to be long-term adverse and beneficial effects related to the presence of these roadways. Beneficial effects are primarily from the creation of ditch-related wetlands associated with runoff from the roadways, which because of their soil, plants and presence of water now qualify as wetlands.

Alternatives 2 and 3

³ As described in the corresponding section in Affected Environment, ACOE jurisdictional wetlands meet all three characteristics of a wetland definition, including having water within the site during delineation, water-dependent vegetation, and water-affected (hydric) soils. State and NPS-designated wetlands meet two of these three characteristics. Those which meet the ACOE definition are regulated under Section 404 of the Clean Water Act as well as other state guidelines. Those that meet the USFWS definition (Cowardin et al. 1979) classification also meet state and NPS definitions and are regulated under state implementation of other regulations and NPS policies, such as under the “no net loss” of wetlands Executive Order.

Hydrology

Actions that disturb soil, such as excavation, importation of fill, placement of fill, and removal of vegetation; actions that change water flow, such as by concentrating runoff into culverts or ditches or to new, unstable areas; and actions that change surfacing treatments, such as by paving existing gravel turnouts would have a variety of short-term adverse effects on area hydrology. Exposed soil would result in the potential for erosion during runoff, while concentration of runoff would continue to minimize opportunities for water to infiltrate naturally in areas near the rehabilitated roadways. Surfacing, as noted elsewhere, would result in faster runoff, and potentially faster transport of pollutants to surface waters.

Approximately 21 ditch relief and 11 intermittent or perennial stream culverts would be replaced along U.S. Highway 101. These would affect snowmelt, intermittent and perennial streams to varying degrees, depending on the location and type of culvert. Culverts concentrate water, rather than allowing for natural sheet flow across the ground surface. As a result, stormwater collects and may move faster toward other surface waters, increasing the potential for erosion, which is often mitigated by the placement of rock at culvert outlets. With few exceptions, culverts in the project area outfall to Lake Crescent. A few culverts connect with side ditches and/or other culverts.

Replacement of culverts would require the placement of sediment barriers, such as wattles to minimize opportunities for soil from excavated areas to enter as a plume of sediment into Lake Crescent. Although stream culverts would be replaced to the extent possible during the dry season, some perennial streams would need to be diverted during replacement, resulting in more opportunities for contaminants, including excess silt, to enter surface water. Several different means could be used to divert the streams, including diverting flow through an excavated channel, pumping, or another culvert. For those streams with fish, fish barriers would be placed and fish would be relocated from in-water work areas prior to dewatering. This is likely to occur on Highway 101 in some perennial streams.

Table 15: In-water Work Windows for Minimizing Fish Impacts

Location	Available Work Window	Other restrictions
Fairholme to Ambulance Point	August 2- March 14	
Ambulance Point to Barnes Point	August - October	Work at other times may be authorized upon consultation with park
Barnes Point to East Beach	August – October preferred	Work may also be authorized at other times of year in consultation with park

Reconditioning four acres of side ditches (51,785 linear feet by three feet wide) could have initial adverse effects on streamflow characteristics, depending on compaction and the degree of runoff. Overall, long-term beneficial effects would occur from improved drainage adjacent to and beneath both Highway 101 and East Beach Road.

In addition to actions that change the flow of water, actions to withdraw water from Lake Crescent would also occur. This would result in undetectable adverse effects because of the volume of water in Lake Crescent. Because of the presence of fish, a screen mesh unit would be used on the pump to avoid impacts to aquatic organisms.

On East Beach Road, diversion of Log Cabin Creek would also be required. With replacement during dry periods and taking a few hours most culvert replacements would have short-term adverse effects, however the more extensive work on East Beach Road would take up to several days (currently the road is projected to be closed for approximately two days).

Water Quality

Most existing impacts to water quality would continue. One exception is that because culverts in poor condition or poorly functioning culverts would be replaced. In addition, some culverts would be enlarged to better carry existing and anticipated stormwater flows. These changes would result in improved drainage beneath both U.S. Highway 101 and East Beach Road. Another exception is that during construction, there could be additional impacts during storms, if sediment transport occurred from areas not yet stabilized within the project area. Because a stormwater pollution prevention plan is required and extensive mitigation measures, such as silt fencing and fiber rolls would be used, overall impacts are anticipated to be small. In addition, riprap placement along the shoreline of Lake Crescent could result in adverse effects on lake water quality from sediment plumes. Among the mitigation measures that may be used to reduce siltation plumes would be a turbidity curtain. Figure 20 shows a sample turbidity curtain in place that would be used to contain sediment to areas near the shoreline until it naturally dissipates. As shown in this image, a turbidity curtain holds silt until it falls out of the water column. Depending on how it is placed, it may affect only a small area near the targeted work (such as placement of riprap in the lake). All of the approximately 33 proposed locations for additional riprap placement are expected to include placement at or beneath the water line (Table 17). Therefore most riprap placement would be onshore and would not be expected to cause immediate impacts from sedimentation. Later, however, if winter winds wash on shore any unstable sediment could be released, causing low grade impacts.

Most impacts to water quality would occur during the first rains following construction (from sediment transported offsite during uncontrolled storm water runoff). Typically, the most contaminated



stormwater also occurs with rain after long dry periods, when petroleum products and other vehicular discharges have had a chance to accumulate on the roadway. Other areas sensitive to erosion would include earth stockpiled during construction in staging areas. Still other potential impacts could occur from spills of fluids or petroleum products during refueling or maintenance operations within construction areas; however, mitigation measures would be used to prevent these.

Figure 20: View of Turbidity Curtain Effects

generated from vehicle travel over hardened surfaces, into Lake Crescent. Although transport would be faster, it would be less likely to be sediment laden because of the paving. This would cause short-term impacts on water quality. Flushes of runoff during storms would also contribute to long-term adverse effects to the extent that these pollutants persisted in streams or Lake Crescent. Petroleum products and metals are deposited onto road and parking lot surfaces from vehicles and picked up during rain, snowmelt, and carried into water sources. These contaminants would also indirectly affect water resources through infiltration into groundwater over time, a process, which (as described under Alternative 1) also result in filtering pollutants before they reach surface water resources. Paving would also reduce routine airborne dust and erosion from unpaved surfaces, a long-term beneficial effect.

New paving of some gravel turnouts would affect water quality by contributing faster runoff of dirt and oil and other roadway contaminants,

In some areas, where there are conifers along the shoreline that could be anchored to the bank, they would be left in place after felling. Large woody debris (LWD) contributes beneficial impacts to water quality, providing effects on temperature and shading, including beneficial effects on fish habitat. Large woody debris provides nutrients by depositing and collecting organic matter in the lake, and also serves to slow the velocity of runoff, where it is along the edges of streams and wave action during storms. Logs along the lake edge also have a role in shoreline erosion protection and in catching other debris in the lake. Similarly, standing trees along the shoreline catch debris along the lake edge.

Wetlands

U.S. Highway 101

Replacement of approximately 21 ditch relief culverts would occur along U.S. Highway 101.

Approximately nine of these would include 18-inch ditch relief culverts that would be replaced with 24-inch culverts. The 70 percent plans show these near the following stations: 179+70 (drop inlet), 197+34 (drop inlet), 200+34, 202+53, 356+13 (drop inlet), 409+82 (drop inlet), 483+83 (drop inlet), 512+44 (drop inlet), and 578+75 (drop inlet). Approximately 12 ditch relief culverts would be replaced in kind. The 70 percent plans show these at approximately the following stations: 155+75, 168+85 (end section), 209+07 (drop inlet), 215+03 (end section), 272+76 (drop inlet), 284+26 (drop inlet), 308+64 (drop inlet), 406+34, 481+51 (drop inlet), 519+95, 590+22 (drop inlet), and 631+30. Together these ditch relief culvert replacements would comprise approximately 0.1056 acre of wetland impacts in the U.S. Highway 101 project area. Of these 0.0898 likely would fall under federal (U.S. Army Corps of Engineers) and state (Washington Department of Ecology) jurisdiction and the rest would be state only jurisdiction (DEA 2015:14). As described in the DEA (2015) report, most non-stream wetland resources in the project area occurred within ditches and were likely formed from road construction many decades ago.

Of the approximately 32 intermittent and perennial streams with culverts that convey water beneath Highway 101 (Table 16), approximately 8-11 are proposed for replacement. Replacement of these culverts would affect approximately 0.0898 acres of wetlands. There are an additional 18 culverts on perennial and intermittent streams not proposed for replacement. These are located at approximately the following stations: 105 (S-27), 302 (S-23), 325 (S-22), 345 (S-20, S-19), 379 (S-17), 390 (S-16a, S-16b), 398 (S-15), 414 (S-13), 417 (S-12), 419 (S-11), 425 (S-10), 454 (S-9), 475 (not listed), 504 (S-8), 515 (S-7), 606 (S-4), and 627 (S-2). (*Note: Correlation with the wetlands delineation is shown in parentheses.*) If these additional culverts were replaced, the Highway 101 project could affect a total of 0.3719 acres, of wetlands, including 0.2662 acres from these replacements.

Excavating soils in wetlands to replace culverts along U.S. Highway 101 could temporarily affect a combined total of 0.1954 acres of wetlands, which would be re-disturbed to replace ditch relief and intermittent or perennial stream culverts. These impacts would occur at the culvert ends and would disturb (temporarily impact) a small degree of soils and vegetation in these areas from excavation. Disturbed areas would be restored following culvert replacement. With replacement during dry periods and taking a few hours most culvert replacements would have short-term adverse effects. Replacement of larger culverts on perennial streams, such as Eagle Creek and Aurora Creek, would take longer and have more potential for adverse impacts.

For the most part, impacts on wetlands associated with culvert replacement on East Beach Road would be similar to that described above related to U.S. Highway 101. The culverts on East Beach Road are also 18 and 24 inches. The exception would be replacement of the 84-inch Log Cabin/Piedmont Creek culvert.

Table 16: U.S. Highway 101 Creek and Cascade Culvert Replacement**

	Station	Culvert Size (inches)	Increase?	a. Correlation with Wetland Delineation b. Wetland Extent	Notes
1	101+80	18	Yes to 24-inches	S-28 (102) 0.0004	Connects to another culvert outside the project area (S-27)
2	162+75	2 36-inch squashed	yes 10-foot span, 8-foot rise	S-26 0.0110	Eagle Creek
3	223+95	48	No	S-24 (224) 0.0270	Unnamed Creek
4	327+34	50 x 40	unknown	S-21 0.0063	drop-inlet Aurora Creek

5	327+39	24	unknown	same as above	overflow culvert for Aurora Creek
6	357+27	18	Yes to 24-inches	S-18 0.0013	Unnamed
7	408+14	30	No	S-14 0.0032	
8	594+09	18	Yes to 24-inches	S-6 (594) 0.0020	drop-inlet
9	597+14	18	Yes to 24-inches	S-5 (597) 0.0116	
10	610+17	18	Yes to 24-inches	S-3 (611) 0.0025	drop-inlet
11	632+80	18	Yes to 24-inches	S-1 (632) 0.0002	Drains a ditch relief culvert.

** Wetlands associated with ditch-relief culverts have been excluded from this list. Overall disturbed wetland impacts to these areas are estimated to be 0.1 acre in addition to those listed above.

Lake Crescent: Impacts from in-water work to place riprap would affect approximately 12,000 square feet (0.48 acre) of wetlands, which could increase depending on final design. This riprap would be added below the high water line in approximately 33 locations and would vary from 234 square feet to 5,695 square feet in each location. Approximately 20 sites would require placement of riprap below the ordinary high water line. Of those 20 with riprap placed below this line, approximately nine are sites with new riprap. In-water work is proposed to take place outside of fish spawning windows.

Table 17: Proposed Riprap Placement Areas along Lake Crescent Shoreline

Beginning Station	Ending Station	Area (Square Feet)	Beginning Station	Ending Station	Area (Square Feet)
109+89	110+19	504	229+40	230+40	1,837
129+80	133+90	5,692	276+70	276+90	234
134+70	135+20	1,179	314+75	316+20	1,616
138+80	139+20	828	317+50	319+20	2,151
141+70	142+30	1,628	321+90	322+40	131
147+70	148+10	836	330+45	335+00	5,695
148+65	150+00	1,952	361+70	362+00	315
153+60	154+00	496	369+25	369+35	130
154+00	154+40	433	393+00	393+40	506
168+20	168+80	774	401+40	402+00	758
172+30	173+00	1,016	405+40	405+80	448
184+80	185+10	433	407+40	409+00	1,856
187+30	187+30	820	508+40	509+00	832
201+00	201+70	1,169	545+90	546+60	897
202+00	202+20	341	548+00	548+30	619
205+30	206+20	1,285	549+90	550+50	783
213+75	213+95	263			

East Beach Road: If all of the culverts on East Beach Road were to be replaced, effects on 0.12 acres of stream associated wetlands and 0.163 acres of natural wetlands and ditch-associated wetlands could occur. Currently, however, eight culverts are proposed for replacement and one is proposed for cleaning (Table 18). Included in this is replacement of the 84-inch hanging culvert on East Beach Road which would affect an estimated 4,500 square feet (0.10 acres) of palustrine forested and open water wetlands. Of the culverts to be replaced, approximately eight are for streams, while the others (nine) are for ditch relief (runoff channeled off the roadway). None of the natural wetlands (comprising 0.086 acres) would be affected.

Table 18: East Beach Road Culvert Replacement

	Station	Replacement Culvert	Notes
1	137+	96 x 114-inches	84-inches now, replacement would also be longer on both sides
2	165+50	24-inch	
3	177+70	24-inch	
4	183+60	24-inch	
5	205+25	24-inch	
6	224+20	24-inch	
7	240+40	24-inch	
8	242+90	24-inch	
9	248+50	n/a	Clean culvert

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to water resources (including hydrology, water quality and wetlands) include:

- Using vegetable-based hydraulic fluid in all machinery.
- Inspecting all machinery for leaks (fuel, oil, hydraulic fluid, etc.) prior to starting work each day and making all necessary repairs to machinery before the commencement of work.
- Employing appropriate best management practices when working in or near wetlands.
- Locating staging and stockpiling areas located away from or protecting nearby surface water resources.
- Delineating staging areas to prevent incremental expansion of the staging area.
- Covering stockpiled fine-grained soil and rock near surface water and, if overwintered, with a breathable, water-repellent fabric, such as silt fence, anchored around the perimeter.
- Using temporary sediment-control devices such as filter fabric fences, sediment traps, or check dams as needed during culvert replacement to minimize fine sediment delivery to the lake.
- Using mulching, matting, and netting; filter fabric fencing; sediment traps and ponds; temporary stream bypasses; or surface water interceptor swales and ditches to prevent water runoff from contamination.
- Identifying the minimum area to be cleared to define the extent and clearing only those areas necessary for construction.
- Minimizing the amount of disturbed earth area and the duration of soil exposure to rainfall.
- Minimizing soil disturbance, and reseeding or revegetating disturbed areas as soon as practical.
- Scarifying slopes, if necessary, to slow erosion.
- Retaining silt fencing in disturbed areas until stabilization (by reseeding or revegetation).
- Constructing temporary diversion devices such as swales, trenches, culverts, or drains to divert stormwater runoff away from disturbed areas, including exposed slopes.
- Using native duff and imported topsoil to cover exposed soil as soon as practical.
- Installing protective construction fencing around, adjacent to, or near wetland and/or riparian areas to be protected.
- Limiting the duration of the in-water work as much as possible.
- Timing projects undertaken adjacent to or near wetlands to occur during the dry season, usually late summer.
- Developing and implementing a Stormwater Pollution Prevention Plan (SWPPP) for construction activities to control surface runoff, reduce erosion, and prevent sedimentation from entering water bodies during construction.
- Developing and implementing a comprehensive Spill Prevention/Response Plan that complies with federal and state regulations and addresses all aspects of spill prevention, notification, emergency spill response strategies for spills occurring on land and water, reporting

requirements, monitoring requirements, personnel responsibilities, response equipment type and location, and drills and training requirements.

- Using work area isolation techniques when work near water present in adjacent streams is necessary.

Measures specific to riprap placement:

- Using equipment excavators from a barge or from the shoreline to place rock below the ordinary high water mark, to reduce the potential for introducing pollutants, including possible leaks of hydraulic fluid or other substances from heavy equipment.
- Ensuring that the contractor properly contains all fuel and other potentially hazardous liquids/materials (for example hydraulic fluid, chemicals, etc.) to prevent entry into the water.
- Any machinery maintenance involving potential contaminants (fuel, oil, hydraulic fluid, etc.) shall occur away from the lake at a distance of at least 150 feet from the edge, with the exception of equipment on the barge.
- Fueling equipment on the barge within a containment system approved by FHWA.
- Providing containment in advance of fueling or other maintenance operations prior to work on the boat ramp or any other area with direct flow into the water.

Prevention of Fuel Spills: The following BMPs to control adverse impacts of fuel spills would also be used:

- Conducting refueling activities at least 100 feet from water sources.
- Identifying and providing containment devices, such as temporary earth berms, for areas where refueling or maintenance of equipment would occur.
- Making absorbent pads available within the work site to clean up spills if needed.
- Restricting the location of fueling sites and ensuring requirements for spill containment, and other measures to safeguard aquatic and terrestrial habitat from construction-related contaminants are identified.

Cumulative Impacts

Past, present, and future actions have likely affected water quality. For example, construction of the original roads and subsequent maintenance to retain and rehabilitate them has introduced sediment sources near Lake Crescent multiple times and provided (primarily in unpaved areas) a source of erodible material that has previously been transported toward the lake. In some cases, heavy rain has caused landslides and/or rock fall onto the roadway and provided more sediment to the lake. Elsewhere, the road has changed the hydrology of water flowing in the project area, from the streams runoff through native vegetation to passage through culverts and ditchlines. Although sedimentation is a natural force, sometimes if it occurs out of season or repeatedly in an area, it can affect the habitat of some species (such as water lobelia) and therefore have adverse effects. Otherwise, sediment delivery to the lake is important for fish habitat and drainage culverts within the project area are designed to transport some sediment (some cobbles, gravel, and soil) to benefit fish habitat from natural inputs upstream of the lake to the lake. Most adverse water quality impacts from sedimentation are temporary and related to the fact that area streams already carry a high volume of sediment, especially during winter runoff.

Throughout the park and along the shoreline of Lake Crescent, the provision of visitor and other human waste facilities, such as septic and sewer systems, water withdrawal for human use and the use of motorized boats on the lake have all contributed to slight changes in water quality, which have generally remained undetectable due to the large volume of water in Lake Crescent. Other visitor uses and facilities in the park and project area contribute to sediments and pollutants, including from litter, oil, and other contaminants that can enter drainages and affect water quality. Septic systems are the primary source of threats to water quality from private development. The range of hydrology, water quality and other similar impacts from natural, recreational and human uses in the park would continue. In addition, some areas considered wetlands would continue to be adversely affected by the presence of the roadways. Some restoration and development projects (e.g., addition of new visitor service facilities and restoration of old

roads and campgrounds or building sites) would continue to occur within the park and could contribute both beneficial and adverse impacts to water resources. Given the localized nature of these actions, overall effects on water resources would generally be limited to short-term adverse impacts from construction coupled with long-term beneficial impacts from restoration and any resultant benefits from slowing unnatural erosion of the Lake Crescent shoreline.

When the impacts of action in Alternative 1 are added to past, present and reasonably foreseeable future actions, there would continue to be a small range of beneficial and adverse effects on water resources, including from continued use of Highway 101 and East Beach Road, as well as from other public and private actions along the shoreline of Lake Crescent. Some of these include ongoing use of park campgrounds at Log Cabin Resort and Fairholme, ongoing impacts from residential development near the lakeshore, from visitor facilities at Barnes Point and elsewhere, and from projects, such as the construction of the Spruce Railroad Trail. Similarly, when the actions in Alternatives 2 or 3 are added to the impacts from these same past, present, or reasonably foreseeable future actions, they would contribute additional cumulative adverse effects on water resources, particularly from additional riprap placement along the south shoreline of Lake Crescent. Existing conditions, including stormwater runoff over newly reconditioned ditches and roadways, would continue.

Conclusion

There would be a range of adverse and beneficial impacts on water resources, including hydrology, water quality and wetlands, from actions to rehabilitate U.S. Highway 101 and East Beach Road. Actions outside the road corridor would be limited and nearly all actions would be in areas previously disturbed by road construction. Short- and long-term adverse impacts would be contributed primarily by work to replace culverts, and by work that resulted in removal of vegetation. Beneficial impacts would be contributed by restoration of some informal turnouts and from revegetation of disturbed areas with native vegetation. Most impacts would be short-term and would last only during construction to a few years following construction. Wetland impacts from replacement of culverts and replacement of riprap are excepted actions under the NPS Director's Order regarding the preparation of statements of findings for wetlands and the degree of wetlands affected by new riprap placement is under the threshold for a statement of findings, therefore a statement of findings is not required.

E. Impacts to Fish and Wildlife

Types of Impacts

Adverse impacts would reduce the size, continuity, or diminish the quality or integrity of wildlife habitat, or result in unnatural changes in the abundance, diversity, or distribution of wildlife species. Adverse impacts also include those that directly remove, relocate, or affect wildlife or wildlife habitat or that indirectly affect wildlife or wildlife habitat through increased disturbance. Disturbance, including noise, can adversely affect wildlife foraging, mating, and nesting behavior. Construction activity can also directly interfere with normal animal movement patterns. Beneficial impacts would result from restoration of wildlife habitat (size, continuity, or integrity).

Alternative 1

There would be no additional impacts to fish and wildlife species or habitat from the implementation of Alternative 1. Existing impacts, including from the presence of U.S. Highway 101 and East Beach Road would continue. Throughout and near the road corridors, it is likely that wildlife is habituated to human activity from decades of close association with the road and attendant human activity, vehicles, and noise. Animals that have grown up in these areas are likely accustomed to traffic noise, periodic maintenance, and existing visitor use.

Ongoing routine and recurring maintenance on the roads, such as mowing, guardrail repair, crack sealing, culvert cleaning, ditch clearing, and other activities would continue to cause periodic noise and human presence that would have short-term localized impacts on wildlife presence, disrupting animal movement

and temporarily displacing species from areas of activity. Ongoing use of the road would also continue to result in relatively consistent daytime and regular nighttime noise and human presence that would continue to cause disturbance of wildlife as well as result in some vehicle wildlife collisions, causing injury or death of some individual wildlife, such as deer.

The presence of the roadways would also continue to cause runoff from the roads toward Lake Crescent. Depending on the time since the last rainfall, and where the runoff occurred, the water could pick up pollutants and carry these toward Lake Crescent, potentially causing localized effects on water quality and affecting fish (see water resources section). If catastrophic road failure occurred, wildlife habitat would be altered, water quality in nearby streams could be degraded, and longer-term noise associated with reconstruction of the roadway could result in additional noise and disturbance of wildlife.

Although state law (RCW 77.57.030) requires that adequate flows and conditions for fish passage be maintained in all culverts under state highways if any fish are present, most streams flowing into Lake Crescent from the project area have minimal fish habitat (tens of feet) upstream of the roadway because of steep cliffs that form natural barriers to fish movement. Based on tribal concerns, culverts which are inadequate for bank-full flows must also be replaced if they impact anadromous fish habitat, however, there are no anadromous fish in Lake Crescent or its feeder streams due to a natural barrier on the Lyre River downstream of the lake outlet. Nonetheless, there is one set of culverts at Eagle Creek that does not accommodate bank-full flows and which is therefore proposed for replacement (see Alternatives 2 and 3). Elsewhere, box culverts on trout bearing streams, such as LaPoel would continue to accommodate all but the highest flows, allowing for adequate fish passage. The hanging culvert on Log Cabin Creek (across East Beach Road), however, adversely affects fish, such as Crescenti cutthroat trout, because they cannot swim upstream of it to access the up to a mile of habitat above East Beach Road. Under Alternative 1 the adverse effects from the East Beach Road culvert on Log Cabin Creek and any potential adverse effects that are occurring from undersized culverts on Highway 101 would continue to occur.

For Beardslee rainbow trout, additional adverse impacts would continue to occur intermittently from the presence of gravel and sediment coursing down East Beach Road and an unpaved turnout toward Lake Crescent. Near the Lyre River, this runoff causes a sediment plume that emanates from East Beach Road and an unpaved turnout along the roadway and which flows into Lake Crescent near a Beardslee trout spawning area. This stormwater begins on both sides of East Beach Road and joins at the unpaved turnout on the roadway, flowing downslope toward the Lyre River, while picking up sediment and debris. This sediment plume has been observed routinely under runoff conditions by Clallam County maintenance crews and park fisheries staff.

Alternative 2

In addition to ongoing routine and recurring maintenance and the overall effects of noise and disturbance associated with construction, the following specific actions called for by this alternative would affect wildlife:

- Above ambient noise and activity and emissions associated with project implementation (such as from asphalt grinding, tree removal, and heavy equipment use) in staging areas, along the road corridor, and in turnouts;
- Removal of some native and nonnative vegetation (including native trees, shrubs and forbs) and topsoil in preparation for specific actions along the roadway, such as deep patches, walls, and guardrails, and staging areas;
- Excavation of soils to construct deep patches, MSE walls, replace culverts, and other road repairs;
- Importation of fill materials;
- Culvert maintenance activities, including cleaning culverts and constructing new drop inlets/replacing grates;
- Removal of and revegetating some turnouts, while retaining and/or narrowing others;
- Removal and replacement of guardrail;

- Adding riprap to the edge of Lake Crescent; and
- Revegetation.

Impacts to wildlife would primarily consist of noise and disturbance from road construction activities because proposed rehabilitation and construction would occur in areas previously impacted by the road prism (cut-slope to fill-slope). Although there are native trees, shrubs and forbs, some roadside areas are comprised largely of nonnative species, and provide little habitat value for wildlife. This is especially true because of its location in a relatively loud environment adjacent to the roadway. Other roadsides provide a range of low quality wildlife habitat because they include trees, shrubs, and other vegetation (including open areas) in a narrow strip between Highway 101 or East Beach Road and Lake Crescent.

During the approximately three years of construction (generally except for mid-winter), noise and human activity associated with work could disturb sensitive fish and wildlife species and temporarily alter wildlife habitat use. Although no large, intact habitat areas would be disturbed, some small roadside habitats, where large trees occur would be affected by the construction of MSE walls and Type II deep patches. In addition, there would be above ambient noise and activity during project implementation (depending on the time of day, with consideration for dawn and dusk during marbled murrelet nesting season – see special status species mitigation).

Because road repair would also coincide to a large degree with the visitor use season, when some of the heaviest traffic occurs on both Highway 101 and East Beach Road, noise and activity associated with the construction would be similar to the noise and disruption of visitor traffic in the vicinity of the proposed project area. Depending on the work being accomplished, road construction could be concentrated in various locations, generally from March through November. As a result, wildlife would tend to avoid the construction areas during daylight hours when project work was occurring. In the evening and on weekends when work would generally cease, wildlife would be expected to return to the project areas. Some species, such as birds, deer, and squirrels might also be seen throughout the day. Since construction impacts would be localized alongside an already highly modified road corridor, and a great deal of suitable habitat for wildlife would continue to be present in the vicinity, these impacts would be localized and short-term and would not be expected to result in changes in overall wildlife presence or loss, except from species struck by vehicles.

Loss of wildlife could occur from excavation to construct deep patches, MSE walls, and to replace guardrail and signs, as well as to rehabilitate turnouts and repair other portions of the road. These actions would likely result in some disturbance and elimination of small mammals and invertebrates not able to move quickly away from the work site. Medium-sized mammals could also be displaced during construction, forced as a result of human activity, to relocate outside the construction limits and increasing their susceptibility to predation or competitive stress. As noted in the Hurricane Ridge Road EA, this displacement would result in a slight population depression adjacent to the corridor, but following project completion and successful restoration, wildlife would again reoccupy restored portions of the project area (NPS 2004: 65).

There would also continue to be wildlife vehicle collisions on the road as a result of normal use. Because speed limits change variously through the project area, and rehabilitation would not be expected to result in faster speeds, the potential for these collisions would remain the same as in the Alternative 1, resulting in long-term, albeit low level adverse effect on wildlife on the roadways.

There would be a range of habitat modification and localized loss caused by implementation of the road rehabilitation that would affect wildlife. There would be both short- and long-term localized loss of food and shelter caused by removal of vegetation and soils in the project area. In some cases, such as when trees and shrubs are removed, this would preclude a return to the former level of use by wildlife in some areas. For example, loss of trees near MSE walls and Type II deep patches could affect bird habitat by removing some areas used to perch, search for food, and nest. Similarly, loss of some trees and shrubs

could locally reduce shelter for some mammals, such as in the replacement of the Log Cabin/Piedmont Creek culvert off of East Beach Road. While loss of cover along the roadway could reduce the incidence of deer, resulting in some indirect beneficial impacts by reducing opportunities for deer to be hit crossing the road to use these habitat areas, this loss could also reduce some desirable browse for deer, resulting in adverse effects. Incremental loss of vegetation would therefore result in short- and long-term localized impacts to a few species dependent on the specific areas where the changes in habitat occurred.

Road work in some areas, such as from MSE walls and Type II deep patches occurring near the Lake Crescent shoreline, as well as from culvert replacement also has the potential to cause sedimentation in adjacent or nearby aquatic habitat, should best management practices fail. If wattles or other erosion protection measures deteriorate or fail, sedimentation could have negative consequences, such as by reducing dissolved oxygen, on fish and amphibian species occurring in, and downstream of, areas where sedimentation occurs. Because mitigation measures would be expected to be effective and to prevent this and would remain in place until the potential for impacts is concluded, overall impacts to fish and wildlife from these actions would be minimal, having no lasting effects beyond project actions, including removal of erosion protection measures (stabilization) and/or revegetation.

At the edge of Lake Crescent, spawning of kokanee (landlocked sockeye salmon) occurs. Elsewhere along the lakeshore are spawning areas for Crescenti cutthroat trout, however because work close to these areas would be conducted outside of the times that fish use these areas (for spawning or when eggs are in adjacent gravel areas), road work along Highway 101 or East Beach Road is not expected to adversely affect Beardslee or Crescenti trout or kokanee. The loss of vegetation from alongside the lake, from placement of Type II deep patches and MSE walls would reduce some cover along the shoreline for the fish. These features, as well as placement of riprap would result in the loss of vegetation and would also preclude some vegetation, such as most trees and shrubs, from reestablishing in these areas. Where possible, large conifers, however that would be removed from these areas would be felled close to these sites and anchored to the bank, if possible, providing some large woody debris to serve as cover along the shoreline, a long-term beneficial effect on fish.

Placement of riprap is expected to cause sedimentation where such placement occurs below the water line. In addition, placement of barge pilings would likely cause a small plume of sediment in each location. Placement of temporary barge pilings and riprap may also produce noise, vibrations, and sound energy or pressure within the water column. Currently that is anticipated to occur in three locations. Most riprap placement therefore, would be on the shoreline above the water line and because it would be done from a barge in the lake, these areas would be unlikely to result in sedimentation during placement, although soil could be dislodged later during winter storms that create wave action along the shoreline. Construction of MSE walls, if the toe must be tied into the shoreline (placed in water) could also cause turbidity in Lake Crescent. As a result, where these actions are proposed, because the potential for sedimentation cannot be eliminated, there would be placement of a turbidity curtain, in the water, a short-distance from where proposed work is to occur (see Figure 20). Placement of this curtain would reduce overall impacts from the sediment by confining it to a predetermined area near the shoreline. No riprap placement is anticipated to affect sensitive species, such as the endemic Beardslee or Crescenti trout or the rare water lobelia (see next section). Riprap placed in water would eliminate a small degree of habitat for aquatic species along the shoreline (an additional approximately 0.15 acre (0.9 above the high water mark and 0.6 acre below). Additional riprap would be placed in another 0.33 acres (0.27 above the high water mark and 0.06 below). Placement of riprap is widespread along the south shore of Lake Crescent. New and old riprap will be placed along approximately 3,143 linear feet of shoreline. Because Lake Crescent contains approximately 23.6 miles of shoreline, however, this riprap placement would continue to adversely affect only the portion of roadway adjacent to Highway 101 and although heavy in this area would not have a widespread effect.

The importation of fill materials, particularly topsoil, also has the potential to result in changes in the microbial composition of the soil, thereby potentially altering its utility or viability for some organisms. Importing topsoil can also change the physical and chemical composition of topsoil and along with

compact affect its viability for some organisms. Most topsoil imported for the project would come from the Olympic Peninsula; however it is likely that other sources could also be used. Because most materials imported for the project would be for subsurface replacement and because soils in key habitat areas would remain and would not be compacted, overall effects from importation of materials would be minimal.

In addition to adverse impacts on wildlife, on Highway 101 there would potentially be some beneficial effects from removal of weed-infested topsoil from between the road and the guardrail and replacement with a native seeded mix and clean topsoil, resulting in habitat improvements. Following construction, the restoration of approximately 3.7 acres, including unsafe or poorly configured turnouts, and roadsides with native species as well as the Aurora quarry (25 acres), would result in improvement of these marginal roadside habitats for wildlife. On East Beach Road, restoration of roadside habitats would encompass 0.3 acres.

New paving of formerly gravel areas could also have adverse effects on wildlife. Although paving would minimize sediment runoff, it would also increase impervious areas, causing faster runoff. Surfacing would also increase the delivery of contaminants such as petroleum products originating from the asphalt, adversely affecting water quality for wildlife.

Among the other impacts from construction that could affect wildlife include:

- Dust emanating from construction sites could affect the use of surrounding habitats by wildlife.
- Diversion of water flows during construction would result in unnatural drying or wetting of wildlife habitat in the vicinity of culvert replacements.
- Wildlife could be killed by traffic or machinery associated with construction.
- Pits and trenches, including drop inlets, could entrap and potentially kill wildlife.
- Although mitigation measures would be used, there is a slight possibility that inadvertent spills of fuel, oil, hydraulic fluid, antifreeze, and other toxic chemicals could affect wildlife, especially where spills were large or unmitigated or where they reached surface water.
- Construction personnel, area residents or visitors could provide a source of human food to wildlife, resulting in habituation of wildlife and in human/wildlife conflicts that adherence to mitigation measures would prevent.

Additional Effects on Fish and Fish Habitat

Although there is no anadromous fish habitat off of U.S. Highway 101 or East Beach Road, culvert replacement on these roadways proposed under rehabilitation of these roadways would improve fish passage for resident trout and other fish inhabiting streams along these road corridors. Replacing the set of culverts that do not accommodate bank-full flows at Eagle Creek would have both short-term adverse and long-term beneficial effects primarily from restoration of natural processes, including delivery of sediment to Lake Crescent. Short-term effects would be related to actions needed to reset the culverts to improve flow, while long-term beneficial effects would result from improving access to a small degree of upstream habitat. Elsewhere, box culverts on trout bearing streams, such as LaPoel, would continue to accommodate all but the highest flows, allowing for adequate fish passage, however upstream habitat is extremely limited (tens of feet) because of the proximity of the road to upstream barriers. The greatest beneficial effects, however, would be from replacing the hanging culvert on East Beach Road, which has blocked fish passage on Log Cabin/Piedmont Creek for decades. Replacing this culvert would have similar short-term adverse effects on fish from potential impacts to water quality and from diverting the stream to replace the culvert, while long-term beneficial effects would result from allowing fish access to miles of habitat above East Beach Road.

Crescenti Cutthroat Trout: There would be a potential for adverse effects to Crescenti cutthroat trout during the temporary setting and removal of barge pilings as additional riprap is placed along the shoreline of Lake Crescent to stabilize eroding banks below the road. None of the current riprap locations however are in areas known to be used by Crescenti and measures to prevent work during the

breeding season for both Crescenti and kokanee would be used. Nonetheless, adding riprap rock to stabilize the bank would reduce or prevent growth of new trees and vegetation, which provide some shade to the lake shore and benefit habitat, an indirect adverse effect on fish habitat.

Beardslee Rainbow Trout: Because Beardslee trout spawn in the Lyre River away from most of the project area for Highway 101 actions, there would be no adverse effects on Beardslee from rehabilitation of Highway 101. The Lyre River, however, is close to actions that would take place to rehabilitate East Beach Road. In fact, one of the proposed actions is to redirect water that currently flows down the road to a turnout on the south side of East Beach Road, away from this turnout because as described under Alternative 1. Under current conditions this flow picks up sediment and debris and travels downslope during storms toward the Lyre River, resulting in occasional sediment plumes emanating from it in the Lyre River, directly over areas known to be used by the trout for spawning, a long-term intermittent adverse effect that would be alleviated from actions to rehabilitate the turnout in this alternative.

Impacts from Alternative 3

Impacts from Alternative 3 would be similar to Alternative 2. Differences in Alternative 3 would be from additional work in the project areas proposed to occur at night. Unlike Alternative 2, night work would occur outside of the marbled murrelet nesting season. Until April 1, and beginning after Labor Day there could be up to a 6-hour period at night when work was performed on the road using flood-lighting and any needed equipment. Working at night could, but may not, reduce the number of daytime closures. Because of the need for set-up, extra lighting, and additional safety precautions, it is unlikely that there would be several locations where night would occur, as a result, night work would primarily be undertaken in a specific location, rather than spread out along the road. Night work would therefore affect wildlife in a limited area, such as for large culvert replacement, or for excavation of deep patches. Because wildlife are most active at night, the bright lighting and noise would likely have greater effects on wildlife and could cause disruption of normal predator-prey responses in addition to reducing wildlife presence in the vicinity of the work being performed. Lighting could cause night migrating birds to be distracted or attracted to the glare in the area. Lighting could also adversely affect the behavior of other, primarily nocturnal species, such as owls and bats, by exposing them to lighting in the project area. Exposure to the glare generated by construction (such as headlights, and the illumination from construction lighting) may differ in some areas, depending on the openness in the area, such as from the extent of roadside vegetation, but would be expected to distract these species and alter their ability to search for food in the lighted areas. To the extent that downcast instead of broadcast lighting sources were used, these impacts could be reduced, however the noise and activity associated with construction operations would likely cause, adrenaline responses in the animals that encountered it because it would be an unfamiliar disruption. Although night work would not be expected to result in additional mortality of species, it could temporarily reduce the fitness of species if it occurred in the same locations for many nights.

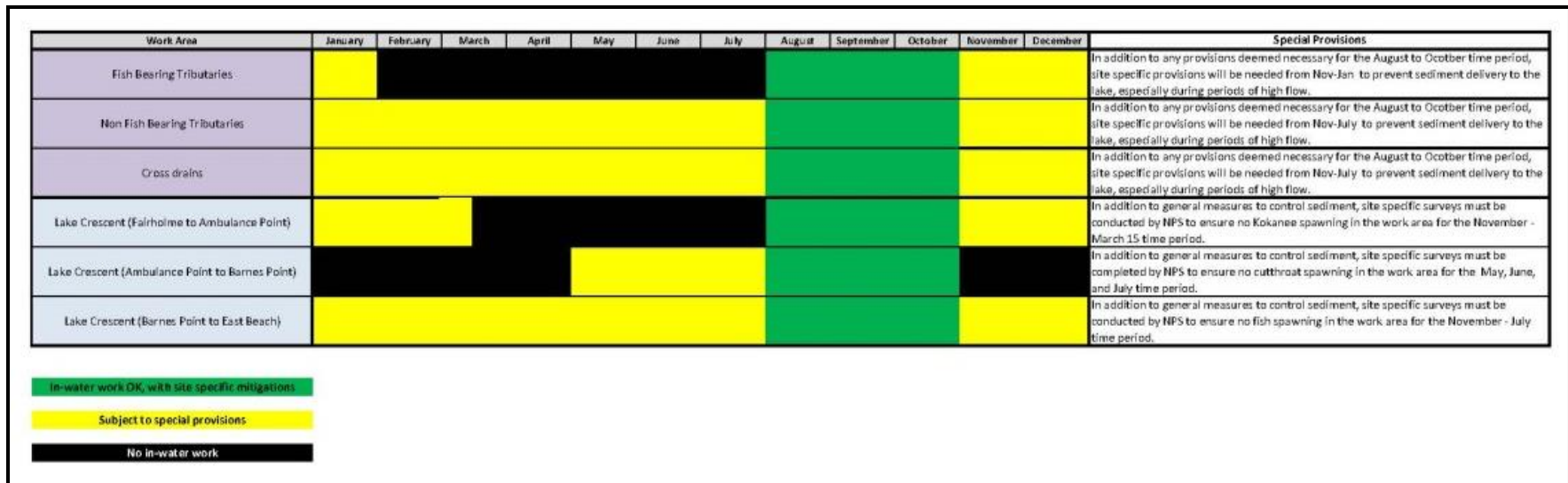


Figure 21: In-Water Work Windows for Sensitive Fish in Lake Crescent

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to fish and wildlife include:

- Scheduling construction activities with seasonal consideration of wildlife lifecycles to minimize impacts during sensitive periods (e.g., bird nesting and breeding seasons). For example, work at the Canada goose nesting turnout which is used annually by a pair of geese, would occur outside the nesting season.
- The timing of the work in water, including culvert and riprap placement, would be limited to avoid spawning and other sensitive periods for fish and aquatic wildlife (see Table 11).
- Minimizing the degree of habitat removal (vegetation clearing) by delineating construction limits.
- Limiting the effects of light and noise on wildlife habitat through controls on construction equipment and timing of construction activities (Alternatives 2-3), as well as by the type of lighting used (Alternative 3).
- Maintaining escape routes for animals that might fall into excavated pits and trenches. If erosion control matting is used, only tightly woven fiber netting or nonbound materials (e.g., rice straw) would be used to ensure that small animals would not be trapped. No plastic netted materials would be used.
- Using spill-prevention measures to prevent inadvertent spills of fuel, oil, hydraulic fluid, antifreeze, and other toxic chemicals that could affect wildlife.
- Discouraging construction personnel at work sites from providing a source of human food to wildlife, avoiding habituating of wildlife and increased human/wildlife conflicts. (Title 36, Code of Federal Regulations, Chapter 1, Section 2.10(d) prohibits anyone from leaving food unattended or stored improperly where it could attract or otherwise be available to wildlife. Title 36, CFR, Chapter 1, Section 2.14(a) prohibits the disposal of refuse in other than refuse receptacles. Title 36, CFR, Chapter 1, Section 2.2(a)(2) prohibits the feeding and molesting of wildlife.)
- Maintaining proper food storage, disposing of all food waste and food-related waste promptly in a bear-resistant receptacle, and removing all garbage off site at the end of each working day.
- Because fish eggs incubate in the gravel for several months after spawning, any in water work should be carefully planned to not only avoid disturbing spawning fish but also incubating eggs.
- The delivery of fine sediment to Lake Crescent would be limited by mitigation measures associated with culvert replacement (see water resources section).

Cumulative Impacts

The combined effects of development in the park and in the surrounding area over time coupled with the purposeful eradication of many predator species during the 1800s and early 1900s have contributed to low level or extirpated wildlife populations of some key species in the park. In addition, extensive loss of habitat from logging on the Olympic Peninsula has changed wildlife presence and abundance, as has rural, urban and suburban development and road development.

Although there are no major development projects planned for the park that would result in additional cumulative effects to wildlife, the cumulative effects of existing development continue to take a toll on wildlife from the effects of collisions on the road as well as from occasional wildlife-human interactions. The existence and maintenance of the road and park developed areas would continue to contribute to a long-term adverse effects on wildlife increasing some species while decreasing the presence of others. When the impacts from past, present and reasonably foreseeable future actions are considered in combination with Alternative 1, there would be no additional cumulative impacts on fish and wildlife, although existing impacts would continue, including blocking access to up to a mile of upstream habitat on Log Cabin Creek for Crescent cutthroat trout. When these actions are combined with the impacts from Alternatives 2 or 3, there would be a range of additional impacts that would not result in loss of additional blocks of wildlife habitat or species or individuals from the project area. Instead, cumulative adverse effects from continued use of the roadway and its attendant effects on wildlife would be combined with cumulative beneficial effects under the alternatives from restoring approximately 3.7 acres

of wildlife habitat by rehabilitating some turnouts and replacing undersized or poorly set culverts underneath U.S. Highway 101 and East Beach Road and the Aurora quarry (25 acres). Compared to other projects occurring on the Olympic Peninsula (including within and near the park) such as continued forest harvest operations and resort development and/or noise from military aircraft overflights that affect fish and wildlife, adverse effects from the rehabilitation of U.S. Highway 101 and East Beach Road would be small, while beneficial effects would improve habitat access for some species, such as fish.

Conclusion

Alternative 1 would have no additional adverse effects on fish and wildlife species or habitat, however existing impacts would continue, resulting in some long-term adverse impacts on Beardslee trout spawning areas and on other fish and wildlife on those species that reside adjacent to the existing Highway 101 and East Beach Road corridors. Alternative 2 would have adverse effects similar to Alternative 1, however, there would be additional short- and long-term adverse (riprap placement) and long-term beneficial effects on fish and wildlife species and habitat from actions to rehabilitate Highway 101 and East Beach Road. Compared to Alternative 1, there would be more beneficial effects and more short-term adverse effects, coupled with a small degree of long-term adverse effects. Under Alternative 3, impacts would be similar to Alternative 2, however there would be a likelihood of greater adverse effects from proposed night work on Highway 101. These adverse effects would be as a result of noise and activity, as well as night lighting in the vicinity of proposed night work, which would otherwise not be present in Alternative 2 and which would adversely affect wildlife during a typically quieter and low level human activity period when many species of wildlife would otherwise be more active.

F. Impacts to Special Status Plants

Types of Impacts

Adverse impacts are those that would alter the range, location, number, or population of a species and/or its habitat. Beneficial impacts would expand, improve, or protect one or more of these characteristics.

Impacts from Alternative 1

There would be no impacts to federal or state-listed species under Alternative 1. In addition, there would be no additional impacts to species considered either federally- or state-sensitive, including water lobelia, from implementation of Alternative 1.

Impacts from Alternatives 2 and 3

Water lobelia is found intermittently along the edge of Lake Crescent, sometimes occurring several meters out, sometimes close to the shoreline. Areas where in-water work is proposed within the road rehabilitation projects have been analyzed. Based on the 30 percent plans, there are approximately five low density water lobelia populations in areas that may be near proposed U.S. Highway 101 road rehabilitation actions. In these locations, sediment control measures to specifically protect water lobelia would be employed; however it is possible that a small amount of sediment release could occur. There would be no direct effects on the plants themselves and it is unlikely, because of the use of mitigation measures, that the small amount of sediment released nearby would accumulate near the plants.

In addition, one population of water lobelia was found where a culvert is proposed for replacement along East Beach Road. In this location, water lobelia occurs in the lake close to the culvert proposed for replacement, however the culvert in question (near station 180+50) does not release directly into the lake, but rather onto the rocky shore. Because the moderate to high densities of the plant are approximately 3-4 meters offshore, they are not in danger of being disturbed by the culvert replacement (Crain pers. comm. 2015).

Impact Avoidance, Minimization and Mitigation Measures

In addition to measures identified under water resources, the following measures would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to special status plants:

- Using erosion control devices, such as wattles, within areas where culvert replacements are proposed near water lobelia habitat to reduce the potential for affecting this species.
- Using silt or turbidity curtains to minimize siltation and undesirable sediment deposition in areas of the lake with surveyed populations of water lobelia.
- Avoiding placement of temporary barge pilings within or near known water lobelia populations.

Cumulative Impacts

Although previous actions, such as riprap placement and removal of structures and barge pilings, have recently occurred (2011) in Lake Crescent, these actions were planned to avoid impacts to water lobelia and giant hellebore populations. Previous actions in Lake Crescent, such as construction of former resorts and recreational activities in Lake Crescent may also have adversely affected water lobelia and giant hellebore populations, however there is no way to determine the extent of this potential effect. Because the implementation of the alternatives has been planned to avoid impacts to these populations to the extent possible, it is unlikely that the alternatives would result in any cumulative adverse effects.

Conclusion

There would be no adverse effects on water lobelia populations from the implementation of Alternatives 2 or 3. There would be no additional effects on water lobelia populations under ongoing implementation of Alternative 1.

G. Impacts to Special Status Wildlife

Types of Impacts

Adverse impacts would alter the range, location, number, or population of a species and/or its habitat. Beneficial impacts would expand, improve, or protect one or more of these characteristics.

Alternative 1

There would be no additional impacts to special status wildlife from the implementation of Alternative 1. Existing impacts however would continue. Northern spotted owl and marbled murrelet habitat would continue to be disturbed by ongoing road use and maintenance on both U.S. Highway 101 and East Beach Road. This routine use combined with routine and recurring maintenance may affect but would continue to be unlikely to adversely affect northern spotted owls and marbled murrelets. Nesting season restrictions would continue to be used to protect northern spotted owl and marbled murrelet habitat. There are no known nest trees in the vicinity of Highway 101 or East Beach Road. There would be no new ground-disturbing activities with the potential to impact individuals or suitable habitat for these species. Disturbance associated with traffic (including noise and human activity from visitor use) would continue to be inconsequential.

Alternatives 2 and 3

Project actions may affect but would be unlikely to adversely affect northern spotted owls and may affect and would be likely to adversely affect marbled murrelets. There would be no effect on other species listed or considered sensitive by the USFWS or Washington Department of Fish and Wildlife. As noted above, there would continue to be a potential for adverse effects on two species of fish endemic to Lake Crescent, Beardslee rainbow trout and Crescenti cutthroat trout that would be mitigated by project design and implementation (see Fish and Wildlife section).

Marbled Murrelets: Although there is no habitat on the roadway, the entire project area on both roadways is within marbled murrelet habitat. There are, however, no known nest trees within the project corridors. Along the U.S. Highway 101 corridor, which is comprised of a linear corridor slightly more than 12 miles

long, a small number of moderate-sized trees (15-40 inches) would be removed. Conifers include (but may not be limited to) a 36-inch dbh cedar near Eagle Creek; a 40-inch dbh Douglas-fir near one of the MSE walls; two 16-inch dbh Douglas-firs adjacent to proposed deep patches; and two cedars (28 and 30-inches dbh), two Douglas-firs (20 and 24-inches dbh) (sizes approximate). In addition, some of these trees may be retained, depending on actual project staking within the proposed construction areas for culvert replacement, Type II deep patches and MSE walls and the ability to use tree protection measures, such as tree wells.

The above trees, as well as other project implementation areas, have been surveyed and none of the trees proposed for removal is considered potential nesting habitat for marbled murrelets or northern spotted owls due to the small diameter of branches and branchlets and other inadequate old growth tree characteristics for nesting marbled murrelets (lack of platforms or non-nesting tree species). In addition, the trees are located directly adjacent to the roadway on the lake side, where potential habitat is comprised of a sliver of habitat comprised of approximately 10-50 feet of vegetation altered by the presence and construction of the roadway. This area comprises poor quality habitat because of its disconnection from contiguous forested areas on the other side.

No other conifers greater than 15-inches are currently proposed for removal, however it is possible that a small number of additional large trees could be removed if these also are not considered habitat and/or if problems are encountered in the roadway that require it. No trees with nesting habitat characteristics would be removed. Smaller diameter trees, however, would be removed associated with numerous proposed project implementation actions, including replacement of the 84-inch culvert on Log Cabin Creek (East Beach Road), replacement of two 36-inch culverts at Eagle Creek, construction of approximately six Type II deep patches along U.S. Highway 101, and placement of riprap. In other areas, vegetation removal would be confined to several deciduous trees (such as red alder, big leaf maple, and willow), seedling and young trees (including Douglas-fir, western red cedar, and other conifers and deciduous trees), small shrubs, ferns, forbs and grasses along the road shoulder and in areas where riprap placement is proposed adjacent to the Lake Crescent shoreline.

Aside from removal of a small number of large trees, the primary impacts to marbled murrelets and northern spotted owls, as well as other wildlife species, would be from noise and human activity associated with implementation of the project in areas that comprise habitat. Because the project area is comprised of the roadways (U.S. Highway 101 and East Beach Road), the entire project area, except for staging near Aurora Creek, is comprised of the road prism, from cutbank to fillslope, including the road, shoulders, side ditches and other drainage or protection (guardrail) features. No realignment of the road would occur and no areas not disturbed as part of the original construction of the road would be disturbed to rehabilitate the roadway.

Impacts from noise and activity during construction would occur in each of three years from approximately March through November. Within this period, impacts from particularly noisy activities (those determined to potentially affect nesting murrelets) would occur primarily outside of the marbled murrelet nesting season (during the time period from after Labor Day to March 31). Other project work during the nesting season (April 1 to September 23) would occur during the day beginning two hours after sunrise and continuing until two hours before sunset. In Alternative 3, however, some nighttime culvert replacement work, which has the potential to affect murrelets would occur after the marbled murrelet early nesting season (following August 6).

Work on the project would involve people using a variety of construction equipment. In some cases, work would occur in a number of locations within the project area simultaneously. In other cases, work would begin at one location and systematically proceed through the project area. Other work, such as rock fall mitigation and stream culvert replacement would occur only during the late summer/early fall to avoid other impacts, such as visitors. Generally, noise and activity from most work could occur in any given location within the project area during the construction season and could last for hours to days in the same location.

Although there would be rock fall mitigation work, it would not involve blasting. As described under *Impacts to Geology*, rock scaling is the description given to technical climbing over the rock face to dislodge loose and unstable rocks using a rock hammer and/or pneumatic (air) drill. Rock scaling dislodges rocks that would otherwise be dislodged intermittently onto the roadway through natural weathering (freeze-thaw cracking and gravity-induced erosion). In rock bolting, holes are drilled into the rockface and bolts inserted to provide another contact surface for retaining unstable rocks. Because the area where rock scaling and drilling would occur is a steep cliff-face, this area does not comprise, nor is it within 110 yards from intact areas of large conifers (see injury threshold distances in Table 20). As a result, there would be a low potential for noise and activity impacts to affect marbled murrelets from work in this area. In addition, rock scaling and bolting is anticipated to occur during a dry period in late August, after the marbled murrelet early nesting season (April 1 – August 6).

Much of the concentrated work in the project area contributing a short-term noise source would involve the use of excavators to remove soil and road fill as areas beneath the travel lanes were repaired with one of the three types of deep patches, cleared for construction of one of the three mechanically stabilized earthen (MSE) walls, or used to place riprap (approximately 33 locations). Although the road includes heavy truck traffic year round, construction equipment is generally louder than the ambient condition of the roadway (an estimated 62 dBA) (Table 19).

Because of the human activity in marbled murrelet habitat, there could also be short-term, indirect, adverse impacts to marbled murrelets from the attraction of corvids (such as crows and ravens) to the project area, resulting in an increase in egg and/or nestling predation, an impact that would be mitigated by restricting the presence of trash and food left in the area by contractors.

Milling of asphalt would also result in noise that moved from one end of the project area to the other. Later, graders and paving equipment, including a mixer for the asphalt-concrete mixture and rollers, would be used. Due to the need to achieve a certain temperature ratio for the paving operations, it is likely that this activity would be conducted in the late summer or early fall, when temperatures are mild enough to work. As a result, it is likely that much, of this activity would be conducted outside the nesting season, resulting in limited disturbance effects.

Table 19: Construction Equipment Noise Level (dBA) at 50 Feet

Compactors (rollers) ¹	72-88 dBA
Front Loaders ¹	72-98 dBA
Backhoes ¹	72-96 dBA
Scrapers, Graders ¹	76-96 dBA
Pavers ¹	82-94 dBA
Trucks ¹	70-96 dBA
Concrete Mixers ¹	72-91 dBA
Pumps ¹	70-80 dBA
Generators ¹	70-82 dBA
Compressors ¹	68-88 dBA
Jackhammers, Rock Drills ¹	76-98 dBA
Pile Drivers (Peak) ¹	89-106 dBA
Cold Asphalt Planer (asphalt milling machine) ²	70-87 dBA
Saws	69-82 dBA

¹Harris 1979 *in* Hurricane Ridge RoadEA

²Caterpillar, Inc. (Caterpillar PM 565 Cold Planer at 23 feet engine running, not in operation) *in* Hurricane Ridge RoadEA

Based on the information presented above, sound and activity-related disturbance to nesting murrelets would occur along U.S. Highway 101 and East Beach Road from early spring through late fall (respecting the nesting season and daytime restrictions). The project area is within murrelet habitat, including the areas

adjacent to and the roadways. In 2015 the disturbance buffer was updated to 120 yards for the longest buffer. For the 12.3 miles of U.S. Highway 101 there are approximately 695 potential acres of effect; and for the 3.3 miles of East Beach Road, there are approximately 206 potential acres of effect.

Table 20: Disturbance, Disruption, and/or Physical Injury Distance Thresholds for Marbled Murrelets April 1 – September 23. Distances are to a Known Occupied Marbled Murrelet Nest Tree or Suitable Nest Trees in Unsurveyed Nesting Habitat

Project Activity	No Effect	May Affect Not Likely to Adversely Affect (Disturbance distance)	May Affect, Likely to Adversely Effect (Disruption distance)	Likely to Adversely Affect (Direct Injury and/or Mortality)
Light maintenance (e.g. road brushing and grading) at campgrounds, administrative facilities, and heavily used roads	> 0.25 mile	<= 0.25 mile	N/A	N/A
Log hauling on heavily used roads	> 0.25 mile	<= 0.25 mile	N/A	N/A
Chainsaws (includes felling hazard trees)	> 0.25 mile	111 yards to 0.25 mile	<= 110 yards	Potential for mortality if trees felled contain platforms
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	> 0.25 mile	111 yards to 0.25 mile	<= 110 yards	N/A
Pile-driving (steel H pipes, pipe piles) Rock crushing and screening equipment	> 0.25 mile	121 yards to 0.25 mile	<= 120 yards	>= 5 yards (injury)

Source: USFWS 2015

Note: Other activities (such as blasting, helicopter and fixed wing aircraft use, tree climbing, and pile burning) are identified in the original table that would not be part of the proposed road rehabilitation projects.

According to the GMP biological opinion, activities that generate loud sounds in close proximity to nesting murrelets (during the April – August early nesting season) may cause disturbance responses, including flushing from the nest, aborted feeding, and postponed feedings (USFWS 2008: 102). There are few studies, however, regarding the murrelet's vulnerability to disturbance effects. Anecdotal research observations indicate that:

murrelets typically exhibit a limited, temporary behavioral response to noise disturbance at nest sites and are able to adapt to auditory stimuli (Singer et al. 1995 *in* McShane et al. 2005; Long and Ralph 1998; Golightly et al. 2002). In general, responses to auditory stimuli at nests sites have been modifications of posture and on- nest behaviors (Long and Ralph 1998). While the unique breeding biology of the murrelet is not conducive to comparison of the reproductive success of other species, studies on other alcid and seabird species have revealed detrimental effects of disturbance to breeding success and the maintenance of viable populations (Cairns 1980; Pierce and Simons 1986; Piatt et al. 1990; Beale and Monaghan 2004) (USFWS 2008: 102).

Further, the biological opinion notes:

Based on the data presented by Nelson and Hamer (1995a), approximately 80 percent of the feedings occur during the 2 hours after sunrise and 2 hours before sunset. Approximately 20 percent of feedings occur during the day, when Park activities are not restricted, so there is a potential for some missed or postponed feedings during unrestricted hours (USFWS 2008: 102).

Therefore, conducting some noisy activities during the breeding season, but by observing timing restrictions, is unlikely to adversely affect nesting marbled murrelets, who receive and deliver most of

their meals in the early morning and late evening.

As described in the GMP biological opinion:

We anticipate that 2,288 total acres of murrelet nesting habitat (0.7 percent) in the Park would be subjected to disturbance activity levels during the early breeding season due to spring road opening and maintenance activities. The majority of these acres would be in areas currently receiving high levels of human activity such as along roads and in recreational areas. Based on an average density of 303 acres of nesting habitat per pair of murrelets, we expect that up to 8 pairs of nesting murrelets could be subjected to disturbance annually during the early breeding season by projects covered in this BO. We believe that the actual number of pairs of murrelets that would be disturbed could be lower than that, due to the expected attenuation of effects within the visual and sound disturbance distances.

A significant disruption of normal breeding, feeding or sheltering behaviors is defined as adult flushes from the nest and missed feedings of chicks. We anticipate that the effects of disturbance in this consultation will primarily be one-time occurrences for individual murrelets because murrelets are most active during dawn and dusk, and the activities will not be conducted during the 2-hour dawn and 2-hour dusk periods during the murrelet breeding season. We assume that young murrelets can miss a feeding without dying or suffering significant nutritional deprivation, and we expect that adult murrelets can flush from the nest without crushing their eggs or hurting their young. Since we expect that most disruptions would be one-time occurrences to individual murrelets, and that murrelets can sustain such disturbance without permanent injury, we anticipate that all murrelets that are disturbed by these activities would survive without any permanent negative effects (USFWS 2008:102)

Therefore, for the road rehabilitation projects, it is estimated that up to 695 acres of habitat for marbled murrelets would be affected by road rehabilitation of U.S. Highway 101 and 206 acres for rehabilitation of East Beach Road. This may affect, and would be likely to adversely affect a small number of marbled murrelets. Because the same conservation measures would be employed, nesting murrelets could be disrupted but these disruptions would be similar to that occurring during spring opening, but would be instead of it, rather than in addition to it since road rehabilitation, instead of maintenance, would occur during the same period.

Additional Impacts from Night Work: As described in the Impacts to Fish and Wildlife section, there would be a range of adverse effects on wildlife, including birds, from night work. Among these could include: disruption of normal predator-prey responses; localized temporary reductions in wildlife presence in the vicinity of the work being performed; distracting or attracting birds to the glare in the area; disorienting nocturnal species exposed to the light; and disrupting or preventing typical wildlife movement activities, such as the ability to search for food or escape from predators, etc. This noise and activity could also cause flush responses in birds; and could temporarily reduce their fitness if they are unable to search for food or are frightened by the noise, such that they remain motionless for long periods. These impacts could also affect murrelets, who even though they have completed nesting, are resident birds that remain in the park year round. Although the noise and activity at night would be unlikely to affect populations of murrelets, because it would not affect nesting behavior or feeding of young, it could affect individual birds, who may return to the area near Lake Crescent to roost at night.

As a result, night lighting combined with noise from heavy equipment and generators would contribute to a wide range of noise and activity occurring during an otherwise quiet period, which is usually a respite for wildlife from daytime activity on and near the roadway. Based on soundscape monitoring, although the roadway remains a relatively noisy area at night, it is comparatively quieter than during the day (see soundscape section) and project activities would not only disturb this quieter period in some locations, but would also add night lighting that could adversely affect birds that are active during dawn and dusk,

times which the night lighting could simulate. Although most activity would be conducted outside the nesting season, some culvert work could affect the tail end of the nesting season (in late August).

Northern Spotted Owls: Northern spotted owls were detected within 1.0-1.3 miles of Highway 101 in 2015, but previous to that had not been detected in the vicinity of the highway since 2010. No known northern spotted owl nest sites occur close to Highway 101 or East Beach Road, and no known home ranges overlap the project corridors. The proposed road rehabilitation project would result in the removal of some higher stature shrubs and trees along the roadsides, possibly improving prey habitat, however, this slight beneficial effect would be offset by excavation work that could result in localized direct and indirect loss on small mammals (see fish and wildlife impacts section) and a potential change in localized abundance of prey species in some areas from loss of and then restoration of vegetation along the roadsides.

Because the most recent surveys along Highway 101 have identified the presence of barred, rather than northern spotted owls, close to the roadway, northern spotted owls have not been found close to the road. Although northern spotted owls are found within 1.0-1.3 miles of the roadway, this distance combined with the high prevalence of barred owls near Lake Crescent forested habitat means that the project may affect, but would not be likely to adversely affect northern spotted owls.

Beardslee and Crescenti Trout: (see Fish and Wildlife Section)

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to special status species include:

- Delineating construction limits with construction fencing, tape, snow fencing, or similar materials.
- Ensuring that resource protection measures are clearly stated in special contract requirements.
- Using scheduling to avoid construction during the nesting season and during sensitive feeding periods by limiting construction activities to two hours after sunrise and before sunset during the early nesting season (April 1 to Labor Day).
- Educating contractors regarding the sensitivity of park resources, including special status species.
- Avoiding actions beyond the construction zone.
- Staging construction equipment and materials in designated area.
- Avoiding impacts, from activities such as blasting.
- Properly maintaining construction equipment (i.e., mufflers) to minimize unintended noise.
- Requiring the contractor to maintain strict garbage control to prevent scavengers (e.g., ravens and crows), which are predators on murrelet nests, from being attracted to the project area. No food scraps would be discarded or fed to wildlife.
- Using only approved commercial material sources and disposal sites.
- Developing and implementing a revegetation plan to restore disturbed areas.
- Restoring areas disturbed by construction to approximate natural contours, replacing topsoil, and seeding and/or planting. This work would occur as soon after the completion of construction as possible.
- Monitoring revegetated areas after construction to determine if reclamation efforts are successful or if additional remedial actions are necessary. Remedial actions could include installation of erosion control structures, reseeding, and/or replanting the area, and controlling nonnative plant species.
- Avoiding introduction of nonnative, including noxious, plant species. On a case-by-case basis the following materials may be used for any erosion control dams that may be necessary: certified weed free rice straw, cereal grain straw (treated to kill weed seed), and wood excelsior bales.
- Adhering to noise and work restrictions during the nesting season.

Cumulative Impacts

Logging and development have had and would continue to have adverse impacts on wildlife, including special status species on the Olympic Peninsula. These adverse effects would include disturbance, displacement, indirect loss through loss of habitat and habitat fragmentation, and direct loss through hunting and vehicle wildlife collisions. Many of these activities would continue to occur on other federal, state and private lands. Development and logging increase forest fragmentation and direct removal of forest habitat used by the northern spotted owls and marbled murrelets and other special status species. For marbled murrelets, pollution, recreational and commercial boating, and near-shore development in the marine environment degrade such habitat and are expected to continue. Substantial influences of pollution, habitat loss, and direct losses to oil spills and net entanglements are affecting marbled murrelet populations within the marine environment (USFWS 2003b *in* NPS 2008).

Past, present and reasonably foreseeable future actions, within and outside the park would continue to contribute short- and long-term adverse impacts on wildlife, combined with some beneficial effects, when wildlife habitat linkages or native plant restoration are taken into consideration along with the developments. Among those inside the park, include reconstruction of the Spruce Railroad Trail as a multiuse path, other road rehabilitation projects, new cabins at Log Cabin Resort and ongoing fire and backcountry management actions. Outside the park, logging and development, as well as other habitat modifications would continue to occur as areas on the Peninsula are converted to housing and shopping areas. The cumulative effects of these past, present, and reasonably foreseeable actions would continue to have short- and long-term, negligible to minor, adverse impacts on wildlife habitat, species composition and presence in and near the proposed project areas.

When the actions in Alternative 1 are added to past, present and reasonable foreseeable future actions, there would be no change in cumulative effects, with both adverse and beneficial impacts from these activities. Compared to the no action alternatives, there would be additional short-term adverse, but little contribution to cumulative adverse effects from the rehabilitation of the roadways under Alternatives 2 and 3 because no additional intact habitat would be affected by the road rehabilitation efforts.

Conclusion

Alternatives 1 and 2 may affect but would be unlikely to adversely affect marbled murrelets and northern spotted owls. Alternative 3 may affect, but would be unlikely to adversely affect northern spotted owls and may affect and is likely to adversely affect marbled murrelets.

H. Impacts to Archeological Resources and Historic Structures

Types of Impacts

Adverse impacts would include activities involving ground disturbance (including soil compaction) in the presence of an archeological site, or activities that would increase the potential for vandalism, illegal collecting of artifacts, or destruction of a site. Beneficial impacts to archeological resources can occur when patterns of visitor use or management action are changed near archeological resources such that an ongoing impact is reduced or eliminated. Direct impacts can occur as a result of grading, trenching, or other activities that damage the structure of an archeological site. Indirect impacts can occur as a result of increasing visitor activity or management action near an archeological site, leading to effects such as artifact collection, accelerated soil compaction, and erosion.

Alternative 1

Archeological Resources

The Hwy 101 corridor along Lake Crescent within Olympic National Park has never been systematically inventoried for archeological resources. Intensive, systematic archeological inventory of the entire APE is not warranted given the low potential for intact archeological resources.

Within the U.S. Highway 101 and East Beach Road corridors, locations such as Barnes Point, La Poel, and the Log Cabin Creek crossing are the only areas where there appears to be archeological potential. One historic period archeological site/cultural landscape was recorded at La Poel. Formal evaluation of this site is in process.

Routine, ongoing maintenance of the road prism (area affected by previous road construction activities) would not result in substantial changes to existing areas of disturbance. Future road failure or additional actions to repair failed culverts would have the potential to disturb previously unknown archeological resources.

Because no additional ground disturbance is proposed and the discovery potential for buried archeological resources would continue to involve mitigation measures identified below, as a result there would be no adverse effect on archeological resources from ongoing implementation of Alternative 1.

Historic Structures

The Washington State Department of Transportation (WSDOT) recently completed a national register eligibility study for selected state highways, finding that the U.S. Highway 101 segment between milepost 221 (Fairholme) and milepost 231.3 (NPS boundary at Govan's Hill) is eligible for the National Register. As demonstrated by historic documentation and photographs, this roadway was constructed in the early part of the 20th century and although actions to rehabilitate the road have occurred since then, its alignment and setting, which are tightly wedged between Lake Crescent and the adjacent mountains, is very much the same and, except for some slight changes made in the 1984 rehabilitation project, in many areas is exactly the same as when it was constructed. There would be no adverse effect on the potential eligibility of the roadway for the National Register. Unlike many roadways from the historic period, which have unique culvert headwalls or end sections, rock walls or other character-defining features, except for the historic viaducts near Sledgehammer Point the character defining features of U.S. Highway 101 are generally limited to the alignment and use of the road. No other historic structures are located along U.S. Highway 101 or East Beach Road within the area of potential effects.

Alternatives 2 and 3

Archeological Resources

The Area of Potential Effect (APE) for this project includes the road corridor and a 50 foot buffer on either side. Nine archeological sites have been documented within one mile of the APE. These include eight historic period sites and one pre-contact site. Historic period sites comprise artifact scatters, a railroad grade, resort remains, and sunken vessels, while the pre-contact site is represented by a lithic artifact concentration located along the lakeshore. Only one of these sites—associated with the La Poel picnic area—is within the APE.

The overall archeological potential within the project APE is low. The vast majority of the road corridor within the APE was cut into the steep hillside adjacent to the lake. Locations such as Barnes Point, La Poel, and the Log Cabin Creek crossing are the only areas where there appears to be archeological potential.

One historic period archeological site/cultural landscape was recorded at La Poel. Formal evaluation of this site is in process. Current project alternatives suggest there will be no adverse effect to the site related to this project. The APE in the Barnes Point area has also been inventoried for archeological resources and none were located. Culvert replacement at Log Cabin Creek along East Beach Road will require archeological inventory. The extent of the inventory is small and the archeological potential is low to moderate.

As in Alternative 1, no adverse effects to archeological resources are anticipated by rehabilitation of U.S. Highway 101 or East Beach Road. Although a potential for finding undiscovered archeological resources exists, that potential is believed to be low because areas of impact, including excavation, along the

roadways consist of previously disturbed areas within the road prism and because archeological resources surveys have not revealed areas of concern. As additional detailed plans are developed, the park would continue to ensure that no known archeological resources would be affected and would continue to comply with Section 106 of the NHPA in analyzing effects to any potential undiscovered cultural resources.

Under Alternatives 2 and 3, archeological resources would be inventoried within the proposed project area as noted above. Because the discovery potential for buried archeological resources would involve mitigation measures noted below, there would be no adverse effect on archeological resources.

Historic Structures

As in Alternative 1, there would be no adverse effects on the character-defining features of U.S. Highway 101 that contribute to making the road eligible for the National Register. Under actions proposed in either Alternative 2 or 3, there would be no changes to the viaducts near Sledgehammer Point and no changes in the width, alignment, or use of the roadway. As a result, proposed actions under these alternatives would not affect the potential eligibility of U.S. Highway 101 along Lake Crescent for listing in the National Register.

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to archeological resources include:

- Stopping work in the area of identification and nearby areas if archeological resources are discovered at any point during the project work (as directed by the park) until the find is evaluated and action taken to avoid or mitigate the impact.
- When it is necessary to stop work due to archeological resources discovery, the contractor would cease all activities in the area of discovery, allow archeologists to complete investigations, and take measures to protect the resources discovered as directed by the park. (During this time, work may proceed in unaffected areas.)
- Determining if a monitoring plan is needed pending final construction plans, the cultural material that might be encountered, important archeological questions that could be addressed, and identifying a range of treatment options (e.g., avoidance, data recovery) for any findings.
- Avoiding further impact by modifying project implementation as needed at the site if archeological resources are discovered during implementation. If this is not possible, as much information as possible would be collected about the site in accordance with applicable laws and regulations and additional consultation with applicable agencies and tribes would occur as specified in the implementing regulations for Section 106 of the NHPA.
- Monitoring ground-disturbing actions as appropriate during construction to ascertain presence/absence of archeological materials within the proposed construction zone. Monitoring would be focused where buried historical deposits might be present beneath existing development. Evaluating the eligibility of the site under National Register of Historic Places criteria if monitoring results in the discovery of archeological materials.
- Following procedures outlined in the Native American Graves Protection and Repatriation Act in the unlikely event that human remains or any objects protected under Native American Graves Protection and Repatriation Act are exposed. This would include the potential need to stop work for a minimum of 30 calendar days. (During that time, work may resume in non-sensitive areas.)

Cumulative Impacts

Human use has occurred in the area comprising Olympic National Park for thousands of years. From prehistoric peoples to early resort owners to contemporary Native American tribes, each group has affected the area. Archeological resources present in the park have likely been adversely affected to varying degrees from past construction-related disturbances (prior to the advent of archeological resources protection laws); visitor impacts and vandalism; and erosion and other natural processes. Compared to past actions, the proposed actions considered in this plan would affect previously disturbed

areas and would have no effect on known archeological resources. Nonetheless, actions proposed in the alternatives would avoid, minimize or mitigate potential impacts to potential archeological resources, if these are later found in the project area.

There would be no contribution to cumulative effects on historic structures, because there would be no adverse effect on U.S. Highway 101. There would be no changes in Alternative 1. Under Alternatives 2 and 3, potential changes would not adversely affect the character-defining features that contribute to the eligibility of the roadway for the National Register.

Because mitigation measures would be employed to avoid or minimize impacts to potentially unidentified cultural resources in this and other park projects, it is likely that these measures would be successful. There would be no construction-related contributions that would affect known eligible archeological or historic resources and therefore no cumulative impacts from Alternatives 1-3. There is a slight possibility; however, that future proposed work could affect currently unidentified cultural resources. Because mitigation measures would be implemented as noted above, Alternatives 1-3 would not be expected to contribute to cumulative effects on archeological resources.

Conclusion

Because selected areas within the APE having elevated archeological potential have been or will be inventoried, because known archeological resources are outside the proposed areas that would be affected by the implementation of the alternatives (1-3), because the project will not adversely affect character defining elements of Highway 101, and because mitigation measures would be employed to detect previously unidentified historic properties, there would be no adverse effects to historic properties.

I. Impacts to Visitor Experience (Access and Transportation, Visitor Use Opportunities, Interpretation and Education)

Types of Impacts

Impacts on visitor experience may occur as a result of changes in road circulation, interpretation, interpretive media, campgrounds, trails, and other facilities and resources that contribute to the type and quality of visitor experience in Olympic National Park. Impacts may also occur from direct actions altering the availability of a specific experience or activity. Visitor experience is also directly affected by actions influencing natural resources, such as air quality, scenic resources, and cultural resources. For example, the experience of a scenic view that is lost on a cloudy or hazy day may diminish the overall experience of a visit to an area that focuses on the view, such as from a wayside exhibit or a vista point. The extent of enhancement or degradation of natural and cultural resources, including air and water quality, the presence of vegetation (such as flowers in spring) or wildlife, and other resources (such as the experience of an excavated and interpreted archeological site or intact historic structure), also enhances or degrades the quality of the visitor experience. Beneficial impacts would enhance visitor participation and visitors' ability to connect with area resources, the quality of visitor experience, and the kinds of opportunities available for recreation area visitors, including scenic resources and safety. Adverse impacts would reduce the number and quality of these experiences.

Alternative 1

Visitor Access and Transportation

Initially, there would be no impacts on visitor access and transportation related to rehabilitation of either U.S. Highway 101 or East Beach Road. Ongoing work for regular and routine maintenance, such as mowing and ditch clearing, however would continue and could continue to cause short delays. Without rehabilitation, there would be ongoing deterioration of the roadways, which could eventually result in longer-term road closures for emergency repairs which could lead to unsafe driving conditions for visitors, commuters, and park staff. As a result, deterioration of the roadways could lead to adverse impacts on visitor access and transportation within and through the park from delays, closures and additional maintenance needs on vehicles from driving on roadways in poor condition.

If failure occurred, without planned repairs it is more likely that road closures in some areas could affect one or both lanes of traffic and could even occur during high periods of visitation. If such failure occurred, visitors and commuters between Forks and Port Angeles might not be able to access certain areas or might experience long detours, such as having to drive around the park on state highways and county roads. This could adversely affect visitation to the Lake Crescent area, as well as the daily activities of people who live within the park or on one side of the park or the other to a higher degree than other visitors. These effects could include longer commutes between Forks and Port Angeles for daily trips, and/or difficulty in accessing some private residences within the park, depending on where the failure occurred. Where closures resulted in the need for more complicated repairs, such as landslides or failures related to stream crossings, there could be longer term area closures or delays while funding, materials and permits were secured for repairs. In the event of a catastrophic road failure, access on U.S. Highway 101 or East Beach Road through the park could be seriously affected for short time periods, or longer times, if the road could not be repaired in an expedient way. These short-term impacts would range in intensity and could seriously disrupt visitor and resident travel on the roadways, depending on the severity of the road failure. Over time, road conditions would be expected to deteriorate further without rehabilitation.

Visitor Use Opportunities/Interpretation and Education

There would be no change in the range of visitor use opportunities available in Alternative 1. The current array of opportunities, including hiking, bicycling, motorized and nonmotorized boating, fishing, and wildlife viewing would continue. Interpretive and educational programs at Barnes Point and elsewhere in the Lake Crescent area would also continue. Unless road failure disrupted access, there would continue to be long-term beneficial effects on visitor experience from visitor use opportunities and interpretive and educational programs in the area.

Alternative 2

Access and Transportation

There would be a range of short-term adverse effects on visitor, resident and commuter access and transportation through the project areas from implementation of road rehabilitation under Alternative 2 or 3. There would also continue to be beneficial effects on visitor experience from maintaining year-round access to Barnes Point, including during construction. At the end of the rehabilitation projects, there would be long-term beneficial effects on visitor experience from increased opportunities for interpretation, increased road safety features, and delineated parking, including more accessible parking.

Construction would, however, affect access and transportation on U.S. Highway 101 and East Beach Road. As a result of the road rehabilitation, park visitors on both roadways would encounter one-lane roads with regular construction delays of up to 30 minutes during the week combined with a limited number of 4-hour delays (with advance notice) on U.S. Highway 101. On weekends and holidays, construction would cease unless occasional approval for work on these days was granted by the superintendent. Road rehabilitation is anticipated to take approximately three construction seasons (generally March through November) to complete and would likely begin the year following project approval.

Daily delays of approximately 30 minutes on the roadway would depend on the work being done. Most of the delays would be as a result of excavation to repair portions of the roadway, so that a pilot car and accumulated traffic could safely pass through one lane areas of the project. Several types of subsurface pavement fixes, including construction of deep patches, MSE walls, subexcavation, and culvert replacement, as well as pavement milling and replacement would require continuous excavation or other work that would occupy one lane of the roadway.

Because U.S. Highway 101 is a commuter route for Olympic Peninsula residents, particularly those traveling from Forks to Port Angeles, however, work at any time would affect this special category of park

visitors. Port Angeles is the county seat and the largest city in the county. Therefore residents from other areas in the county must commute to Port Angeles for a range of activities, including shopping, jury duty, hospital visits, school sports activities, etc. As a result, delays would affect all types of drivers, including Clallam County transit buses, school children, commuters, logging trucks, court activities, hospital visits and others. Effects would be greatest on those living along Lake Crescent on either U.S. Highway 101 or East Beach Road because not only would construction activities disrupt travel, they would also produce noise and activity in the vicinity of residences.

During the daytime delays, visitors, commuters and residents could choose to take their typical routes through the project area or other routes on state and/or county roads that took them around the project area without delays. These other roadways, such as State Highway 112/113 from Forks to Port Angeles, take slightly longer (5-10 minutes) but are on roadways that are subject to washouts and also in need of repair in some areas. These alternatives also are curvier roads and have some tight (hairpin) turns. Nonetheless, they offer alternatives to the delays through the construction area and some beneficial effects, such as coastal views.

To minimize effects on visitors, residents and commuters, materials deliveries would take place to the extent possible outside of typical morning and evening commute hours. Construction materials would also be staged in the project area where possible, such as in large turnouts and at the former Aurora quarry so that more convenient access to these could occur. Under Alternative 2, regular daytime hours would be established for work. In addition, park visitors and area residents would be informed of longer construction delays (such as for rock and culvert work) through various means, including the park newspaper, press releases to local media, signs in the park and state highway information road condition (phone) reports. Because the road would remain open, albeit with delays and the project would last approximately three years, overall, there would be short-term adverse effects on visitor access from road construction that would likely result in frustration for visitors stuck on the roadway during both short and long delays.

In addition to overall effects from one lane closures on U.S. Highway 101 and East Beach Road, the following actions are those that would have a higher potential for variable effects on visitor experience, including visitor access and transportation, interpretation and education, and visitor use opportunities, because work would be concentrated in one area over a period of time, because it would occur systematically from one end of the project to another, or because it affects a specific visitor use area:

- Asphalt milling, asphalt concrete paving, guardrail replacement, ditch relief and drainage culvert replacement, ditch rehabilitation, and rehabilitating turnouts (including restoring some).
- Continuing to provide slow vehicle turnouts/passing lanes.
- Staging of materials and supplies for improving the Sledgehammer Point day use areas (west and east). This would require closure of both at the same time.
- Conducting rock scaling and bolting.
- Replacing large culverts, such as at Log Cabin Creek and Eagle Creek.
- Constructing the Barnes Point transit stop (including access trails)

Several actions would occur throughout the project area, including asphalt milling (taking off the top layers of asphalt and saving some of this material for mixing with that later used on the project or for later use elsewhere in the park) and subsequent paving of the finished roadway; guardrail replacement (replacing all of the deteriorated guardrail posts and rails in the project area with new, longer-lasting metal and composite components); replacing ditch-relief and drainage culverts (numerous 18-24 inch culverts would be replaced in kind or upgraded from 18-24 inches and replaced) and rehabilitating drainage ditches; and restoring some turnouts, while rehabilitating others, while providing some slow vehicle turnouts/passing lanes. These systematic actions or actions which would occur throughout the project area would cause many of the 30-minute delays in the project area. To the extent that work could be completed off the roadway, such as for inserting guardrail posts and for attaching guardrail, they would

result in limited delays but the delays, even if well-signed and carried out would likely cause driver dissatisfaction and frustration.

Continuing to provide slow vehicle passing lanes in approximately two locations along U.S. Highway 101 would also result in some long-term beneficial effects on visitor use opportunities as people took advantage of these new passing lanes to overtake slower vehicles or to turn out themselves to enjoy the road at a slower pace.

Although the Sledgehammer Point area is popular for day use, including for its introduction to the park for first-time visitors, closing both of the Sledgehammer Point turnouts during rehabilitation would minimize the potential for visitor conflicts to occur associated with roadwork. For example, large trucks would not be turning in close proximity to (and with limited sight distance of) visitor vehicles (see Human Health and Safety section). Work would also likely be able to proceed more quickly because materials would be staged readily at hand, instead of needing to be hauled from a longer distance. If one of the turnouts remained open during rehabilitation, concurrent work in the adjacent area would adversely affect visitor experience in the other, leading to a reduction in the quality of the visitor experience, even if access was available. Because this is a popular visitor use area, overall closures would be limited in duration and would occur during the shoulder season(s). Ultimately, the work at Sledgehammer Point east would improve the overall visitor experience, by providing a more defined edge and accessible pathways at the overlook, improving parking by delineating some spaces, landscaping some degraded areas, and locating a park entrance sign in concert with improvements.

As described under geology and special status species, rock fall mitigation would consist of rock scaling and bolting and would be conducted by technical climbers on the cliffs at the base of Mt. Storm King. Although no blasting would be used, the use of rock drills and pneumatic air hammers to dislodge rocks would result in rock fall onto the roadway that would need to be moved away before traffic could resume. Because of safety precautions and the dangerous type of work, set-up of the work area also requires some lead time. To avoid most impacts to visitors, work would be conducted in late summer/early fall (August and September) and would result in up to 4-hour daytime delays on the roadway. Although these delays would be well-publicized and signed, it is likely that visitors and residents would be adversely affected by the delays, which could cause them to want to avoid the construction area by taking nearby state highways. Visitors could also decide to avoid the Lake Crescent area entirely on the small number of days when these longer delays would occur. Because the work would result in changes to the plans of visitors and commuters and because it is possible that some visitors and commuters would not know of the delays or would have to wait through the delays, they would adversely affect visitor experience. In some cases, such as for residents called to jury duty or those that commute to jobs on either the east or west side of Lake Crescent, there would be no choice but to pass through the area with the delay or to choose to take another route that would go around the delay.

In 2012, during the rock scaling and bolting project that took place then, numerous slides occurred that resulted in the road being closed for up to four hours when rocks and trees came down onto the road and/or were hung up in an unstable manner on the slope above the road, resulting in the need for additional work to clear the road for safe passage. Because of a rockslide, the road had to be closed during the scaling operation for about 36 hours while it was cleared, resulting in longer delays for visitors and others using Highway 101. Because the same type of work is proposed, it is possible that large slides, resulting in similar unexpected closures on the roadway could result. Without the work, however, these closures could be more frequent. Rock scaling and bolting on unstable slopes is recommended every 5-7 years to more effectively limit unexpected slides and closures.

Replacing large culverts, particularly the Log Cabin Creek culvert would result in additional delays and closures. For instance, to replace the Log Cabin Creek culvert would likely result in closure of East Beach Road near the entrance to Log Cabin Resort for approximately three days. Although the resort would be accessible from the east or the west, both access routes would not be open at the same time during this closure. As a result, visitors and nearby residents would need to access the area from one end or the other,

resulting in inconvenient travel for a few days. The closure is needed to fully excavate down to and then beyond the existing “hanging” culvert to install a longer, likely open bottom culvert that meets the streambed and allows for fish and water passage at grade. In addition, to complete the work, streamflow would be diverted to meet hydraulic project approval (Army Corps of Engineers [ACOE], Washington Department of Fish and Wildlife [WDFW] and Washington Department of Ecology [WDOE]) permit conditions. At the conclusion of the culvert replacement and road rehabilitation project on East Beach Road, visitors and residents would find an improved roadway, which would be easier to drive, since it would be smoother and any minor pavement drainage improvements would occur.

Constructing the Barnes Point Transit Stop would primarily occur outside of the existing footprint of the road but within the road prism on the shoulders. Since the operation requires felling of some small trees in the vicinity, as well as placement of fill to construct the accessible linkage trails and construction of the shelters, it is possible that some delays could occur in the vicinity of the proposed work, resulting in some adverse effects on visitor access both from the roadway and on adjacent trails from the delays. Most of the visitor use impacts from the transit stop, however, would be long-term and beneficial, resulting in improved access to the trail to Barnes Point for those traveling by bus from Port Angeles or Forks and from providing a shelter for visitors or area residents waiting for the bus in either direction.

Visitor Use Opportunities

Most visitor use opportunities would be the same as in Alternative 1. In addition, as noted above, there would be new visitor use opportunities to take advantage of accessible linkage trails at the Barnes Point transit stop (however, the trails beyond the transit stop would continue to not be accessible). In addition, accessible parking would be provided at Sledgehammer Point and there would be an accessible trail to the overlook from the parking area. Overall, there would be a range of improved visitor use opportunities related to use of Highway 101 and East Beach Road. On Highway 101, visitors, commuters and residents would find an improved roadway, with better turnouts, safer roadsides (from new guardrail) and fewer nonnative invasive species, among other improvements. The roadway would also have better drainage from replacement of culverts and rehabilitation of drainage ditches.

Changing the configuration (number and size) of turnouts could result in some adverse and beneficial effects on visitor use opportunities. Overall, visitors would find fewer informal turnouts along Highway 101, but most remaining turnouts would be paved and would continue to allow visitors to leave the main roadway to take in views. Although some small, informal inaccessible or unsafe turnouts would be removed, those near roadway attractions which are able to accommodate more than one vehicle would remain. As mentioned elsewhere, one turnout along East Beach Road would be obliterated to improve habitat for Beardslee rainbow trout spawning in the Lyre River. The turnout, although popular parking for horse trailers and kayakers, is among the sources of a sediment plume that affects Beardslee trout habitat in the Lyre River and thus would be reconfigured with a berm and vegetation to eliminate this adverse impact, resulting in attendant adverse impacts on visitors who may use this turnout. Parking accommodation for kayakers and horse trailers would eventually be made in connection with the improvements to parking adjacent to that same end of the Spruce Railroad Trail.

Interpretation and Education

Although no specific actions would improve education in the Lake Crescent area, educational programs would be indirectly benefited by providing improved trail connections from the Barnes Point transit stop to existing trails at Barnes Point used by NatureBridge staff and participants. Interpretive improvements would be made at Sledgehammer Point in connection with rehabilitation of the overlook there. Among the interpretive improvements would be from future modifications to waysides and installing a park entrance sign within the existing vegetated area at the turnout. Combined, these would benefit visitors to the area.

Impacts from Alternative 3

Impacts would be the same as in Alternative 2, except that under Alternative 3 there would be additional six hour delays at night on U.S. Highway 101 after the marbled murrelet nesting season (from after Labor Day to March 31). Therefore, unlike Alternative 2, there could also be regular nighttime work hours on the roadway. These delays would occur particularly in the fall (September through October) but could also occur later in the fall and in the winter (October – March), if suitable weather permits. Night delays would allow work to proceed on large culverts and would be accompanied by downward cast lighting run by portable generators. Although there are fewer vehicles traveling on U.S. Highway 101 at night, these night-time delays would likely have greater adverse impacts on visitors and commuters since there would be fewer opportunities to use the delays for other activities and because a disruption in evening/night schedules is likely to have a larger impact on an individual's leisure time. Therefore it is likely that many drivers, knowing the construction delay schedule in advance, would choose to either avoid traversing the road during night time delays by changing their plans for night activities, or would take an alternate route, such as by traveling State Highways 112/113. This would result in some increase in driving on less familiar roads at night. In addition, for an individual traveling U.S. Highway 101 between Forks and Port Angeles, it is possible that there could be a day time delay of four hours in late August for rock work coupled with a night time delay of six hours. As described above, drivers who might experience this would likely choose to take another route during at least one of these trips, resulting in the same kinds of impacts as described above. It is unlikely that most people would wait in their vehicles during a six-hour delay at night. As a result, this delay could be perceived as being a road closure, rather than a delay. Because roadwork would result in delays, not closures, no formal detour route would be signed. This could result in drivers taking a roadway that is less familiar to them during a more dangerous time for driving and in some drivers being confused about the route and possibly more likely to take a wrong turn, an indirect adverse effect on visitor access and transportation that would last during the three-year construction period whenever nighttime delays occurred. As a result, over time, those drivers who were unfamiliar with the route initially, but who chose or needed to take it regularly, could become more familiar with it.

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to visitor experience include:

- Limiting most construction delays and one-lane closures through the project area to no longer than 30 minutes.
- Requiring a traffic management plan from the Contractor for review and approval by the Federal Highway Administration and the park. This plan would include: proposed areas of construction and anticipated delays, safety considerations, estimated lengths of delay, and estimated number of vehicles stopped at any one point, as applicable to the construction. The 30-minute delay in each direction (plus limited 4-hour delays in Alternatives 2 and 3, and additional 6-hour night delays in Alternative 3) would be considered maximum and the plans would include proposals for less than 30-minute delays for the total length of the road. The plan would also include, as necessary, a limit on the number of vehicles that could be stopped at any one point to avoid backup into critical areas.
- Allowing for no more than two sections of road under alternate one-way traffic control at any one time.
- Requiring the contractor to provide a weekly delay schedule with daily updates to the Federal Highway Administration's project engineer to better inform management and the public regarding impacts on visitation and park operations.
- Providing a means to allow for evening, weekend and holiday work, including construction delays, with permission of the superintendent.
- Making materials deliveries (to the degree possible) during non-commute hours and by proceeding along the shortest route possible.
- Using press releases to inform visitors through local media, signs in the park and state highway information recordings of road conditions in the park during the project.

- Scheduling work that would affect or close major visitor use areas, such as Sledgehammer Point, at the beginning and end of the primary visitor use season to avoid impacts to the greatest number of people.
- Maintaining one lane of traffic at all times except when during the four hour daytime (Alternatives 2 and 3) or 6-hour nighttime (Alternative 3) delays.
- Routing emergency traffic immediately through the project area (to the degree possible).
- Using electronic sign boards to notify travelers of upcoming and active project work that would affect travel along U.S. Highway 101 and East Beach Road.
- Limiting vehicle and equipment parking and materials storage to existing disturbed areas within the project construction limits. These would be in existing turnouts, parking lots, and the Aurora quarry, or other park-approved locations.
- Taking advantage of long-daylight days with an increased road construction period.
- Minimizing construction delays during commute hours on Highway 101.
- Implementing the park's vehicle idling policy through liaison with the contractor and project manager and in the project's special contracting requirements.

Cumulative Impacts

Over time, there have been a range of adverse and beneficial impacts on visitors, commuters and residents regarding access and transportation on U.S. Highway 101 and East Beach Road. Beneficial impacts have included opportunities to access park lands and areas beyond through use of the roadway, while adverse impacts have been contributed from particularly long closures, such as from landslides and delays, from previous construction work and occasionally from routine maintenance. When the impacts of the alternatives are considered within the context of past, present and reasonably foreseeable future actions Alternative 1 would continue to contribute a small degree of adverse effects combined with ongoing beneficial effects, unless failure of a portion of the roadway caused closure or delays. The action alternatives (2-3) would contribute short-term adverse impacts from delays and noise and activity associated with construction combined with cumulative beneficial effects from an improved visitor experience from driving a roadway in good condition. The eventual good condition of the road would likely outweigh short-term adverse effects from traffic delays related to pavement rehabilitation efforts, including from transport of fill and construction materials and other road construction activities. Similarly, parking, signage and interpretive improvements would result in beneficial effects.

Changes in the number and kind of interpretive and educational programs over time have also contributed to and would continue to contribute to long-term beneficial effects on visitor experience. Similarly, because the range of visitor use opportunities has increased gradually over time, with the development of visitor facilities and programming, visitors and others would continue to have the opportunity to take advantage of these. The action alternatives would contribute a small degree of cumulative beneficial effects from improving some interpretation near Sledgehammer Point, from providing for accessible parking in visitor use areas, from improving scenic views from the roadway related to restoration of some turnouts, and from providing for a new Clallam Transit bus stop shelter and access trails near Barnes Point. Similarly, a small degree of cumulative adverse impacts would be contributed from rehabilitation of the roadway, including by temporarily diminishing visitor use opportunities to see some wildlife, and from noise, activity and temporarily degraded areas associated with construction.

Conclusion

Alternative 1 would have no additional immediate adverse effects on visitor experience, including access and transportation, visitor use opportunities and interpretation or education. Alternatives 2-3 would have adverse effects on visitor access and transportation, including from road delays and potential inability to visit some areas during construction activities. During the primary visitor use season (May-August), access to key visitor use areas, such as Sledgehammer and Barnes points would remain available. Year-round access to Barnes Point would also be available. Under Alternative 2, delays would routinely be 30-minutes and there would also be a limited number of 4-hour delays to complete some work, such as large culvert

replacement and rock scaling and bolting. East Beach Road would be closed to through traffic for approximately two days to replace the Log Cabin/Piedmont Creek culvert, however access would be maintained from either the east so that Log Cabin Resort could be reached. Alternative 3 impacts would be similar; however, there would also be nighttime delays of up to six hours on U.S. Highway 101. There would be a range of beneficial effects that would also be present in Alternatives 2 and 3, especially following road rehabilitation, when visitors, commuters and residents would find an improved roadway, as well as rehabilitated areas, including the predominance of fewer nonnative invasive plants.

J. Impacts to Human Health and Safety

Types of Impacts

See Visitor Experience

Impacts from Alternative 1

There would be no specific safety improvements to U.S. Highway 101 or East Beach Road in Alternative 1. Existing conditions on both roadways would remain. On U.S. Highway 101, this includes deteriorated guardrail posts; road edge failures; slumping, potholes and other poor pavement conditions; threats from plugged culverts or culverts in poor condition from not being able to pass adequate water flow; threats from rock fall hazards; threats from missing drop inlet grates; and potential hazardous conditions for visitors waiting for Clallam Transit buses at Barnes Point. On East Beach Road, hazardous conditions include the narrow roadway, combined with poor sight distance in some areas, and culverts in poor condition. Hazardous conditions also occasionally develop from plugged culverts.

Although this range of safety hazards currently exists on the roads, only one incident has been reported from U.S. Highway 101, in which rock fall resulted in damage to a vehicle, but not human impacts. As shown in the corresponding section in Chapter III: *Affected Environment*, none of the recent accidents on U.S. Highway 101 is specifically attributed to the above safety issues, many however were collisions with fixed objects and a few involved gravel on the roadway and/or wet weather conditions. Combined these would continue to result in the potential for adverse impacts on human health and safety.

Impacts from Alternatives 2 and 3

A variety of health and safety hazards inherent with road work may affect construction workers, employees and visitors. Those that would affect construction workers and employees would be related to the implementation of the project under the action alternatives, while those related to visitors would primarily be related to traveling through the construction area and to benefits from completion of the project.

Construction workers would face the hazards of long days of difficult work with a variety of hand tools and heavy equipment in an area renowned for its scenic beauty, where day to day observations could be distracting. Depending on the work being accomplished, a variety of safety hazards would be present and a range of personal protective equipment, including clothing, earplugs and other gear would be required to minimize the potential for injury. Construction sites are noisy, busy places and communication between workers is often difficult.

Rehabilitation of U.S. Highway 101 would improve the potentially hazardous conditions on the roadway noted above, as well as make other systematic improvements, such as repaving, that would also alleviate safety conditions on the roadway. Improvements would correct pavement failures such as potholes, slumping, and edge failures; replace plugged or poorly functioning culverts; replace missing drop-inlet grates; and replace existing guardrail on the road. Systematic rock scaling and bolting would also reduce rock fall hazards. These actions would result in long-term beneficial effects in making the highway safer to drive.

Similarly, rehabilitation of East Beach Road would result in culvert replacement, pavement milling and replacement and formalizing of some turnouts that would improve the roadway for vehicles.

During repair of Highway 101, the most hazardous operations would be related to the implementation of rock scaling and bolting. For this reason, the actions would take place during the projected driest time of the year and would involve cordoning off the affected area near the road during a protracted daytime delay of up to four hours. During this time, technical climbers, skilled in scaling would dislodge rocks and allow those to fall on the roadway. Because this operation involves some risk, it has contributed, in the past to dislodging larger rockslides and taken longer than projected to accomplish to safely return the road to a drivable condition. Although safety precautions and personal protective gear, including ropes, would be employed, the operation is not without some risk.

Other precautions employed to increase safety on Highway 101 during rehabilitation operations would include staging from one of the Sledgehammer turnouts while working on the other (see visitor experience section) to minimize the potential for visitor vehicle and large truck conflicts because of sight distance and the narrow shoulders in the area. Eliminating visitor use in the area would also reduce the potential for visitors to inadvertently disrupt rehabilitation actions if they crossed from one turnout to the next. These precautions would result in short-term beneficial effects on visitor (and contractor) safety during the rehabilitation.

Additional safety precautions would be undertaken in the pre-treatment of nonnative invasive plants, such as Scotch broom and herb-Robert at the Aurora quarry. Treatment methods would be according to the park's invasive plant management program and could include hand-pulling and herbicide use. As with all herbicide applications, risks to applicators would be reduced by the use of timing, appropriate weather conditions, and personal protective equipment, including outer layers of clothing, gloves, and other recommended equipment, such as respirators. In addition, application methods would focus on the target species.

Additional Impacts from Alternative 3

Night work would be authorized in Alternative 3 for work on U.S. Highway 101 during the late or post marbled murrelet nesting season. As with other incentives that could reduce overall construction time, conducting night work would be provided as an option to the contractor. Although working at night would likely reduce the overall construction time, night work can also be more hazardous to construction workers and may result in a lower quality product. Because of these inherent additional risks to workers and possibility for a reduced quality product, measures would be in place to minimize them. As a result, there would be an increased safety risk for construction workers and others in the construction zone, that would be mitigated by additional safety precautions. Night work is especially hazardous because it results in reduced visibility of the construction site for motorists, bright lights produce glare, nighttime drivers are more likely to be drowsy or impaired from the use of alcohol or drugs, and people, including workers, drivers and pedestrians are likely to be less alert. On the roadway, lower traffic results in higher speeds, and there may be an increase in some types of traffic, such as trucks. In the project area, workers are less visible and decreased visibility outside of the lit area may result in more opportunities for slips, trips, falls, and backing accidents as well as equipment mishaps

(https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RoadwaySafety_Toolbox_English/RoadwaySafety_Toolbox_Night_Risks_English.pdf accessed 12-2-15). According to the Department of Transportation, approximately half of construction fatalities from 2005 to 2010 resulted from workers being struck by construction vehicles or equipment. This risk increases at night because it is more difficult for crew members to see their colleagues and to perceive depth at night (http://www.ehow.com/list_7460948_hazards-construction-work-night.html accessed 12-2-15). There are also additional hazards because often there is little room between traffic lanes and workers.

Specific precautions would also be in place for employees. These include identification of safe routes to parking, restrooms, and the work station prior to work commencing, ensuring that employees have an

adequate sleep schedule which makes sleep a priority especially if overtime work is also performed, encouraging employees to drink an adequate amount of water, to minimize caffeine consumption, and to maintain family or other personal relationships, all of which can affect the quality of work performed. Irritability and sluggishness can result from high intensity or repeated night work and may cause employees to be less sharp and careful in work performance (http://www.ehow.com/list_7460948_hazards-construction-work-night.html accessed 12-2-15). Although some construction workers regularly work at night, others work at night only occasionally, such as to meet project deadlines. As a result, employees may not be used to alternate daytime sleep schedules and may be drowsy, which can contribute to serious problems if they are working with tools and machinery and/or on elevated areas.

There is also a different range of personal protective gear employed at night, including high visibility apparel, and more and longer road channeling devices with more reflectors, improved signage, and reduced spacing for cones.

Standards require workers such as flaggers, survey crews, construction workers, and others to be visible and recognizable as a person from a minimum distance of 1,280 feet (https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RoadwaySafety_Toolbox_English/RoadwaySafety_Toolbox_Night_Risks_English.pdf accessed 12-2-15).

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to employee and visitor safety include:

- A roadway safety management plan would include a section on night work precautions and hazards.
- Appropriate personal protective equipment (PPE) would be worn by construction workers and park staff while on the roadway and would match the type of work being done (daytime, nighttime, supervising, operating heavy equipment, etc.)
- Emergency vehicle access through the project area would be maintained during construction.

Cumulative Impacts

The alternatives would contribute a variety of mostly short-term adverse and long-term beneficial effects on human health and safety. Alternative 1 would be more likely to contribute cumulative adverse impacts if conditions on the roadway continued to deteriorate. Road improvements under the action alternatives (2-3) would contribute more beneficial effects. None of the alternatives would measurably add to cumulative effects because, in general, safety issues are not cumulative in nature. If other road projects, however, were being conducted in the vicinity, these could lead some drivers to be weary of construction delays and possibly more irritable with construction zones and workers, causing a slightly elevated degree of safety hazards for others on the roadway. Although simultaneous road construction could be occurring on East Beach Road, drivers on that roadway would be less likely to encounter the construction zone on U.S. Highway 101 since East Beach Road provides access to an alternate route around Lake Crescent. Similarly U.S. Highway 101 drivers, except for visitors seeking services at Log Cabin Resort would be less likely to encounter both zones on the same day.

Conclusion

There would be no additional adverse effects under Alternative 1, however, a small range of existing adverse effects would continue and could be exacerbated if U.S. Highway 101 and East Beach Road are not rehabilitated. Alternatives 2 and 3 would result in short-term adverse effects, coupled with long-term beneficial effects from improved human health and safety from returning both roadways to good condition.

K. Impacts to Park Operations

Types of Impacts

Adverse impacts would increase staffing, operating costs or fuel consumption. Beneficial impacts would decrease these. With beneficial impacts, the efficiency of park operations would also be improved and may lower the overall cost of operation. The discussions of impacts are for those operations that would be new, undergo major operational change, or show susceptibility to increases or decreases in operational activity. For example, old facilities would require additional staff time to operate or maintain, whereas replacement of facilities would likely use existing staffing levels. Impacts on park operations would result from the need for additional staffing or changes in duties for current staff, changes in funding levels, and from cost-saving measures associated with new facilities.

Impacts from Alternative 1

There would be ongoing adverse and beneficial impacts on park operations from the need to manage the U.S. Highway 101 MOA with the Washington State Department of Transportation and the East Beach Road agreement with Clallam County. Adverse effects would result from the continued need for park staff to perform some functions associated with roadway maintenance, such as nonnative invasive plant treatment and other activities, as well as from the need to manage the agreements and to monitor work accomplishment. Adverse effects could also be contributed if the roadways deteriorated and funding was needed but was not forthcoming to repair roadway failures. Beneficial effects would result from needing fewer maintenance staff to maintain both roadways since most work to maintain the roads would be done by employees from either WSDOT or Clallam County.

Impacts from Alternatives 2 and 3

In addition to impacts from Alternative 1, under Alternatives 2 and 3 there would be a range of short-term adverse impacts on park operations, such as staffing, from maintaining construction oversight, including contract monitoring. During the road rehabilitation project, there may be a need for additional staffing, and/or changes in duties for current staff. Although there would be an increase in funding, associated with implementation, most of this would be directed at road improvement actions. Some would likely also be directed toward resource impact monitoring and construction monitoring. During implementation, staff time, expertise, and assistance, would likely be diverted from other daily duties of park staff, including providing for visitor services, resource protection, and safety. Following construction, long-term beneficial impacts would occur from a decreased workload associated with maintaining new road facilities in good condition. As a result, the efficiency of park operations would also be improved and overall costs of operation for maintaining the roadways could be lower for a period of time. Because the road alignment or length would not change, future management would rely on existing staffing levels after the rehabilitation.

Additional Impacts from Alternative 3

In addition to impacts described above for both Alternatives 2 and 3, as noted under Human Health and Safety and elsewhere, night work could slightly reduce the overall construction time, resulting in beneficial effects on park operations from a shorter overall project, however because night work would also involve delays on the road of up to six hours, this work could be perceived as closing the road and could cause people who live and/or work in and travel through the park to be more likely to be more disrupted by the road project. Depending on when the night work occurred, it could interrupt travel for a variety of evening activities. If this occurred it could indirectly affect park operations, particularly for management and communications staff required to address concerns or complaints. There could also be some moderate-term beneficial effects that would occur during the project timeline from people enthusiastic about the potential for completing the road sooner and sharing this with park management staff.

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to park operations include:

- Coordinating work between NPS and FHWA park liaison to minimize disruption to normal park activities.
- Monitoring construction activities to ensure adherence to mitigation measures and to provide recommendations to minimize impacts on park resources.
- Conducting legal boundary surveys prior to scheduling work that may have the potential to affect private property.
- Using contractors and term employees to facilitate short-term workload increases.
- Coordinating work with park staff to reduce disruption to normal activities.
- Informing construction workers about the special sensitivity of park resources and values and regulations.
- Providing orientation on park resources for the contractor(s).
- Encouraging park resource specialists to be involved in inspections and monitoring and providing recommendations during the road rehabilitation work.

Cumulative Impacts

There would be few cumulative adverse or beneficial impacts from implementation of the alternatives described in this Environmental Assessment. When the impacts of Alternative 1, are added to the array of past, present and reasonably foreseeable future actions, there would be a small contribution to cumulative adverse effects if the roadways continued to deteriorate over time. Eventually, it is likely that additional project planning and funding would need to be dedicated to fixing the road, thus these adverse impacts would not continue unabated. In contrast, implementation of either Alternative 2 or Alternative 3 would result in cumulative beneficial impacts on park operations from providing for continued long-term use of U.S. Highway 101 and East Beach Road as travel routes for visitors, residents and commuters. Additional cumulative adverse effects could occur, however, if management of either roadway changed from the current agreements with WSDOT and Clallam County, thus putting a greater burden for road management on park staff and adversely affecting park operations.

Conclusion

There would be no additional adverse effects under Alternative 1. Existing impacts on park operations from management of the agreements for roadway maintenance would continue and if the roads deteriorated, there could be some additional adverse effects from efforts to attain funding to complete needed repairs in the absence of full rehabilitation. Under Alternatives 2 and 3, comprehensive rehabilitation of the roadways would result in long-term beneficial effects on park operations, perhaps reducing annual maintenance costs and allowing some flexibility in the use of funding, staffing and agreements ordinarily used to maintain the road.

L. Impacts to Socioeconomics

Types of Impacts

Adverse impacts would decrease economic benefits either in one sector of the economy or regionally, resulting in loss of income or increased expenditures for people living in the area. Beneficial impacts would increase these. Adverse impacts could also occur if they affected a disproportionate number of people in one or another demographic category or economic sector.

Impacts from Alternative 1

There would also be no effect on demographics, population, or tourism related expenditures from the implementation of Alternative 1 because the NPS and FHWA would not undertake road rehabilitation on either U.S. Highway 101 or East Beach Road.

Not repairing the roadways, however, could adversely impact socioeconomics because over time. This section of Highway 101 along Lake Crescent and East Beach Road would likely deteriorate and the potential for catastrophic failure of the roadways would increase (FHWA 2014). Consequently, there

could be unplanned delays and closures to conduct needed repairs on the road. These unexpected delays or closures would affect the daily activities of people using the roadway, including educational and work commuters, logging trucks, and the ability of various public service providers, and private citizens to drive between Port Angeles and the west end of the Olympic Peninsula. These individuals, some of whom are business owners or educators, would not be able to plan ahead and prepare appropriately for construction delays because it is unknown where the road would fail or how long needed repairs would take, including whether or not funding could be obtained quickly and repairs expedited.

Olympic National Park would continue to be an important contributor to the regional economy and gateway communities because of employee jobs and wages supported and operational expenditures by the National Park Service. In addition, the park would continue as a primary local and regional tourism attraction. Food, lodging and gift services providers benefit by those who travel through the park and spend more than a day, while food and gift providers may benefit by those just traveling through the area but not stopping overnight. Other services in the region may also benefit from park visitors, including those who provide other recreational venues. According to the annual study of NPS economic benefits, visitors would continue to generate tourism-related spending within the regional economy (\$259,746 non-local visitor spending in 2014), and contribute to the gross domestic product of the regional economy (\$227,305 value added in 2014) (Cullinane et al. 2015).

If one of the roads were to fail, however, expenses could increase to transport goods and services, including employees across different, longer or less convenient routes. Because there would initially be no changes in roadway use on either U.S. Highway 101 or East Beach Road, however, the current level and types of economic effects related to concessions would be unaffected.

Impacts from Alternatives 2 and 3

As in Alternative 1, there would be no anticipated effects on population or demographics. Although workers on the road construction projects would likely come from a range of demographic sectors and be of a wide array of ethnicity or race, these characteristics would be unlikely to be discernible against the larger regional population due to the short time the construction work would occur in.

Road rehabilitation, occurring over approximately three years in Alternative 2 would result in the potential for regular road delays from March through November, with additional delays of up to four hours possible in late August and September. Because road delays would occur during the visitor use season but would allow major facilities, such as at Barnes Point to remain open, there could be some adverse effects on socioeconomics if some visitors decided to postpone a visit to the Lake Crescent area to another time. Because road construction occurs widely over the northwest in the summer, knowledge of this activity at the park, however, is unlikely to greatly influence a visit to the park, especially because other areas of the park would remain fully available during work on U.S. Highway 101 and/or East Beach Road. Although there could be a slight decrease in tourism spending related to rehabilitation of these roadways near Lake Crescent, it is unlikely to be detectable amid the influx of construction spending that would occur at the same time to provide people to staff and equipment to be used in the project areas. Park expenditures for goods and services from the gateway communities would likely increase as well and would continue to be beneficial, providing income, employment, and jobs to the local and regional economy.

Although Clallam County Transit would benefit from the transit station proposed at Barnes Point, during road construction, buses would necessarily be on a longer schedule in travel between Port Angeles and Forks and back. Bus schedules and perhaps the route may also change during the small number of projected four-hour delays on U.S. Highway 101. Because the schedule of one bus also affects others, this could also result in some indirect adverse effects on other buses that connected with the Port Angeles to Forks (and return) buses. Similarly, other businesses, such as private logging areas beyond the park, could also be affected by road delays, however, because these would generally occur during the day and be of relatively short duration (30 minutes), the delays are unlikely to have a widespread adverse effect but

could occasionally (during the small number of four-hour delays) reduce the overall number of trips made on the road.

U.S. Highway 101 is also used as a route to conduct county government business, including for residents of Forks to access county government services, such as to report for jury duty and other county services, as well as to access important community services, such as the hospital in Port Angeles, alternative schools, and shopping. Because of this, residents of Forks and other areas west and south of Port Angeles could bear a larger burden in planning ahead for access to these services during road construction. The route to Port Angeles, Seattle and beyond is also important for food, goods, medicine, logging, and recreational and commercial fishing. Because the delays would be relatively short (30 minutes), and because the longer delays for more intensive road work needs would be well-advertised and signed and small in number, overall adverse effects on residents of these areas would be limited. Some delays may also be able to avoid morning and afternoon commute hours. Sometimes, travelers would also approach the construction zone at the right time and may not be delayed, except for slower traffic through construction areas.

The anticipated four hour delays needed to complete rock fall mitigation and culvert replacement on U.S. Highway 101 would be conducted during the non-peak visitor use season. Therefore, although most visitors would be less likely to be impacted by these longer closures, this work would likely have increased effects on residents and local commuters, especially those commuting between Forks and Port Angeles at the beginning of the school season. Because there would be a limited number of delays and because they would be well-advertised, most commuters would likely be able to plan in advance to take an alternate route and/or to alter their schedules to avoid these delays. Some people, however, would likely be adversely affected by these longer delays, resulting in frustration and possible lost income from the inability to take another route and/or to alter their work or education schedule.

As in Alternative 1, if closure, rather than delays on the road occurred, there could be effects on local businesses or other agencies. Road closures would not be part of the implementation of Alternative 2. Access to Log Cabin Resort, for example, would be available from the west during work on the large culvert beneath the roadway, which could take approximately two days to install. Access up to the area would also be available from the west, but there would be a short-time period when access from the east would be limited by the culvert replacement. Because an alternate route from the west would be available, this action is not expected to adversely affect most visitors.

There would be no anticipated changes in concession-provided facilities or operations near Lake Crescent, however, a small number of visitors may choose to travel elsewhere in the park during road construction. Individual concessioners could experience changes in business activity in conjunction with normal year-to-year variability, which could be alleviated by overall modest long-term increases in visitor use and/or increase in visitation related to the centennial year of the National Park Service. Despite the road construction, most visitors are expected to continue to visit Olympic National Park (3.2 million recreation visits in 2014), as is the case in other national parks. For example: Although Yellowstone National Park has been undergoing a 20-year road repair and reconstruction program, the park continues to receive over three million recreation visits per year (3.5 million in 2014) (<https://irma.nps.gov/Stats/Reports/Park/YELL>). In addition, 2015 resulted in the largest ever number of visitors to the park. Therefore, impacts on visitor spending and their contribution to the local economy would likely be small.

Implementation of Alternative 2 could also provide some beneficial impacts to the local economy in Clallam County from opportunities for construction employment and from the purchase of some locally obtained goods and services. The most likely benefits would be in the food service sector, including coffee and lunches purchased by construction workers en route to work on the roadways, as well as expenditures for groceries and potentially for leisure time activities as well. It is likely that some workers would be from the area and some from outside of the area, depending on the origin of the contractor, however, both types of employees would likely increase purchases due to additional income generated by their construction jobs. These benefits could result in some increase in revenues for local businesses and

governments generated from additional construction activities and workers. Any increase in workforce and revenue, however, would be temporary, lasting only as long as construction (approximately three years).

Additional Impacts from Alternative 3

Impacts from Alternative 3 would be the similar to Alternative 2. In addition, if opportunities for nighttime construction were to reduce the overall time it would take to implement the road construction, there could be slight beneficial impacts on socioeconomics. Nighttime construction, however, would also impact opportunities for those traveling at night through the park, however overall traffic is less at night than during the daytime and thus would affect fewer people. Because the delays would be up to six hours it is likely that most travelers would choose to take an alternate route around the park, such as on Highway 112/113 or to delay their trip for another night without delays or until the road had shorter delays (during the day).

Impact Avoidance, Minimization and Mitigation Measures

Measures that would be included in the proposed project (as appropriate to the alternative actions) to minimize impacts to socioeconomic resources include:

- Working with the Washington State Department of Transportation (WSDOT), Clallam County, park concessioners, nearby towns and cities (including Port Angeles, Sequim and Forks), and others to ensure that motorists were informed of travel delays, road construction updates and other information.
- Including a range of communications outreach measures in advertising road construction and delays, including on the park website (such as real time road construction and delay updates), radio and television public service announcements, articles and schedules posted on bulletin boards and park handouts, and sent to local and regional; electronic road signs; and visitor contact stations.
- Allowing emergency vehicles to pass immediately through the construction area. Radio communications on either end of the project would be tied into emergency communications (park dispatch center and the project traffic and safety supervisor), who could be alerted to the need for emergency vehicle passage and would then work to facilitate it.
- Facilitating safe bicycle passage through the construction area using the existing advance warning system, and extending the length of flashing light during road delays.
- To reduce impacts on public transit and improve transportation, the park would partner with the Clallam Transit System to build a Barnes Point transit stop shelter along both sides of Highway 101.
- Access to Barnes Point would be maintained from either the east or west portion of U.S. Highway 101.
- Pilot vehicles and/or traffic lights would be used to guide visitors, logging trucks, commuters, and other local and regional users through construction areas that have one lane closures.
- A series of construction contract clauses would be provided to minimize overall socioeconomic impacts during construction. Among these, as requested by public comments, could be financial incentives for early completion of work projects. Likewise, there would be financial penalties if work was not completed within the projected target date(s).

Cumulative Impacts

Olympic National Park is a primary visitor attraction on the Olympic Peninsula and one focus of regional tourism and the hospitality industry. The operation of the park benefits the local and regional economy, through visitation, through its purchases of goods and services, and through employment of staff that reside in the region. This results in beneficial cumulative impacts on the socioeconomic conditions within the region, but particularly the gateway communities in and around the park. Past, present and reasonably foreseeable future actions, including replacing cabins and improving accessibility at Log Cabin Resort, and planned road projects would also contribute to beneficial effects on socioeconomics from

construction spending. Adverse effects could also be contributed from long-term rehabilitation proposals which result in changes associated with visitor use in certain areas, such as from closure of popular facilities for rehabilitation. For the most part, however, effects related to construction are short-term and would not contribute to cumulative effects on socioeconomics.

Although there are also regional proposals that are intended to have cumulative beneficial impacts on the regional four-county economy, these are still in the proposal stage and effects from implementation of the alternatives would not contribute to these. Two such proposals are the “*Olympic Peninsula Economic Development Initiative*” that is intended to spur economic growth, strengthen the long-term viability of key industries, and protect natural resources for future generations (Kilmer.house.gov 2015:1), and the Wild Olympics proposal that would increase opportunities for property owners at Lake Crescent, Lake Ozette, and Queets Corridor to sell up to 20,026 acres to the Olympic National Park at their discretion (Headwaters Economics 2012:33).

When the actions in Alternatives 2 and 3 are combined with past, present and reasonably foreseeable future actions, there would continue to be a range of socioeconomic benefits from the presence of the park and its contribution to the regional economy, including from construction spending if road construction is undertaken. The minimal contribution of adverse effects from potential delays from road construction would be unlikely to contribute to cumulative effects because they would be undetectable within the regional economy.

Conclusion

Rehabilitation of U.S. Highway 101 and East Beach Road would have small beneficial impacts on the regional economy from construction spending on staff and materials, as well as from additional goods and services used by construction personnel. These would likely be undetectable in the regional economy, but could benefit some local businesses. Adverse effects from businesses and individuals changing their plans related to the road construction delays would also likely be undetectable against the background of the regional economy because most areas in Olympic National Park would remain unimpacted by the road projects near Lake Crescent. Olympic National Park would continue to be an important contributor to the regional economy and gateway communities because of jobs and incomes supported through operational expenditures by the National Park Service, concessioners, contractors, and tourism-related spending by visitors.

Table 21: Impact Comparison Summary

Resource	Impacts from Alternative 1	Impacts from Alternative 2	Impacts from Alternative 3
Geology	No additional impacts. Existing impacts from unstable rock would continue.	A small degree of short- and long-term adverse effects from rock scaling and rock bolting to decrease rockfall hazards and from changing the underlying conditions on the roadway.	Same as Alternative 2
Soils and Vegetation	No additional impacts except in the event of road failure. Existing impacts from previous modifications to soils and from ongoing impacts from nonnative invasive plants would continue.	Short-term adverse effects on soils and vegetation on the road, road shoulders, including cut and fill slopes, and in staging areas. Long-term beneficial effects from restoration of disturbed areas and from retaining existing road alignment.	Same as Alternative 2
Acoustic Environment and Soundscapes	No additional impacts. Heavy traffic on the Highway 101 would continue to create a fairly loud acoustic environment. East Beach Road would remain relatively quiet.	Same as Alternative 1. In addition, the project would contribute short-term noise impacts throughout the duration of construction (approximately 3 construction seasons for Highway 101 and one year for East Beach Road). Beneficial effects from reducing noise could be contributed by roadways in good condition.	Same as Alternative 2. In addition, construction noise would continue during the night.
Water Resources	<i>Hydrology:</i> No additional impacts. Existing adverse impacts from alteration of drainage channels, drainage through side ditches and culverts, and shoreline riprap would continue. <i>Water Quality:</i> No additional impacts. Existing impacts from runoff and potential for contaminants would continue. <i>Wetlands:</i> No additional impacts. Existing long-term adverse effects from modifications of drainage and beneficial effects from unnatural wetlands created by the roadway.	<i>Hydrology:</i> Same as Alternative 1, plus short-term adverse effects from additional erosion and runoff related to removal of vegetation and paving. <i>Water Quality:</i> Most existing impacts would continue, however larger culverts would more easily carry runoff/stream flow, other improvements could result in faster runoff. Potential for most impacts would be reduced by mitigation measures. Beneficial effects from restoring natural stream processes through installation of properly sized culverts on Lake Crescent. <i>Wetlands:</i> Temporary effects on 0.2 acres of wetlands, including 0.1 acres of stream channels on Highway	Same as Alternative 2

		101, 0.13 acres of riprap along Lake Crescent, and up to 0.069 acres of wetlands for Log Cabin Creek off of East Beach Road. Long-term beneficial effects from restoration of wetlands up and downstream from culvert.	
Fish and Wildlife	No additional impacts. Existing impacts from noise and activity along the roadways would continue. Ongoing impacts from hanging culvert blocking fish passage on Log Cabin Creek and East Beach Road sediment plume effects on Beardslee trout.	Short-term adverse impacts from project noise and activity. Loss of native and nonnative vegetation would adversely affect habitat. Long-term beneficial impacts from revegetation, and improved access to and quality of aquatic habitats through installation of properly sized culverts.	Similar to Alternative 2, however additional adverse impacts from night work, including from unnatural lighting and noise and disturbance during an otherwise quieter time of day.
Special Status Plants	No effect.	With mitigation measures, no effect on water lobelia.	Same as Alternative 2
Special Status Wildlife	Crescenti Cutthroat: No effect. Beardslee Rainbow: Potential for ongoing adverse effects from sedimentation potential over spawning area and from continued exclusion from habitat in Log Cabin Creek. <i>Marbled Murrelet and Northern Spotted Owl</i>: May affect, not likely to adversely affect.	<i>Crescenti Cutthroat Trout</i>: Potential for adverse effects from setting and removal of barge pilings and riprap from habitat impacts. <i>Beardslee Rainbow Trout</i>: Reduced potential for sedimentation over spawning area from rehabilitation of turnout. <i>Pacific Fisher</i>: No effect. <i>Marbled Murrelet and Northern Spotted Owl</i>: May affect, likely to adversely affect.	Same as Alternative 2
Archeological Resources and Historic Structures	<i>Archeological Resources</i>: No adverse effect. No additional ground disturbance except as needed to perform routine/recurring road maintenance. In addition, the discovery potential for archeological resources would include mitigation measures. <i>Historic Structures</i>: Although U.S. Highway 101 is eligible for the National Register of Historic Places, there would be no changes to the characteristics	<i>Archeological Resources</i>: Similar to Alternative 1. Although there is a potential for finding archeological resources, that potential is low because areas of impact have been previously disturbed and because archeological surveys have not revealed areas of concern. <i>Historic Structures</i>: No adverse effect on the character-defining features of U.S. Highway 101 that contribute to	Same as Alternative 2

	that make it eligible, therefore there would be no adverse effect on U.S. Highway 101. No other historic structures are located along U.S. Highway 101 or East Beach Road in the area of potential effects.	making the road eligible for the National Register.	
Visitor Experience	<i>Access and Transportation:</i> Ongoing potential for failure of roadway if repairs are not undertaken could lead to adverse effects. <i>Opportunities/Interpretation and Education:</i> No change in the range of visitor use opportunities. Continued long-term beneficial effects on visitor experience from array of activities.	<i>Access and Transportation:</i> Short-term adverse impacts from delays (30-minutes to four-hours) over three construction seasons from road rehabilitation actions. Beneficial effects from maintaining access to Barnes Point from one direction year-round. Diminished adverse effects from minimizing work delays during commute hours. Long-term beneficial effects from improved roadway in good condition. Opportunities: Similar to Alternative 1, with new visitor use opportunities from linkage trails at the Barnes Point transit stop, improved opportunities from improved road with better turnouts, safer roadsides, and reduced nonnative species. Some short-term adverse effects from elimination of turnout on East Beach Road which contributes to sedimentation of spawning area in the Lyre River. Eventual replacement of trailer and kayaker parking closer to the Spruce Railroad Trail. <i>Interpretation and Education:</i> Long-term indirect beneficial effects from improved trail connections at Barnes Point for NatureBridge programming. Long-term beneficial effects from improvement of Sledgehammer Point, including from future planned improvements to wayside exhibits and signs.	<i>Access and Transportation:</i> Same as Alternative 2, plus additional adverse effects from six-hour delays at night. Although visitors and commuters could choose to avoid travel on the road at those times or could choose an alternate route, it is likely that these options would be cumbersome over the estimated three years of the construction project. <i>Opportunities:</i> Same as Alternative 2 <i>Interpretation and Education:</i> Same as Alternative 2

Human Health and Safety	No specific safety improvements would be undertaken, resulting in potential long-term adverse effects from continuing roadway deterioration (slumping, potholes, deteriorated guardrail, road edge failures, plugged /undersized culverts, etc.)	Potential for short-term adverse effects for construction workforce, employees and visitors from work/travel during construction. Long-term beneficial effects from improvement of potentially hazardous conditions on roadway. Long-term beneficial effects from systematic rock scaling and rock bolting would improve the most hazardous known conditions.	Same as Alternative 2 plus additional hazards from consistent night work.
Park Operations	Ongoing adverse and beneficial effects on park operations. Over time, adverse effects would increase from additional road maintenance needs.	Similar to Alternative 1, however, initial adverse effects would be greater from construction cost and operations. Afterwards, long-term beneficial effects would increase from fewer maintenance needs for improved roadway in good condition, potentially freeing some funding for other high priority needs.	Similar to Alternative 2, plus slight potential for shorter construction time from consistent night work could result faster project accomplishment.
Socioeconomics	No effect on demographics, population, or tourism related expenditures. Over time, not repairing the road could affect socioeconomics from roadway deterioration and the potential for catastrophic failure. Expenses could increase to transport goods and services, including for commuters and employees, over different, longer, or less convenient routes.	No effect on population or demographics. Potential for some adverse effects if visitors decided to postpone a visit to Lake Crescent because of road delays (March – November), however most visitors would not be deterred. Public transit delays would have adverse effects on transportation between Forks and Port Angeles. The small number of four-hour delays could reduce the overall number of trips on the road during non-peak periods. Because there would be delays rather than closures and because access to key features, such as Barnes Point and Log Cabin Resort would remain open, overall effects would be diminished. Short-term beneficial effects would occur from the purchase of goods and services and from employment related to construction.	Potential for small beneficial effects if nighttime construction reduced overall construction time.

Chapter V: Consultation and Coordination

A. Internal Scoping

The NPS used internal scoping to define the purpose and need for the project and the proposed project goals and objectives. An interdisciplinary team comprised of staff from the park and regional office was identified. This process continued with identifying potential actions to address the need, and determining what park resources could potentially be affected by the proposal. Internal scoping began when the idea for the proposed rehabilitation of U.S. Highway 101 was submitted to the NPS internal projects database and the FHWA and continued through development of this Environmental Assessment in numerous meetings and site visits between the NPS and FHWA, including in November 2014, March and October 2015. During the design phase, the proposed project areas were surveyed in detail and staked with station markers. As the designs developed, these were reviewed and analyzed for potential environmental impacts.

A variety of concerns were identified regarding what should be in the plan and what impacts should be included. The interdisciplinary team defined the purpose and need, identified ongoing and potential management actions, determined the likely issues and impact topics and provided related information about proposed improvements. The site visits were also conducted to evaluate proposed actions and to discuss impacts associated with these.

B. Public Involvement

Alternatives Scoping

Olympic National Park conducted public scoping of the six preliminary alternatives identified for rehabilitation of the Lake Crescent portion of U.S. Highway 101. There were two public meetings, held in Port Angeles and Forks, Washington on May 18 (Port Angeles) and May 20 (Forks), 2015, respectively. Approximately 14 people signed in at the meeting in Port Angeles and 34 signed in at the meeting in Forks.

The public comment period extended from May 7 – July 7, 2015. Articles about the public scoping were published in the following newspapers: Peninsula Daily News (5-11-15), Sequim Gazette (5-13-15), and The Tacoma News Tribune (5-16-15). Radio broadcasts also occurred on KONP Radio Port Angeles (5-11-15) and KBKW Newstalk Grays Harbor (5-8-15). Notice of the public meeting was also sent to approximately 75 people, businesses and organizations, as well as other civic and government entities on the park's mailing list.

In response to the public scoping press release and supplemental information about the six preliminary alternatives, the park received 42 pieces of correspondence. Correspondence was received via the NPS Planning, Environment and Public Comment (PEPC) website (www.parkplanning.nps.gov), and/or via email, formal letter, or in a hardcopy public comment form completed and submitted at a public meeting. Optional Public Comment forms were available at both public meetings. In addition to the two public meetings, where comments were recorded and entered into PEPC, there were 26 website (PEPC) comments, six letters, six optional public comment forms, one email, and one phone message to the park's Chief of Maintenance. Correspondence was received from people in 13 cities or communities in Washington State. No correspondence was received from outside of the region; however one correspondence did not identify an origin.

In addition to the general public, letters were submitted from three government entities (Clallam County Commissioners, City of Forks, and Clallam Transit System); one tribal government (the Quileute Tribal Council), five businesses (Aramark, Domaine Madeleine Bed and Breakfast, Interfor, Riverview RV Park, and Sunsets West Co-op); and six non-governmental organizations (Far West Art League, Forks Chamber of Commerce, Friends of Lake Crescent, Juan de Fuca Scenic Byway Association, NatureBridge, and Olympic Peninsula Visitor Bureau). No comments were received from environmental groups.

Many commenters used or referred to the Topic Questions provided by the park during scoping. These questions, which were provided to help commenters frame their responses and to assist the planning team in refining the alternatives, included:

1. Which alternative would best accommodate your use of U.S. Highway 101 at Lake Crescent?
2. What would you change about the alternatives?
3. Do you think there should be other alternatives evaluated for the project? If so, what would you suggest?

The six preliminary alternatives considered during the public scoping process included:

- Alternative 1: No Action (Continue Current Management)
- Alternative 2: 30-minute Delays -- Rehabilitate Lake Crescent Segment of U.S. Highway 101 (30-minute delays throughout duration of construction)
- Alternative 3: 30-minute Delays and Shoulder Season Closure --Rehabilitate Lake Crescent Segment of U.S. Highway 101 (30-minute delays and shoulder season spring [March-April] and fall [October-November] closure / Highway 112 Reroute)
- Alternative 4: Alternative 4: 30-minute and 8-Hour Delays -- Rehabilitate Lake Crescent Segment of U.S. Highway 101 (workday closure Monday – Friday from 9 a.m. to 5:00 p.m.; open mornings before 9:00 a.m., evenings after 5:00 p.m. and weekends with 30 minute delays) / Highway 112/113 Reroute)
- Alternative 5: Alternative 5: 30-minute Delays and First Season Closure --Rehabilitate Lake Crescent Segment of U.S. Highway 101 (Closed during the first construction season [March – November]; open with 30-minute delays throughout the remainder of the road rehabilitation / Highway 112/113 Reroute)
- Alternative 6: March – November Full Construction Closure --Rehabilitate Lake Crescent Segment of U.S. Highway 101 (full closure for duration of construction March-November / Highway 112/113 Reroute)

Of the 42 correspondences received by the park, there were 285 separate comments generated. These comments were categorized into 46 specific topics. Although there were several commenters (6) that thought the road could be closed during construction so it could be completed faster, the majority of commenters were against road closure. Eighty-three of these comments identified a reason for disagreeing with road closure.

The comments also identified alternatives to road closure that could get the project completed sooner. These options included doing construction work at night, working around the clock, opening/closing the road at various times of day/night, phasing the work, or only working on the road on an as needed (emergency) basis. For those who expressed an alternative preference in their comments, most favored preliminary Alternative 2.

Closure during normal working hours and/or commute hours was not acceptable to more than half of the commenters (26 comments). The main reason given for the public not wanting lengthy road closures or reroutes onto State Highway 112/113 was the potential for a wide range of visitor experience and socioeconomic impacts. Ninety comments expressed concern about potential socioeconomic impacts, including the need to conduct a professional socioeconomic impact analysis if road closure was proposed. Ten comments also suggested that the federal government compensate businesses and employees for the increased costs that could be incurred by a potential reroute onto State Highway 112/113 and/or travel delays on U.S. Highway 101.

Based on the comments received during alternatives scoping, the preliminary alternatives were modified to avoid full closures of the roadway. The two action alternatives discussed herein are modifications of preliminary Alternative 2, with opportunities for a small number of longer delays to complete rock fall mitigation and to replace large culverts, as well as to incorporate the opportunity for night work to occur.

The full text of all substantive comments received during the public scoping period for the rehabilitation of the Lake Crescent segment of U.S. Highway 101 (Substantive Comment Report) is available upon request and is posted on PEPC. The comments are verbatim; grammatical and typographical errors have not been modified. The comments reflect the sentiments of the authors, and do not necessarily represent the sentiments of the entire public and may not accurately reflect actual existing conditions on the ground or in park management. Not included are comments outside the scope or comments that expressed only an opinion, such as an alternative preference.

C. Agency Consultation

U.S. Fish and Wildlife Service

In accordance with the Endangered Species Act, the National Park Service contacted the U.S. Fish and Wildlife Service to determine which federally listed special status species should be included in the analysis. Based on subsequent analysis of the project and its potential effects, the park has determined that there would be no effect on most species identified by the USFWS as present in the project area, including northern spotted owls (see impact analysis section). The project, however, may affect, and is likely to adversely affect marbled murrelets. During public review of this document, prior to preparing a NEPA decision document, concurrence with this determination of effect from the USFWS will be sought.

Washington State Department of Archaeology and Historic Preservation

In accordance with Section 106 of the National Historic Preservation Act, the National Park Service provided the State Historic Preservation Officer (SHPO) of the Washington State Department of Archaeology and Historic Preservation an opportunity to comment on the effects of this project.

Analysis of the significance of U.S. Highway 101 is ongoing by the Washington State Department of Transportation. Proposed actions are anticipated to have no adverse effect on the potential eligibility of U.S. Highway 101 for the National Register of Historic Places. Prior to making a decision as to which alternative or combination of alternatives would be implemented, concurrence with this determination of effect would be sought from the SHPO.

Washington Department of Fish and Wildlife

During project analysis, the NPS also contacted the Washington Department of Fish and Wildlife to determine state status for a range of rare species.

Native American Indian Consultation

Native American Indian tribes, including the Lower Elwha Klallam Tribe were included in public scoping notices and letters. Comments were received from the Quileute Tribe during alternatives scoping. Tribal concerns were primarily that the Highway 101 route not be closed: "It is the opinion of the Quileute Tribe that no alternative that includes the complete closure of Highway 101 should be considered. The impacts on commuting employees, community members seeking services, especially medical services in Port Angeles, public safety, and impacts on tourism and other economic activity are too severe for a complete closure."

Letters are also being sent to the Jamestown S'Klallam Tribe and Port Gamble S'Klallam Tribe.

Regular meetings are also held with the tribes to discuss issues of concern. During those meetings, no additional issues regarding the proposed improvements to Highway 101 or East Beach Road were identified as concerns.

D. List of Preparers, Persons and Agencies Consulted

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Appendix 1: Formal and Informal Turnouts

Number	Description	Station	North or South?	Maintain Or Remove	Existing Surface	Proposed Surface	Edge Treatment	Comments
1	Mine Access Rd/Driveway	45+20	N	Maintain	Gravel	Gravel	Retain gate	Maintain gate and driveway to abandoned mine
2	Bus Stop and Biker Notice/Flashing sign controller	106+00	S	Maintain	Gravel	Asphalt	Replace guardrail at same location. No treatment necessary at base of hillside	Accidents have occurred when vehicles pull out from this location. Could be elongated with additional paved shoulder to the east for bus acceleration/ deceleration at congested area.
3	Fairholme Store Parking Lot	110+00	N	Maintain	Asphalt	Asphalt	Railing on top of wall to meet code requirements	Remove sinkholes etc. Regrade parking lot (should be accomplished with deep patch repairs)
4	1 st turnout east of Fairholme on South side	124+50	S	Remove	Gravel	Restored	Extend ditchline	Remove (too small and no room to expand)
5	1 st turnout east of Fairholme on North side	134+00	N	Maintain	Asphalt	Asphalt	Guardrail at same location	Popular turnout for photographers and fishermen
6	Eagle Point	162+00	N	Reduce Depth	Asphalt	Asphalt	Guardrail	Trees block the view. Eliminate parking and provide slow vehicle turnout
7	Gravel Turnout	186+10	S	Remove	Gravel	Restored	Extend ditchline	Unacceptable depth for safety
8	Meldrin/Ambulance Point	196+00	N	Maintain	Asphalt	Asphalt	Replace guardrail edging. Provide gap in rail similar to existing gap for visitor access to point	
9	Turnout east of Ambulance Point	207+00	N	Maintain	Asphalt	Asphalt	Guardrail	
10	Long Turnout	220+00	N	Maintain	Asphalt	Asphalt	Extend guardrail entire length (currently is half	

Number	Description	Station	North or South?	Maintain Or Remove	Existing Surface	Proposed Surface	Edge Treatment	Comments
							guardrail and half log wheel stops)	
11	Short turnout at east end of curve	225+00	N	Remove	Gravel	Restored	Guardrail	Unneeded turnout
12	La Poel	243+00	N	Reduce by 1/2	Gravel	Asphalt	Guardrail	Eliminate western ½ of parking west of driveway. Formalize eastern half for bus and slow vehicle turnout.
13	MP 224 at culvert grate	261+50	S	Remove	Gravel	Restored	Extend ditchline	Remove
14	Goose nesting turnout	281+00	N	Maintain	Asphalt	Asphalt	Guardrail	
15	Gravel Turnout at west end of passing lane	288+00	N	Reduce size	Gravel	Asphalt	Guardrail	Used by LE and Emergency vehicles. Reduce depth and width.
16	Paved turnout at east end of passing lane	298+00	N	Reduce size	Asphalt	Asphalt	Extend Guardrail	Used by LE and emergency vehicles. Reduce depth and width to approx. 100' of parking. Maintain parking at east end of turnout, remove west end.
17	Gravel turnout at old access road and pit	307+50	S	Reduce size	Gravel	Asphalt	Replace berms when access to former Aurora quarry is no longer needed	Reduce depth but maintain access to former road/pit for staff and provide slow vehicle turnout
18	Gravel shoulder along curve	315+50 to 318+00	S	Remove	Gravel	Restored	Extend ditchline	
19	Paved turnout – Opposite Aurora Creek Trail	327+30	N	Maintain	Asphalt	Asphalt	Guardrail	Currently space for 3 parallel parked vehicles for Aurora Creek Trailhead.
20	Gravel turnout east of Aurora Creek Trail	330+00	S	Remove	Gravel	Restored	Extend ditchline	Poor sight distance
21	Wallace Point	340+00	N	Maintain	Asphalt	Asphalt	Same treatment as West Sledgehammer (timber bumper logs and concrete wheel stops with timber	

Number	Description	Station	North or South?	Maintain Or Remove	Existing Surface	Proposed Surface	Edge Treatment	Comments
							finish)	
22	Former contractor barge access (east end of Wallace Pt)	344+00	N	Maintain	Gravel	Gravel	Extend guardrail on east side to a berm that can be removed when lake access needed in the future. Begin timber bumper logs from west side of berm through Wallace Point	Design to prevent visitor vehicle access.
23	Wallace Pt – South Side	343+00	S	Maintain	Asphalt		Extend ditchline	Pedestrian crossing is hazardous. Maintain enough depth for truckers to pull off and allow faster vehicles to pass (approx. 20' deep), restore the remainder of the turnout. Post no parking signs along turnout and remove pedestrian crossing sign downstation
24	Maple Point – Large turnout	383+00	N	Reduce Size	Asphalt	Asphalt	Extend Guardrail	Construct slow vehicle turnout
25	Turnout east of Maple Point	391+00	N	Maintain	Asphalt	Asphalt	Guardrail	Retain for water feature photo opportunities
26	Paved turnout opposite waterfall	408+00	N	Maintain	Asphalt	Asphalt	Guardrail	
27	Gravel turnout west of waterfall	408+00	S	Remove	Gravel	Restored	Extend ditchline	Insufficient area for typical turnout, drain inlet dangerous
28	Gravel turnout on curve	416+00	S	Remove	Gravel	Restored	Extend guardrail	Poor sight distance
29	Turnout partially behind guardrail	418+00	N	Remove	Gravel	Restored	Extend guardrail	Poor sight distance
30	Paved turnout at private residences	425+00 to 435+00	N	Maintain	Asphalt	Asphalt	No edge treatment necessary	Maintain for driveways access
31	Two turnouts at flares in guardrail at west end of Barnes Point bridge	452+00	N&S	Remove	Gravel	Restored	Extend guardrail	Provide means to prevent visitor vehicles parking behind guardrail
32/33	Bus Turnouts	452+15 –	N&S	Improve	Asphalt	Improve		

Number	Description	Station	North or South?	Maintain Or Remove	Existing Surface	Proposed Surface	Edge Treatment	Comments
		455+00						
34	Turnout east of Barnes Point	481+00	N	Remove	Asphalt	Restored	Extend guardrail	Too small, poor sight distance
35	Turnout west of rock face	505+00	N	Maintain	Asphalt	Asphalt	Guardrail	Used by law enforcement and maintenance crews for clearing rock spalls
36	Turnout west of Sledgehammer, opposite side of road	540+00	S	Maintain	Asphalt	Improve	Redefine ditchline	Used by law enforcement and maintenance crews
37	West Sledgehammer	543+00	N	Maintain	Asphalt	Improve	Timber bumper logs and concrete wheel stops with timber finish set five feet in front of timber bumper log	
38	East Sledgehammer	550+00	N	Maintain	Asphalt	Improve		
39	Bottom of Govin's Hill	595+00	N	Maintain	Asphalt	Asphalt	Remove boulders and extend guardrail	
40	West of waterfall	618+00	N	Maintain	Asphalt	Asphalt	Guardrail	
41	Waterfall – behind guardrail flare	625+75 & 627+50	S	Remove	Soil	Restored	Extend ditchline and/or guardrail	Design to prevent vehicles parking behind guardrail
42	Turnout with Biker Notice sign	635+00	N	Maintain	Asphalt	Asphalt	Guardrail	Unpopular parking spot, but useful for slide cleanup and currently has bicyclist sign
43	1st turnout inside park boundary on north side	642+00	N	Maintain	Asphalt	Asphalt	Extend guardrail	
44	1 st turnout inside boundary on south side	642+15	S	Reduce considerably	Gravel	Asphalt	Extend ditchline	Maintain enough depth for slow vehicles to pull off and allow faster vehicles to pass (approx. 20' deep for trucks), restore the remainder of the turnout. Post no parking signs along turnout.

Appendix 2: U.S. Highway 101 Lake Crescent Section Accidents 2009 - 2013

Date	Time	Location	Mile Marker	Weather	Road Surface	Property Damage	Injury	Collision Type	Comments
10/8/2013	18:14	Bottom Fairholme Hill				Yes		Collision with another motor vehicle	
9/28/2013	20:02		229	Rain	Wet	Yes		Collision with fixed object	
9/23/2013	7:25	Off Roadway	230	Rain	Wet	Yes		Collision w Fixed object	
9/15/2013	21:52	Off Roadway		Rain	Wet	Totaled			Gravel on roadway
9/4/2013	15:49		224	Cloudy	Wet	Yes		Non Collision	
7/28/2013	17:18	Off Roadway		Clear	Dry	No	No	Accident Class-other	
7/7/2013	5:40	Roadside		Clear	Dry	Yes		Collision with fixed object	
4/8/2013	11:51	Roadway	226	Clear	Dry	Yes		Collision with fixed object	
1/24/2013	8:37	Roadside	230	Clear	Icy	Yes		collision with fixed object	
1/20/2013	11:30	Roadway	231		Icy	Yes		Collision with fixed object	Tires extremely worn; slight grade
1/20/2013	22:00	Roadway	231.5		Icy	Yes		Non collision in ditch	
1/12/2013	11:11	Roadway	227		Dry	Yes		Collision with Animal	
12/15/2012	17:14	Roadside	219	Sleet	Icy/Slushy	Yes		Collision with fixed object	
10/19/2012	2:49	Roadway	227.9	Rain	Wet	Yes		Collison Other	
10/3/2012	12:50	Off Roadway	231	Clear	Dry	yes		non-collision	
7/12/2012	9:58	Roadway	221	Cloudy	Dry	yes	Minor	non-collision	
7/1/2012	23:00	Off Roadway	225		Dry	Yes		Collision with fixed object	
6/3/2012	7:12	Roadway	230		Dry	yes		Non-collision	Gravel, motorcycle
5/31/2012	14:00		230		Dry	Yes		Collision with fixed object	
5/19/2012	9:00	Roadway	222.5	Clear	Dry	Yes		Collision with another	

Date	Time	Location	Mile Marker	Weather	Road Surface	Property Damage	Injury	Collision Type	Comments
								motor vehicle	
10/14/2011	22:30	Outside Shoulder Right	222	Clear	Dry	Yes		Non Collision	DUI
9/25/2011				Rain	Wet	Yes		Collision with fixed object	Swerved right to avoid head-on
9/23/2011	0:12	Roadway				Yes		Collision with other object	Debris in roadway
4/26/2011	16:15	Outside Shoulder Left	225	Rain	Wet	Yes		Collision with fixed object	
4/5/2011	15:40		220.5	Rain	Wet	Yes		Collision with fixed object	
3/14/2011	6:00	Roadway	230	Rain	Wet	Yes		Collision with fixed object	
3/5/2011	16:00		224	Rain	Wet	Yes		Collision with fixed object	
7/24/2010	5:10	Outside Shoulder Right	231			Yes		Collision with fixed object	Loose gravel
7/24/2010	16:00	Workzone	231				Yes	Non Collision	Loose gravel; workzone
6/16/2010	17:45	Outside Shoulder Right	224.9	Clear	Dry	Yes		Non Collision	Motorcycle
5/4/2010	9:30	On Roadway	223.5	Cloudy	Dry	Yes		Collision with fixed object	
5/2/2010	13:35	Outside Shoulder Right	223	Ran	Wet	Yes		Collision with fixed object	
4/20/2010	12:25	Turnout/overlook off roadway	223	Rain	Wet	Yes		Collision with another vehicle	
4/17/2010	13:00		227	Rain	Wet	Yes		Collision with fixed object	Too fast for road conditions
4/2/2010	20:00		226	Rain	wet	Yes		Collision with fixed object	
2/12/2010	19:11	East of Fairholme Store; on road		Rain	Wet	Yes		Collision with fixed object	
2/3/2010	19:15	Roadside	226	Rain	wet		Minor	Collision with fixed object	
11/20/2009	10:30		223		Dry			Collision with another	

Date	Time	Location	Mile Marker	Weather	Road Surface	Property Damage	Injury	Collision Type	Comments
								object	
11/16/2009	14:44	Pullout, N side Hwy, outside shoulder	224	Rain	Wet		Minor	Collision with fixed object	
9/10/2009	12:52	Adjacent to Fairholme Store	221.1		Bare, Dry			Collision w another Vehicle	Failure to give full time and attention
3/15/2009	11:30	Fairholme Hill W/B			3" Snow	Yes		Collision with Fixed Object	

Source: NPS Olympic National Park data