ENVIRONMENTAL ASSESSMENT
OLYMPIC NATIONAL PARK FIRE MANAGEMENT PLAN

Submitted to:

Becky Brooks
Project Contracting Officer's Representative
National Interagency Fire Center
3833 South Development Avenue
Boise, Idaho 83705

and

Christina Miller
Planning and Compliance Lead
Olympic National Park
600 East Park Avenue
Port Angeles, Washington 98362

Prepared by:

SWCA Environmental Consultants
200 West 22nd Street, Suite 220
Lombard, Illinois 60148

March 2019

CONTENTS

FIGURES

TABLES

CHAPTER 1. PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Olympic National Park (herein called the park) is located on the Olympic Peninsula, in the northwest corner of Washington State and is administered by the National Park Service (NPS). The park was originally established in 1938, with additions in 1940, 1943, 1953, 1976, 1986, and 1988, bringing the park to 922,651 acres. The park was established:

> "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 (H.R. 2247)."

This Environmental Assessment (EA) was prepared for the update of the park's Fire Management Plan (FMP) in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (40 Code of Federal Regulations [CFR] 1508.9), and the NPS Director's Order 12 Conservation Planning, Environmental Impact Analysis, and Decision-Making (2015).

The term wildland fire is used throughout this EA, as defined in NPS Reference Manual 18: Wildland Fire Management (RM-18; NPS 2014a: Chapter 2, pg. 1). The definition is summarized here for the reader. Wildland fire is a general term describing any non-structure fire that occurs in vegetation and/or natural fuels. There are two types of wildland fire: planned ignitions and unplanned ignitions. Planned ignitions are also referred to as prescribed fire. Prescribed fire is any fire intentionally ignited by management under an approved plan to meet specific objectives. Unplanned ignitions are those fires not intentionally ignited by management and are also referred to as wildfire. Unplanned ignitions can be human-caused (intentionally or unintentionally) or naturally caused (such as by lightning strikes). A prescribed fire that has expanded beyond the prescribed fire plan is considered a wildfire. These terms are used throughout the EA and are visually summarized in Figure 1.1.

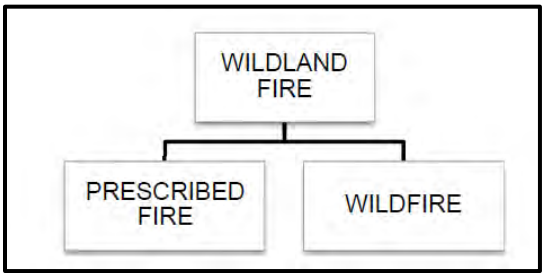


Figure 1.1. Types of wildland fire as defined in NPS Reference Manual 18 (NPS 2014a: Chapter 2).

Fire is an age-old element of ecosystems on the Olympic Peninsula (Agee 1994). As a natural disturbance process, wildland fire influences the species composition and vegetative structure across the landscape. In addition to naturally occurring fires, American Indians intentionally applied fire in prehistoric times to modify portions of their environment (Agee 1993; Boyd 1999). In the modern era, fires are ignited by natural causes (lightning) and, directly or indirectly, as a result of a range of human actions. This EA provides for analysis of the alternatives relative to the implementation of the park's FMP, a planning and operational document that ensures the protection of life and property and sensitive natural and cultural resources, while advocating for the perpetuation of natural ecosystem processes in the park. The no action alternative continues the strategy of the 2005 Fire Management Plan, which limits opportunities for managing wildfire for multiple objectives, including resource benefits (NPS 2005).

The proposed FMP revision would address wildfire and fuels management throughout the park, including strategies for the suppression of unwanted wildfires, the management of some wildfires for multiple objectives, the use of prescribed fire, and the implementation of manual fuel reduction treatments.

All maps depicting the project area, alternatives, and resource information are provided in Appendix A. A list of acronyms and abbreviations used in this EA is also provided in Appendix A. A summary of the park's fire history is provided in Appendix B.

1.2 PROJECT AREA

Olympic National Park protects 922,651 acres of three distinct ecosystems, including rugged glacier-capped mountains, wild Pacific coast, and vast stands of old-growth and temperate rain forest (Figure A.1). The park encompasses one of the largest wilderness areas in the contiguous United States; 95% (876,447 acres) of the park is congressionally designated wilderness, offering visitors a chance to experience the diversity of the park in its natural and pristine state. A detailed discussion of resources that occur within the park is provided in Chapter 3, under the affected environment section for each resource.

Occupying the central core of the Olympic Peninsula, with a narrow strip along the Pacific coast, the park is within a 5-hour drive of the metropolitan region stretching from Vancouver, British Columbia, south to Seattle, Washington, and Portland, Oregon. The park is surrounded by a network of land and marine areas managed by state and federal agencies, tribes, and private interests. Among these entities are eight federally recognized tribes that have traditional association with the Olympic Peninsula, including the Lower Elwha Klallam Tribe, Jamestown S'Klallam Tribe, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Quinault Indian Nation, Hoh Tribe, Quileute Nation, and Makah Tribe. Federally owned lands surrounding the park make up the Olympic National Forest and include five designated wilderness areas (NPS 2008a, 2010).

1.3 PURPOSE OF AND NEED FOR THE ACTION

The purpose of the federal action is to update the FMP for the park to comply with the NPS's wildland fire policy directives and Director's Order 18 (DO-18), Wildland Fire Management. DO-18 requires that parks "with burnable vegetation must have an approved Fire Management Plan that will address the need for adequate funding and staffing to support its fire management program" (NPS 2008b:3). In addition, the purpose of the revision is to modify the management approach for using wildfire for multiple objectives, including the protection of listed species' habitat.

The existing FMP for the park needs to be updated to meet current NPS policies. The NPS, U.S. Department of the Interior (DOI), and interagency policies have changed since the 2005 FMP was written. Revisions and updates have been made to NPS RM-18 (NPS 2014a) to comply with the 2009 Guidance for Implementation of Federal Wildland Fire Management Policy (DOI and U.S. Department of Agriculture [USDA] 2009).

RM-18 identifies wildland fire management activities as "essential to the accomplishment of the NPS mission" and cites the following National Cohesive Wildland Fire Management Strategy (NPS 2014a: Chapter 1, pg. 4):

- Restore and Maintain Landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
- Create Fire-Adapted Communities: Human populations and infrastructure can withstand a wildfire without loss of life and property.
- Respond to Wildfire: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

The proposed update of the Olympic National Park FMP would:

- Bring the FMP into conformance with current NPS wildland fire policy directives and standards set forth in DO-18; its companion guidance document, RM-18; and NPS *Management Policies* (2006) addressing wildland fire management and resource protection.
- Improve overall management of planned and unplanned ignitions, and manual and mechanical treatments to reflect the experiences of the past decade. Since the park's 2005 FMP, wildfires have exceeded acreage constraints in the existing plan, and the NPS and U.S. Fish and Wildlife Service (USFWS) recognize that past wildfires have not resulted in adverse effects to listed species.

- Provide the park with the flexibility to manage fire on a landscape scale and in coordination with the U.S. Forest Service (USFS), in accordance with current federal wildland fire management strategy adopted since the publication of the 2005 FMP. Recent experience has brought into question the assumption that wildfires in difficult wilderness terrain can be readily suppressed without posing extreme risks to wildland firefighters and sensitive resources. Furthermore, the presence of steep, inaccessible terrain with heavy fuel types and other hazards can substantially limit direct fire suppression actions.
- Integrate the preservation of wilderness character into all fire management strategies and actions that have the potential to affect the park's wilderness.

The 2005 FMP is no longer adequate for managing wildfire as an ecological process within the park. Agee and Flewelling (1983) observed that because fire return intervals in the park are so long, the years of fire suppression have probably had minimal impact parkwide to date. The vegetative composition, structure, and fuels across the park are considered to be in a Fire Regime Condition Class I, meaning there has been little departure from the historical or natural range of variability. However, some of the natural fires that were suppressed at a small size might otherwise have grown large, creating forest openings and diverse habitats. It may be hundreds of years before fires occur again at those sites, thereby providing a missed opportunity for increasing habitat diversity. The approach of suppressing wildfires to meet the 2005 acreage constraints could eventually affect stand structure and composition, the abundance of subalpine meadows (Agee 1993), and habitat available for wildlife species (Huff 1984).

The park's recent fire history indicates that an average of 1,200 acres per year can be expected to burn, acknowledging that there will be years with little or no fire and other years with fires totaling several thousand acres. This average is also informed by fire specialists' expectations of continued environmental change that will continue the trend toward more active burning conditions.

The revision of the FMP is needed to address wildfire on a landscape scale and allow fire management activities to continue within the park, while addressing the resource needs of the park. Furthermore, the number of Fire Management Units (FMUs) can be simplified to reflect the adoption of wildfire for multiple objectives by the neighboring Olympic National Forest. This concept is discussed further in Chapter 2, under the no action alternative.

A summary of other NPS relevant plans and policies is provided in Appendix C.

1.4 FIRE MANAGEMENT PLAN GOALS AND OBJECTIVES

The goals and strategic objectives of the park's FMP and wildland fire program are as follows:

Goal 1. Ensure that firefighter and public safety is the first priority in every fire management activity.

Objectives/Actions:
- Provide required annual safety training to all red-carded personnel per the Interagency Standards for Fire and Aviation (Red Book) and NPS standards.
- Incorporate safety considerations into all decision processes (e.g., Wildland Fire Decision Support System [WFDSS], Fuel Treatment Plans, etc.). Follow safety and qualification standards per the Red Book.
- Provide adequate Personal Protective Equipment (PPE) to all operations staff.
- Provide operational briefings that include safety to all line personnel prior to each shift.

Goal 2. Maintain natural fire regimes to the maximum extent practicable so natural ecosystems can operate essentially unimpaired by human interference.

Objectives/Actions:
- Allow a range of fire effects and fire conditions to create a mosaic of fire severity across the landscape.
- Manage human-caused wildfires to minimize resource damage from suppression actions and unwanted fire effects.

Goal 3. Protect natural resources (including flora, fauna, air quality, geologic resources, aquatic resources) and cultural resources from adverse effects from wildfires, prescribed fires, and non-fire fuel treatments.

Objectives/Actions:

- Apply Minimum Impact Strategies and Tactics (MIST) to all fire operations (see Appendix D).
- Assign resource advisors to wildfire in the park when dictated by the values at risk.
- Implement resource-specific mitigation strategies as detailed in this EA.

Goal 4. Manage fire to preserve the tangible and intangible qualities of wilderness character.

Objectives/Actions:

- Manage natural ignitions in wilderness to maximize opportunities for fire as a natural disturbance process that promotes ecological integrity and preserves wilderness character.
- Provide justification for taking full suppression actions on naturally caused fires within the wilderness.
- Follow the Programmatic Minimum Requirements Analysis (PMRA) guidelines (Appendix E) and incorporate the applicable PMRA strategies for each fire into WFDSS.

Goal 5. Reduce hazardous accumulations of fuel near non-wilderness park structures.

Objectives/Actions:

- Inspect structures annually and prioritize fuels treatments.
- Work with other park divisions (e.g., maintenance) to remove identified hazardous fuels within the limitations of staff and budgets).

Goal 6. Manage fire on the Olympic Peninsula collaboratively by coordinating with other park divisions and neighboring agencies to improve landscape-scale management and maximize efficiency in fire management and response.

Objectives/Actions:

- Include other park divisions in planning and operations.
- Review interagency operating agreements annually. Update as needed.
- Develop a formal interagency agreement with USFWS and the USFS.

Goal 7. Maintain preparedness for wildfire response.

Objectives/Actions:

- Review and update the Interagency Fire Danger Operating Plan prior to each fire season.
- Submit budget requests and justification to support the program.
- Inspect and replace equipment, as needed.
- Provide required and additional training that effectively prepares personnel for fire response.

Goal 8. Ensure that financial costs are commensurate with protection or enhancement of resource and wilderness values during each wildfire response.

Objectives/Actions:

- Use the WFDSS analysis process for long-term events to evaluate preferred and alternate strategies.

Goal 9. Manage wildland fire using the best available science and technology. Use information gained through inventory and monitoring to evaluate and improve the program.

Objectives/Actions:

- Implement monitoring protocols as directed by Fire Ecology Assessment Tool (FEAT), Fire Effects Monitoring and Inventory System (FIREMON), Monitoring Trends in Burn Severity (MTSB), and Reference Manual 18.

Goal 10. Employ adaptive programmatic and incident management strategies that incorporate changing knowledge and conditions.

Objectives/Actions:

- Review the FMP and past year actions and identify areas for improvement.
- Identify new research opportunities.
- Incorporate new information and research into fire management objectives and operations.

Goal 11. Minimize the impacts of undesirable post-wildfire conditions on human safety, infrastructure, and natural, cultural, and wilderness values within the park.

Objectives/Actions:

- Following every wildfire within or adjacent to the park, assess the need to implement Emergency Stabilization/Burned Area Emergency Response (ES/BAER) and/or Burned Area Rehabilitation (BAR) to 1) protect human life, property, and critical natural and cultural resources from emergency post-fire conditions, and 2) stabilize, restore, or enhance the functionality of burned ecosystems, and repair or replace minor infrastructure damaged by wildfire or post-fire events, if determined necessary and appropriate to do so.
- Develop standard operating procedures for ES/BAER and BAR that are consistent with park fire management goals and objectives related to firefighter and public safety, infrastructure, and the protection of natural, cultural, and wilderness values.

1.5 DECISION TO BE MADE

The NPS Pacific West Regional Director will use the findings of this Environmental Assessment along with consideration of substantive public comments on the EA, to decide which alternative to adopt and whether the preferred alternative has the potential for significant and adverse environmental impacts. The Regional Director's decision is documented in a Finding of No Significant Impact, which concludes the NEPA process. If the NEPA process determines that the selected alternative has the potential for significant adverse impacts that cannot be effectively mitigated to a level below significance, the NPS must then begin the process to prepare an Environmental Impact Statement, modify the alternative to mitigate impacts to a level below significance, or decide to take no further action.

1.6 PUBLIC SCOPING

Public scoping for the park's Fire Management Plan Environmental Assessment was conducted from February 1 to March 2, 2018. Public scoping materials were posted on the NPS Planning, Environment and Public Comment (PEPC) website. A press release was emailed to the park's mailing list, which includes local media outlets. The NPS hosted four public scoping meetings in February 2018. These meetings were held in Quilcene (February 15), Amanda Park (February 20), Port Angeles (February 22), and Forks (February 28), Washington. The public scoping period ended on March 2, 2018. Eight comment letters or forms from the public and non-governmental organizations were received during the public scoping period. This EA reflects comments received from all entities during the public scoping period. A brief discussion of impact topics retained for further analysis and those issues considered but dismissed from further analysis is provided in Appendix F.

CHAPTER 2. ALTERNATIVES

NEPA requires federal agencies to explore a range of reasonable alternatives aimed at addressing the project's purpose, need, and objectives. The alternatives considered must include the "no action" alternative as prescribed by Council on Environmental Quality regulations for implementing NEPA (40 CFR 1502.14). Alternative A, the no action alternative, would continue the park's current fire management program. Current fire management practices differ in some areas from what is described in the 2005 FMP due to changes in policies and requirements. The NPS also developed an action alternative, alternative B, to revise the 2005 FMP to reflect new policies, requirements, terminology, and updated wildland fire science.

2.1 OVERVIEW OF ALTERNATIVES

Based on input from internal and public scoping, preliminary consultation with permitting agencies, examination of regional fire history and trends, monitoring data, and current research, the NPS proposes two alternatives for examination in the EA. The no action alternative would maintain the current fire and fuels management strategy. Alternative B (the preferred alternative) proposes an update to the park's fire management strategy that would allow for a more flexible use of wildfire for multiple objectives, which includes increasing the number of acres allowed to burn annually. Table 2.1 provides a summary of each alternative considered in this EA. Terminology definitions and additional details about each main program element follow after Table 2.1.

Table 2.1. Comparison of No Action Alternative and the Preferred Alternative

Main Program Elements	Alternative A (No Action)	Alternative B (Preferred Alternative)
Fire Management Units (FMUs)	Three units: Exclusion, Conditional, Wildland Fire Use	Two units: Non-Wilderness, Wilderness
Wildfire Management	Wildfire suppression would be the wildfire management strategy for the Exclusion FMU. Wildfire for Multiple Objectives would be allowed as follows: • Maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, and an additional 600 acres once per 5 years in Conditional and Wildland Fire Use FMUs (combined) • Maximum of 500 acres over 5 years outside northern spotted owl and marbled murrelet habitat in Conditional and Wildland Fire Use FMUs (combined) • Conduct additional consultation with USFWS and environmental analysis if wildfires exceed the acreage limits. The need for fire suppression repair, BAER, or BAR activities would be assessed post-wildfire.	Wildfire in both FMUs would be expected as follows: • An average of 1,200 acres of wildfire per year based on current conditions and recent fire history • Wildfire for Multiple Objectives would be allowed under appropriate safety and resource conditions. The need for fire suppression repair, BAER, or BAR activities would be assessed.
Manual and Mechanical Treatment	• Maximum of 200 acres per year in wilderness and non-wilderness (combined) • In wilderness, manual and mechanical treatments may be used in accordance with PMRA, when wilderness is at immediate risk from wildfires.	• Maximum of 100 acres per year in the Non-Wilderness FMU. • In the Wilderness FMU, treatments may be used in accordance with the PMRA when wilderness infrastructure is at immediate risk from wildfires, until final decisions are made in the Wilderness Stewardship Plan.
Prescribed Fire: Pile Burning	• 200 acres per year of pile burning; maximum of 75 acres over 5 years of pile burning (non-wilderness only) • The potential use of pile burning in wilderness would be addressed in the Wilderness Stewardship Plan or separate environmental compliance and minimum requirements analysis (MRA).	• Maximum of combined 20 acres per year of pile burning (Non-Wilderness FMU only) • The potential use of pile burning by fire in the Wilderness FMU would be addressed in the Wilderness Stewardship Plan or separate environmental compliance and MRA.

Main Program Elements	Alternative A (No Action)	Alternative B (Preferred Alternative)
Prescribed Fire: Broadcast Burns	• In non-wilderness: a maximum of 125 acres of broadcast burn over 5 years, with no more than 65 acres in any one year. • In wilderness: broadcast burns would be dependent on the decisions made in the forthcoming Wilderness Stewardship Plan and require additional compliance.	• Broadcast burns would not be allowed in either FMU under the revised FMP without additional environmental review and compliance. • Broadcast burns in wilderness would be dependent on the decisions made in the Wilderness Stewardship Plan and require additional compliance.
Activities in Wilderness	• PMRA would be developed for most fire management operations (see Appendix E). • PMRA guidelines would be followed and applicable PMRA strategies for each wildfire event would be incorporated into WFDSS. • Methods and tools outside the parameters of the PMRA would require a separate MRA.	Same as alternative A.
Minimum Impact Strategies and Tactics (MIST)	MIST would continue to be used on all fire management activities.	Same as alternative A.
Resource Advisors	Consider for all fires over 10 acres	Assigned to wildfires based on the values at risk per WFDSS and Resource Advisor Guide.

2.2 PROPOSED FIRE MANAGEMENT ACTIONS

The two FMP alternatives would employ many of the same types of wildland fire and fuels management actions, but differ as to where in the park the actions could be employed (such as wilderness or non-wilderness locations), how the actions would be carried out, and under what circumstances. The EA provides descriptions of the common elements of each of the actions.

2.2.1 Consideration of Fire Management Actions in Wilderness

The vast majority of Olympic National Park is federally designated wilderness protected under the 1964 Wilderness Act (876,447 acres or 95% of the park). Wildland fire operations within wilderness areas would adhere to the requirements of the Wilderness Act, NPS *Management Policies* (2006); Director's Order 18, Wildland Fire Management; and Director's Order 41, Wilderness Stewardship.

All fire management activities affecting wilderness within the park must be evaluated using the minimum requirements analysis (MRA). This documented process is used to determine whether administrative activities affecting wilderness character, resources, or the visitor experience are necessary, and if so, what techniques and tools are needed to minimize impacts to wilderness character. The MRA is applied as a two-step process: 1) the NPS determines whether the proposed fire management action is necessary or appropriate for administration of the area as wilderness and does not cause a significant impact to wilderness resources and character; and 2) if the action is necessary/appropriate, the agency analyzes the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized.

To fulfill this requirement, a PMRA has been developed to guide fire management activities in wilderness (see Appendix E). Any fire management activities not listed in the PMRA require a separate MRA, approved by the superintendent prior to implementation. Programs or activities requiring a separate MRA include proposed pre-wildfire fuels treatment, post-wildfire programs/activities (i.e., emergency stabilization, rehabilitation, restoration), prescribed fire, and fire activities (including long-duration fire activities) within wilderness that are outside the scope of the PMRA. Though unlikely, if debris pile burning is proposed within the wilderness, a separate MRA is also required. Methods and tools outside the parameters of this PMRA require a separate MRA, including fireline explosives, remote satellite internet communications (e.g., satellite dish, Wi-Fi), generators (including those for powering communications), safety zone clearing, and the use of markers for fire ecological monitoring other than wood or buried metal (e.g., small metal bars and magnets), or any markers for long-term monitoring

(>2 years). Though only to be considered under extreme and rare circumstances in wilderness, a separate MRA would be required for use of heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles.

The majority of proposed long-duration fire activities within wilderness would likely fit within the scope of this PMRA. Any long-duration fire activities not approved within the PMRA, however, would require an incident-specific MRA to evaluate those tools and/or strategies. This may be triggered when there is an increase in operational activities as management action points are reached and an increase in personnel, equipment, and fireline construction is proposed that would go beyond the parameters within the PMRA. Prior approval by the park superintendent would be required in the form of a signed MRA specific to the event. Post-fire programs/activities (i.e., BAER, BAR) would also require separate MRAs.

2.2.2 Wildfire Suppression

Federal Wildland Fire Management Policy defines suppression as "all the work of extinguishing a fire or confining fire spread" (Fire Executive Council 2009:16). In accordance with Federal Wildland Fire Management Policy and NPS Reference Manual 18, the initial actions on human-caused wildfires will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Notwithstanding protection of life, the cost of suppression, emergency stabilization, and rehabilitation must be commensurate with values to be protected (Fire Executive Council 2009). A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. This section describes the type of suppression activities that could be employed for all or part of a wildland fire that needs to be curtailed, and Section 2.2.3, Managing Wildfire for Multiple Objectives, describes the type of activities that could be employed for all or a part of a wildland fire in order to: allow it to function in its natural ecological role; maintain natural fire regimes; and protect, maintain, and enhance resources.

Depending on the anticipated consequences and management objectives for the area that is likely to burn, any one or a combination of the following strategic and tactical actions may be chosen: a) full suppression—a strategy developed to achieve control of a fire and prevent it from exceeding a defined perimeter; b) point/zone protection—suppression actions taken to protect a specific point or area from fire, usually by directing the fire movement away from identified values at risk; c) monitor—a management strategy that periodically checks the fire to ensure objectives are being met; and d) confine—restricting a wildfire to a defined area, primarily using natural barriers that are expected to restrict the spread of the wildfire under the prevailing or forecasted weather conditions. These strategies may change in time and space in response to given and anticipated conditions, and subsequent effect of fire.

Wildfires are evaluated through deliberative risk analysis using the WFDSS process to determine the appropriate management response. The WFDSS analysis tool documents the decision to manage a naturally ignited wildfire, or part of a fire, for resource benefit and would depend on many factors including, but not limited to: firefighter and public safety, fire management unit objectives, fire cause, current and predicted weather, current and potential fire behavior and effects, proximity to private land and park infrastructure, resource availability, and cost effectiveness. Additional information about WFDSS is contained in the Interagency Standards for Fire and Fire Aviation Operations, also known as the "Red Book," which is available online at: https://www.nifc.gov/policies/pol_ref_redbook.html.

Wildfire suppression strategies would be implemented to curtail fire spread and minimize threats from an unwanted fire, either of human or natural origin. Depending on the location and nature of each fire, ground and/or aerial firefighting resources would be used to contain the fire. A range of fire suppression techniques would be used to break the continuity of forest fuels, cool a fire, and slow the advance of a flaming front. Actions may include construction of firelines; cutting of vegetation; and application of water, foam, or retardant. The application of fire is another fire suppression technique that can be used to consume (burn up) fuels between the advancing wildfire and a constructed fireline.

Small wildfires would be suppressed using hand tools—sometimes supported with a chainsaw for cutting fuels, a fire engine (only in non-wilderness) or portable pump for delivering water, and/or a helicopter to transport water, supplies, and firefighters. Larger fires or fires with greater spread potential may require the use of drip torches, fuses, fireline explosives, or retardant-filled aircraft or extensive water drops. All wildfire suppression activities would provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and the use of critical firefighting resources. Within wilderness, all proposed methods and tools would need to meet the parameters within the fire management PMRA.

Other suppression actions include mop-up activities such as extinguishing or removing burning material near firelines, felling snags, trenching logs to prevent rolling after an area has burned to ensure control of the fire, or reducing residual smoke. Patrolling the area provides information to help prevent, detect, and suppress spot fires and hot spots beyond the fireline. Fire suppression could also involve vegetation clearing for helispots. Staging areas for equipment and fire crews, as well as incident command centers, would likely be established within the park in non-wilderness. Spike camps could be located in wilderness or non-wilderness. Electronic devices including but not limited to global positioning units for mapping and locating fires, and cell phones and portable radios for communications, would be in use.

Fire suppression repair is a series of immediate post-fire actions taken to repair damage and minimize potential soil erosion and impacts resulting from fire suppression activities and usually begins before the fire is contained and before the demobilization of an Incident Management Team. This work would include the repair of firelines, roads, trails, safety zones, and drop points used during fire suppression efforts.

A BAER team may be called in during or after the suppression effort to develop a plan to rehabilitate park resources impacted by wildfire. The BAER team would identify emergency threats to human life, property, and critical natural and cultural resources. Non-emergency, longer-term threats and damages to minor infrastructure would be addressed via BAR. BAER/BAR treatments are developed based on impacts observed or anticipated. These may include treatments to address soil disturbance, erosion and compaction, sediments or excessive debris entering waterways, damage to roads and trails, spread of nonnative invasive plant species, damage to cultural resource sites, and hazardous trees near public use areas. BAER activities would likely require a stand-alone MRA.

2.2.3 Managing Wildfire for Multiple Objectives

Managing wildfire for multiple objectives, including resource benefit,[1] is a strategy that is used to accomplish predetermined resource management objectives in specific geographic areas. In accordance with Federal Wildland Fire Management Policy, fire managers have the ability to implement a full range of strategic and tactical options in response to a wildfire (defined above in Section 2.2.2). Based on the range of strategic and tactical actions that are deemed appropriate for a wildfire, an appropriate response could include aggressive suppression on one portion of the fire and monitoring another portion of the same fire. All actions related to managing wildfire for multiple objectives would be monitored to protect human life, property, natural and cultural resources, and wilderness character. Some wildfires would only be monitored due to the wildfire's location and minimum or low relative risk. In these cases, no on-the-ground operations would occur. If a wildfire managed for multiple objectives no longer meets the desired objectives or if external concerns (e.g., multiple new starts in the area) make it inadvisable to continue the action, the fire would be considered an unwanted fire and the WFDSS decision would be updated to incorporate changes in strategy.

Managing wildfires for multiple objectives would be used to allow fire to function in its natural ecological role; maintain natural fire regimes; and protect, maintain, and enhance resources. This strategy requires continuous monitoring, implementing MIST, and use of resource advisors to ensure that impacts to critical natural and cultural resources are minimized. Wildfires managed for multiple objectives would be coordinated with adjacent jurisdictional agencies to minimize unwanted spread onto adjacent lands to the extent practicable.

2.2.4 Manual and Mechanical Treatments

Manual and mechanical treatments include the use of hand-operated power tools and hand tools and specialized equipment to cut, clear, or prune herbaceous and woody species. Specifically, RM-18 defines manual and mechanical treatments as follows:

> Manual: the use of hand-operated power tools and hand tools to cut, clear, or prune herbaceous and woody species. Plants are cut above ground level to remove undesired vegetation, or root systems are dug out to prevent subsequent sprouting and regrowth. Hand tools such as handsaws, axes, shovels, rakes, machetes, and hand clippers are used in manual treatments. Power tools such as chainsaws and power brush saws may also be used.

[1] The term "wildland fire use" was used in past documents, such as the 2005 Olympic National Park FMP, to describe a fire management strategy with similar objectives and practices.

> Mechanical: the removal of undesired or excess live and dead fuels through the use of wheeled tractors and crawler-type tractors or specially designed vehicles with attached implements, e.g., saw heads, excavators, fetching arches, and disks and blades. (NPS 2014a: Chapter 7, pg. 22)

In the park, manual and mechanical treatments have been used to remove excess woody debris from the ground; to remove "ladder" fuels, such as low limbs and brush which could carry fire from the forest floor into the crowns of trees; and to thin dense stands of trees in order to reduce the horizontal continuity of fuels. Occasionally, larger motorized equipment (e.g., boom truck, front end loader) would be used to move large boles and build burn piles. Large equipment would be restricted from driving off road unless included in a work plan and approved by the superintendent.

These actions are to be used as a preventative measure to reduce hazard fuels and provide defensible space around administrative sites, historic structures, wildland-urban interface communities, and roadways. Hazard fuel reduction around structures would reduce the likelihood of ignition, potentially reduce fire intensity and resistance to control, and lessen potential fire damage. The distance to be treated around each structure would vary from 0 to 250 feet and would depend on several factors including the size and value of the structure, historic significance, proximity to aquatic resources or important habitat, characteristics of local fuels (height, loading, flammability), wilderness character, visitor use of the area, and proximity to neighboring properties.

The park's interdisciplinary team would prioritize hazardous fuel reduction projects based on the following criteria: degree of hazard, proximity to values at risk, logical project sequence, coordination with adjacent efforts and land managers, environmental effects, and maintenance cycle. In the Wilderness Fire Management Unit (FMU), manual or mechanical fuel treatments may be used in accordance with the PMRA when park infrastructure is at immediate risk from wildfires.

The risk to individual structures outside wilderness would be rated using the International Code Council's *International Urban-Wildland Interface Code* (2015), a standard adopted by the NPS. The code identifies defensible space and maintenance requirements for wildland-urban interface areas.

At each site, the area closest to the structure, also known as defensible space, would receive the most intense fuel reduction, with subsequent grading to lighter treatments further from the structure. Due to the rapid growth of some tree species in this environment, some trees next to park structures may have grown relatively large since the establishment of the structure. In some cases, these trees create a fuel hazard because their limbs impinge on the structure or create a closed canopy adjacent to the structure where fire could move easily from crown to crown or from crown to structure. To balance concern over hazard fuels with concern for protecting old-growth trees, an interdisciplinary team would evaluate individual large trees. According to Franklin and Spies (1991), the density of shade-tolerant individuals larger than 16 inches diameter at breast height (dbh) in groups of at least 10 distinguish old growth from younger stands. Therefore, for the purposes of this plan, trees larger than 16 inches dbh would be considered components of old-growth stands, and would not be cut without specific evaluation by an interdisciplinary team.

Manual and mechanical treatments would occur on a cyclic basis to maintain lower fuel loads within the developed areas in the park. There are a large number of private properties within the park boundary where private landowners may accomplish fuel maintenance on their own lands. NPS requests that these property owners coordinate with the park staff prior to implementing fuel maintenance projects.

Thinned fuels would be used by the park for other projects, piled and burned in place, chipped on-site, or moved to another location such as a burn pit. The method of disposal depends on the logistics and character of the individual site. For example, material would be hauled away if there is no safe location to burn the thinned fuels or to avoid visual impacts from burned areas. After the initial treatment, most structures need regularly scheduled inspections to evaluate the need for vegetation retreatments to maintain defensible space. The maintenance treatments would primarily involve the use of hand tools such as loppers and D-ring brushers.

2.2.5 Pile Burning

Pile burning would be used to dispose of vegetative material that has been concentrated from manual and mechanical treatments for hazard fuel reduction or maintenance projects (i.e., cleaning up windfall debris from roads). Pile burning would occur in approved locations and would follow the guidelines in RM-18, Chapter 7- Fuels Management. Any

material being burned for debris disposal must be classified as permissible to burn under applicable federal, state, and local regulations.

2.2.6 Minimum Impact Strategies and Tactics (MIST)

MIST are incorporated into the planning and implementation phases of both alternatives (see Appendix D). The objective of using MIST is to reduce resource damage from fire management actions, while minimizing costs and providing for firefighter and public safety. MIST is a framework for conducting fire management actions by selecting strategies that cause the least impact on resources while allowing for the management of the fire's existing or potential behavior. Like the philosophy behind the MRA, which is required to assess an appropriate tool for use in wilderness, MIST directs firefighters to use the minimum tool in terms of resource impact to safely and effectively accomplish a task.

2.2.7 Prevention and Education

Fire information would continue to be communicated to the public through interpretive programs, NPS brochures, park films, press releases, social media, and the park website. This includes, but is not limited to, educational information, the dissemination of information regarding fire prevention and fire management projects, and the role of fire in the ecosystem.

2.3 ALTERNATIVE A: NO ACTION

Alternative A (no action) would continue the current management practices under the 2005 FMP, in conformance with current federal wildland fire management, NPS *Management Policies* (2006), and the park's General Management Plan.

2.3.1 Fire Management Units

Under alternative A, the park would continue to be divided into three fire management units: Exclusion Unit, Conditional Unit, and Wildland Fire Use Unit (Figure A.3). The three FMUs would be used to manage wildfire appropriately based on the geopolitical setting of the park.

The Exclusion FMU includes a coastal section and an inland section. The coastal section is a long, narrow unit situated between the Pacific Ocean to the west, and private and state-owned lands to the east. The inland portion of the Exclusion FMU consists of an irregularly shaped crescent that encircles most of the Wildland Fire Use FMU, except where there is adjoining Olympic National Forest wilderness along the southeastern portion of the park. Varying in width from less than 1 mile to more than 10 miles, the inland Exclusion FMU provides a protective area between the Wildland Fire Use FMU and non-NPS lands. The majority of access roads, developed visitor use areas, and administrative areas are located in the Exclusion FMU. Boundaries of the Exclusion FMU were chosen to capitalize on natural barriers, where fires could be more readily suppressed. More than 85% of the Exclusion FMU is within wilderness.

The Conditional FMU is located along the southeastern portion of the park between the Wildland Fire Use FMU and Olympic National Forest lands. Most of the Conditional FMU adjoins USFS wilderness. At the time the 2005 FMP was written, the USFS had not formally adopted wildfire for multiple objectives in the Olympic National Forest Plan. The purpose of the Conditional FMU was to allow cross-boundary management of wildfires between NPS and the USFS based on the most recent incident coordination between the USFS and NPS. Now that the wildfires are managed on a landscape scale by both federal agencies, the Conditional FMU is no longer necessary. Slopes are generally steep, many in excess of 80 percent. Approximately 99% of the Conditional FMU is within wilderness.

The Wildland Fire Use FMU consists of the rugged and remote interior of the park. The physical characteristics of the Wildland Fire Use FMU are similar to the Conditional FMU, with generally steep slopes, cirques, and valleys. The higher elevations consist of non-forested areas primarily composed of rock, snow, and ice. More than 99% of the Wildland Fire Use FMU is within wilderness.

2.3.2 Wildfire Fire Suppression

Under alternative A, all fires in the Exclusion FMU would be suppressed to protect frontcountry developments and to reduce the potential for wildfire to spread from or to adjacent lands.

In the Conditional and Wildland Fire Use FMUs, naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response. Suppression strategies would be implemented to extinguish or control a wildfire in order to protect human life and property, sensitive cultural and natural resources, or other values at risk that are threatened by fire.

2.3.3 Managing Wildfire for Multiple Objectives

A full range of management responses would be considered for naturally ignited wildfires in the Conditional and Wildland Fire Use FMUs. The appropriate management strategy for individual fires would be determined by conducting a risk analysis process and evaluating objectives using WFDSS, including input from interdisciplinary team members. In accordance with the 2005 FMP, wildfires managed for multiple objectives including resource benefit under alternative A would be limited to 200 acres per year in areas where there is suitable habitat for northern spotted owls or marbled murrelets, with an allowance for up to 600 acres to be managed as fire for resource benefit in one year out of five.

Wildfires managed for resource benefit would be limited to 500 acres per year in areas outside of suitable habitat. Naturally ignited fires in the Wildland Fire Use FMU that have the potential to exceed these acreage figures, but meet all other criteria for managing fire as a resource benefit, would be considered candidates, and would warrant additional environmental analysis and consultation.

The acreage limits were identified using data analyzed prior to the approval of the 2005 FMP. The limits were based on the worst-case scenario of fires intense enough to kill large trees, thus removing suitable old-growth habitat.

2.3.4 Manual and Mechanical Treatments

Since the FMP's approval in 2005, changes in manual and mechanical treatments have occurred based on updated policies, fire management guidelines, and resource limitations. Within non-wilderness, manual or mechanical treatments for preventative maintenance would be implemented in the Exclusion, Conditional, and Wildland Fire Use FMUs. A majority of non-fire fuel treatments would occur in the Exclusion FMU where the greatest concentration of structures is located. Under alternative A, manual and mechanical treatments may occur in wilderness in accordance with the PMRA.

Up to 200 acres per year of manual or mechanical treatments could be implemented across the entire park (wilderness or non-wilderness) on a cyclic basis in an effort to maintain lower fuel loads around park infrastructure and when park infrastructure is at immediate risk from wildfires.

2.3.5 Pile Burning

A maximum of 275 acres per year of pile burning over 5 years would occur in non-wilderness areas of the Exclusion, Conditional, and Wildland Fire Use FMUs to burn piles of cured vegetation cut during manual or mechanical treatment. A majority of pile burning would occur in the Exclusion FMU. The General Management Plan requires the park to develop a Wilderness Stewardship Plan to determine management actions in wilderness. Therefore, the potential use of pile burning in wilderness would be dependent on the decisions made in the forthcoming Wilderness Stewardship Plan or separate environmental compliance and MRA.

2.3.6 Prescribed Fire: Broadcast Burning

Broadcast burning under alternative A is allowed in only non-wilderness areas of the three FMUs. A maximum of 125 acres could be treated using broadcast burning over a 5-year period, with no more than 65 acres treated in any one year.

2.3.7 Resource Advisors

The park would consider assigning resource advisors to fire management operations and activities for all fires greater than 10 acres in size. Resource advisors would provide input in the development and implementation of fire strategies and tactics to minimize or mitigate the expected impacts of fire and fire suppression actions on natural and cultural resources and wilderness character.

2.4 ALTERNATIVE B (PREFERRED ALTERNATIVE): FMP REVISION

Alternative B would revise and update the park's FMP to reflect current federal regulation and guidance, and the best available science and practices in regard to fire management. Alternative B would provide a range of strategies and tactics that could be used to respond to changes in the environment and the specific needs of individual firefighting efforts.

2.4.1 Fire Management Units

Alternative B differs from alternative A in that Olympic National Park would be divided into two FMUs: the Wilderness Unit (876,447 acres) and the Non-Wilderness Unit (46,204 acres) (Figure A.4). Each FMU follows a set of management strategies which affect the level and extent of actions to be taken.

Fire management of the Wilderness FMU would focus on maintaining the natural fire regime and preserving wilderness character, while including standards and limitations necessary to protect other natural, cultural, or infrastructure resources. Elevation ranges from near sea level to almost 8,000 feet above sea level. Ground access is difficult in many areas of the Wilderness FMU due to generally very steep slopes (many greater than 80 percent). The Wilderness FMU encompasses all vegetation zones and non-forested areas in higher elevations. Streams and rivers flow east toward Hood Canal, north into the Strait of Juan de Fuca, and west to the Pacific Ocean.

The Non-Wilderness FMU includes scattered clusters of human developments such as developed visitor use and administrative areas, and access roads. The Non-Wilderness FMU would focus on protecting infrastructure, reducing the potential for wildfire to spread from or to adjacent lands, and may include components that enhance cultural or natural resource conditions. The elevation in the Non-Wilderness FMU ranges from sea level to about 7,200 feet and includes all vegetation zones except the Douglas-fir Zone.

2.4.2 Wildfire Response

All unplanned natural and human-caused ignitions in the Non-Wilderness FMU would receive a suppression-oriented response to protect frontcountry developments and reduce the potential for wildfire to spread from or to adjacent lands. In the Wilderness FMU, naturally ignited wildfires would be evaluated through a deliberative risk analysis and systematic decision-making process using WFDSS to determine the appropriate response. A wildfire or portions of a wildfire in the Wilderness FMU may receive a suppression-oriented response to protect firefighter and public safety, and values at risk.

In the Wilderness FMU, naturally ignited wildfire would be evaluated to protect, maintain, and enhance resources, and be allowed to function untrammeled in its natural ecological role to the extent practicable, in accordance with the current Guidance for Implementation of Federal Wildland Fire Management Policy (DOI and USDA 2009).

2.4.3 Managing Wildfire for Multiple Objectives

A full description and definition of managing wildfire for multiple objectives is provided in Section 2.2.3. Managing wildfire for multiple objectives, including resource benefit, under alternative B would differ from alternative A by providing fire managers with the flexibility to adapt to changes in the environment and updates in wildfire management policy. In response to data collected on wildfires in the Daniel J. Evans Wilderness and changes in fire behavior and fire size in recent years, an average of 1,200 acres per year of naturally ignited wildfire may be managed for resource benefit within the Wilderness and Non-Wilderness FMUs under alternative B.

This strategy allows for the natural process of wildland fire in the Olympic Range to be managed across the NPS and USFS boundaries, creating increased heterogeneity of forest stand structure, in order to promote a more resilient

landscape and reduce the spatial extent of high-intensity stand replacement wildfire that could severely alter the habitat of federally listed species.

2.4.4 Manual and Mechanical Treatments

In the Non-Wilderness FMU, up to 100 acres per year of mechanical and manual treatment could be implemented as a preventative measure to reduce hazardous fuels and provide defensible space around developments and infrastructure. In the Wilderness FMU, manual or mechanical fuel treatments may be used in accordance with the PMRA when park infrastructure is at immediate risk from wildfires. In some cases, vegetation clearing may be required in addition to other structure protection activities, such as covering the structure with fire-resistant wrap or foam.

2.4.5 Pile Burning

Alternative B differs from alternative A by proposing a maximum of 20 acres per year of pile burning that would occur within the Non-Wilderness FMU.

2.4.6 Prescribed Fire: Broadcast Burning

Similar to alternative A, the potential for prescribed fire in the Wilderness FMU is dependent on the decisions made in the park's forthcoming Wilderness Stewardship Plan. Further compliance and consultation would be required to implement broadcast burns in either FMU.

2.4.7 Resource Advisors

Under alternative B, the NPS would assign resource advisor(s) to an incident as dictated by values at risk, the Resource Advisor guides, and WFDSS. Resource advisors would provide input in the development and implementation of fire strategies and tactics to minimize or mitigate the expected impacts of fire and fire suppression actions on natural and cultural resources and wilderness character. A resource advisor would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The resource advisor's duties during the incident would include comparing proposed management strategies and tactics with the limits established for each element/action of the assigned wilderness wildfire strategies (i.e., the wilderness minimum requirement guidelines for methods and tools in the PMRA).

2.5 COOPERATION AND COORDINATION

Under the Endangered Species Act (ESA), the NPS has an affirmative responsibility to conserve threatened and endangered species. Sections 7 and 10 of the ESA require consultation with the USFWS and National Marine Fisheries Service (NMFS) for any action proposed by a federal agency which may adversely affect a threatened or endangered species. The NPS is coordinating with the USFWS and NMFS regarding the potential effects to federally listed species from the revised FMP. This coordination and consultation effort is currently underway. In the event of a wildfire that is beyond the scope of the preferred alternative considered in this EA, the park may need to enter into emergency consultation with the NMFS and/or USFWS to comply with the ESA, while also responding immediately to the wildfire event.

The park would consult with the State Historic Preservation Office for planned treatments and unplanned wildfire activities. Planned fire management actions would be required to comply with Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 CFR 800). Unplanned actions would follow the process set forth under 36 CFR 800.12 for Section 106 compliance in emergency situations. Cultural resource specialists may be engaged, when necessary, to address cultural resource issues associated with planned and unplanned undertakings (e.g., archeologists, historical architects, cultural landscape architects, anthropologists). The park would consult with affiliated tribal groups during the fire management planning process and in response to unplanned fire-related activities.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the beneficial and adverse impacts that would result from implementing either of the alternatives that were previously described in Chapter **Error! Reference source not found.**. It is organized by resource and provides a comparison between the alternatives based on the issues identified for detailed analysis. This document addresses the direct and indirect potential environmental impacts from all aspects of the no action alternative and alternative B (the preferred alternative). At the conclusion of each resource discussion, applicable cumulative impacts are described and a brief conclusion of impacts is provided.

For the impact analysis provided in this chapter, it is assumed that the mitigation measures and best management practices described in Chapter **Error! Reference source not found.** would be implemented under both alternatives. These mitigation measures are intended to minimize adverse impacts to resources, while achieving the objectives of the FMP.

3.1 IMPACT ASSESSMENT METHODOLOGY

The environmental consequences for each resource were assessed 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 under *Environmental Consequences*, the analysis is based on a qualitative assessment of impacts.

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).

Type of Impact: The type of impact is a measure of whether the impact would improve or harm the resource and whether that harm would occur immediately or at some later point in time.

- **Beneficial:** Improves or benefits the resource being discussed.
- **Adverse:** Reduces or harms the resource being discussed.

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 the duration of the wildfire event up to two growing seasons.
- **Long-term:** Reversible over a much longer period, or may occur continuously based on normal activity, or for more than 2 years.

3.2 SIMILAR AND CUMULATIVE ACTIONS

Per the NPS Director's Order 12 NEPA Handbook (NPS 2015a), connected, similar, and cumulative actions are actions that result as a direct or indirect consequence of the alternatives and can be undertaken by federal, state, or local entities. There are no connected actions associated with the alternatives. Similar actions are those that have similar geography, timing, purpose, or other similar features to the preferred alternative. Cumulative actions are those actions that have additive impacts on a particular resource. Cumulative actions may have occurred in the past, present, or are reasonably foreseeable to take place in the future. Table 3.1 summarizes similar and cumulative actions.

Table 3.1. Similar and Cumulative Actions to Be Analyzed in the EA

Action	Summary of Action
Mountain Goat Management Plan	The NPS, in cooperation with the USFS and the Washington Department of Fish and Wildlife, has completed an Environmental Impact Statement for a Mountain Goat Management Plan to address resource stewardship and human safety concerns resulting from the presence of nonnative mountain goats within Olympic National Park. The selected action includes removal of the nonnative mountain goat population from the Olympic Peninsula. Fifty percent of the goats would be translocated to native mountain goat habitat within Mt. Baker-Snoqualmie and Okanagan-Wenatchee National Forests, 40% of the goats would be lethally removed, and the remaining 10% of goats would either be lethally removed if accessible or allowed to diminish naturally.
Final Disposition of the Enchanted Valley Chalet	The NPS is currently preparing an EA for the future of the Enchanted Valley Chalet, which is located on an active floodplain of the Quinault River within the park's wilderness. Constructed in the early 1930s, the chalet served as a backcountry lodge, a wilderness ranger station, and emergency shelter. The chalet is listed in the National Register of Historic Places. In 2014, a concise EA was prepared and the chalet was temporarily relocated as an emergency action for the protection of the Quinault River and bull trout critical habitat. The current EA will assess options for the final disposition of the historic structure.
Washington State Department of Transportation Elwha Bridge Replacement	The Washington State Department of Transportation is working with Olympic National Park to develop an EA that proposes to reconstruct the existing U.S. Highway 101 Elwha River Bridge on Elwha Project Lands managed by the NPS. This action would require a Highway Easement Deed. The proposed action also includes realignment of the U.S. Highway 101 intersection at Olympic Hot Springs Road.
Verizon at Hurricane Ridge	The purpose of this project is to comply with NEPA and consider Verizon's (VZW) application for an NPS right-of-way permit to site a cell tower and associated equipment at Hurricane Ridge. VZW proposes to provide Long Term Evolution wireless coverage to the Hurricane Ridge Visitor Center, and surrounding trails and recreational areas, some of which may be located in wilderness. VZW's proposal requests construction of a wireless telecommunications facility near the main parking lot. The facility would be located in non-wilderness and would include panel antennas, a microwave dish, equipment cabinets, and a diesel generator.
Pacific Northwest National Scenic Trail	The USFS Region 6 is developing a Comprehensive Plan to establish administrative and management goals, objectives, and practices for public lands through which the 1,200-mile-long Pacific Northwest National Scenic Trail passes. This includes the Northern and Pacific Northwest Regions of the Forest Service, as well as Glacier, North Cascades, and Olympic National Parks, and Bureau of Land Management lands in northern Washington.
Olympic Hot Springs Road Geotechnical Investigation	The NPS, in coordination with the Federal Highway Administration, has completed an EA to conduct a geotechnical investigation to assess subsurface conditions of the eastern bench adjacent to the Olympic Hot Springs Road. The road has been damaged by repeated flooding, leading to frequent closures and costly repairs. The geotechnical investigation would help determine the feasibility of relocating the road to the adjacent bench on the east side. Other considerations may include long-term access to the Elwha Valley.
Olympic National Park Wilderness Stewardship Plan	The NPS has recently terminated the Wilderness Stewardship Plan planning process. However, in the near future, the park intends to reinitiate the project, to include new alternatives. The Wilderness Stewardship Plan will guide the long-term management of the Daniel J. Evans Wilderness. The Wilderness Stewardship Plan will establish long-term goals, monitoring, and management strategies that will protect wilderness character.
Elwha River Ecosystem Restoration Project	The NPS completed an Environmental Impact Statement for the proposed full restoration of the Elwha River ecosystem through the decommissioning of the Elwha Dam (removed in 2012) and the Glines Canyon Dam (removed in 2014) and issued the Record of Decision in June 1995. The project also includes ongoing research, monitoring, and revegetation efforts.
Wildland Fire Management	Federal and state agencies conduct ongoing wildland fire management activities that could cumulatively impact air quality, vegetation, wildlife, and special-status species habitat. The USFS conducts routine and specific projects near the interface with the park, with opportunities for managing wildfire for resource benefits on a landscape scale. Additionally, fire activities in British Columbia, Canada, could also have cumulative impacts to air quality in the vicinity of the park.
Military, private, and commercial overflights	Fixed-wing and helicopter flights occur regularly over the park to include military training activities; private charter flights; and commercial flights. Administrative flights also occur for research and resource monitoring, maintenance activities (such as, but not limited to, privy, trail, and repeater maintenance), and intermittent search and rescue operations.

3.3 AIR QUALITY

3.3.1 Affected Environment

Olympic National Park is designated as a Class I area under the Clean Air Act, as amended in 1977. All surrounding areas are considered Class II areas. A principal objective of the 1977 amendments is to prevent significant deterioration in areas where air quality meets or is better than the national ambient air quality standards (NAAQS), and to provide for improved air quality in areas that do not meet NAAQS ("nonattainment" areas). The 1977 amendments to the Clean Air Act

established Class I, II, and III areas, where emissions of particulate matter, sulfur dioxide, and nitrogen dioxide are to be restricted to control impacts on visibility from haze and smog. The restrictions are most protective in Class I areas, such as Olympic National Park. In accordance with the Clean Air Act, the NPS, as the Federal Land Manager of the park, is responsible for the protection of the park's air quality-related values (AQRVs) such as visibility, odors, plants, animals, soils, water quality, and cultural and historic structures that may be affected by air pollution. Federal managers use AQRVs to determine the impact of pollution to federal lands. Visibility, both day and night, is a sensitive AQRV affected by air pollution.

As a Class I area, only the smallest increment of criteria pollutants can be added to the air by a proposed source. Stationary and mobile emissions in the region are the major sources of air pollution near the park. These include motorized vehicles, paper mills, lumber mills and associated lumber processors, marine vessels, sand/gravel/asphalt companies, residential wood heating, urban development, agriculture, logging, slash burning, prescribed forest burning, and wildfires.

Under the Clean Air Act, the park must follow strategies to ensure that its air quality is enhanced or maintained with no significant degradation and that nearly unimpaired views of the landscape are available within and outside the park. These policies and strategies are meant to ensure that scenic views that are integral to the visitor experience, which have been identified in the park in accordance with the Clean Air Act, remain substantially unimpaired (NPS 2017).

The NPS also has developed guidance on air quality and smoke management related to wildland fires in Chapter 9 of Reference Manual 18: Wildland Fire Management Guidance (2014a) and Reference Manual 77: Natural Resource Management (2004). Additional air quality guidance and policies include the *Interim Air Quality Policy on Wildland and Prescribed Fires* (U.S. Environmental Protection Agency 1998), federal Wildland Fire Management Policy (NPS 2014a), and PM_{10} Natural Events Policy (U.S. Environmental Protection Agency 1996). A principal park management objective is to manage air quality effects of prescribed fire by working with regional air district personnel and using the latest technology to monitor and manage smoke-related effects on visitors, residents, and employees. For a description of the park's fire history, refer to Appendix B.

The impact of wildland fires on air quality depends on meteorology, fire plume dynamics, the amount and chemical composition of emissions, and the atmosphere into which emissions are dispersed. The amount and composition of fire emissions depends on a range of variables related to fuel characteristics and fire behavior (Urbanski et al. 2009). Because wildland fire is an episodic event, combustion and visibility impacts occur primarily during the time the fire is burning; however, greenhouse gas emissions from wildland fire combustion would contribute long-term to ongoing climate change.

3.3.1.1 *National Ambient Air Quality Standards*

The primary objective of the Clean Air Act is to establish federal standards for various pollutants from stationary, mobile, and area sources, and to provide for the regulation of polluting emissions via State Implementation Plans. As required by the Clean Air Act and its amendments, the U.S. Environmental Protection Agency set national ambient air quality standards for six criteria pollutants considered harmful to public health and the environment. These include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in size (PM_{10}), particulate matter less than 2.5 microns in size ($PM_{2.5}$), and sulfur dioxide (SO_2) (Table 3.2).

The U.S. Environmental Protection Agency developed primary standards for air quality to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards were established to protect public welfare, such as protection against decreased visibility, and damage to animals or crops, vegetation, and buildings.

Table 3.2. National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead (Pb)	Primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)	Primary	1-hour	0.100 ppm	98th percentile, averaged over 3 years
	Primary and secondary	Annual	0.053 ppm	Annual mean
Ozone (O_3)	Primary and secondary	8-hour	0.075 ppm (75 ppb)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Matter (PM)	$PM_{2.5}$ Primary and secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10} Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)	Primary	1-hour	0.075 ppm	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.500 ppm	Not to be exceeded more than once per year

ppb = parts per billion

ppm = parts per million

µg/m^3 = micrograms per cubic meter

High concentrations of particulate matter create haze, diminish views, degrade visitor experiences, and potentially impact human health. Volatile organic compounds and NO_x and are both produced by wildland fires. The amount of NO_x and volatile organic compounds generated is dependent on the type of fuel, moisture content, and combustion temperature (Sandberg et al. 2002). Ozone, although not directly emitted from smoke, is formed as a secondary pollutant when sunlight reacts with volatile organic compounds and NO_x. Ozone production from fires is a complex interaction, dependent on amounts of various chemical reactants and catalysts available, radiation loading and air temperature, the size and intensity of the fire, the weather-controlled dispersion of the plume, and chemical composition of the burning vegetation (Nikolov n.d.). Ozone can be of particular concern to NPS managers as it can have a negative impact on plants and human health when present in high concentrations.

Wildland fires also produce a number of other toxic air pollutants, including but not limited to acrolein, benzene, and formaldehyde, but in much lower concentrations than particulate matter and CO (Ammann et al. n.d.; California Air Resources Board 2003). Particulates can remain suspended in the atmosphere for a few days to several months and can reduce visibility as well as contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can also result from multiple burn days and/or multiple landowners burning within an airshed over too short a period to allow for dispersion.

Common human health impacts resulting from wildland fire emissions include respiratory illnesses, cardiovascular conditions, and central nervous system effects. People with existing health problems, particularly respiratory problems, are most vulnerable, but even healthy people that are active outdoors can be affected when smoke emissions are high.

Areas in violation of NAAQS can be considered non-attainment areas subject to more stringent planning and pollution control requirements than areas meeting the standards. However, past and current monitoring indicates that air quality in the park is relatively good, with all areas currently in attainment of all criteria pollutant standards (Department of Ecology 2018; NPS 2018b).

3.3.1.2 *State and Local Ambient Air Quality Standards*

All prescribed fire and pile burning would comply with the latest regulations contained in the Washington State Department of Natural Resources (DNR) Smoke Management Plan (DNR 1998 or current version). The Smoke Management Plan provides regulatory direction, operating procedures, and advisory information regarding the management of smoke and fuels on the forestlands of Washington State. It applies to all persons, landowners, companies, state and federal land management agencies, and others who do outdoor burning in Washington State on lands where the DNR provides fire protection, or where such burning occurs on federally managed, unimproved forestlands and tribal lands of participating American Indian nations in the state (DNR 1998). The Smoke Management Plan does not apply to agricultural outdoor burning and open burning as defined by Washington Administrative Code (WAC) 173-425-030 (1) and (2), nor to burning done "by rule" under WAC 4 8/98 332-24 or on non-forested wildlands (e.g., rangelands) (DNR 1998). The plan applies to silvicultural burning only. Under the Revised Code of Washington (RCW) Clean Air Act (RCW 70.94), silvicultural burning means burning of wood fiber on forest land consistent with the provisions of RCW 70.94.660. All prescribed fire activities in the park are considered silvicultural burning. The Smoke Management Plan is supplemental to the forest fire protection laws of Washington State (RCW 76.04) and the Clean Air Acts of Washington State (RCW 70.94) and the United States (42 United States Code [USC] 7401 et seq.).

The park is located in Clallam, Jefferson, Mason, and Grays Harbor Counties, where air quality is regulated by the Olympic Region Clean Air Agency (ORCAA). ORCAA administers these regulations under the requirements and purposes of the Washington State Clean Air Act, contained in RCW 70.94, as amended, and the federal Clean Air Act. The RCW 70.94 states its intent to "protect the public welfare, to preserve visibility, to protect scenic, aesthetic, historic, and cultural values, and to prevent air pollution problems that interfere with the enjoyment of life, property, or natural attractions" (RCW 70.94). ORCAA designates an air quality burn ban when levels of fine particulate ($PM_{2.5}$) are predicted to exceed or exceed state and federal standards.

Additional clean air regulations are found in the WAC 173-400. A permit is required for all outdoor burning as specified under WAC 173-425-060; however, the DNR does not require a burn permit for less than 100 tons per day for silvicultural burning.

The FMP must be in conformance with the Smoke Management Plan. Smoke impacts must not adversely affect public health or welfare and must comply with state and NAAQS visibility protection requirements for any affected Class I area. In Section 6.11, *Air Quality* (Director's Order 41), park managers are given direction: "Managers will be responsible for reducing the impacts of smoke from wildland fires in wilderness, while understanding and promoting the need to re-introduce the natural role of fire into wilderness ecosystems."

3.3.1.3 *Visibility*

One of the concerns for fire management is avoiding prolonged smoke impacts on the views that are most important to park visitors, as well as protecting the overall park visibility. At times when the view from the Olympic Mountains is unimpeded by clouds, haze, or smoke, visitors can enjoy views of the Cascade Mountain Range to the east and northeast; Mt. Rainier to the southeast; the Strait of Juan de Fuca, Vancouver Island, and the San Juan Islands to the northeast; the Puget Sound Basin to the east; and the Olympic Mountain Range in all directions. Scenic viewpoints in the park include, but are not limited to, Lookout Rock, Hurricane Ridge, Hurricane Hill, and Deer Park—all heavily visited areas.

The NPS has conducted photographic visibility monitoring at Olympic National Park since 1980 to provide qualitative documentation of visual conditions. Beginning in 2001, the NPS has participated in the national Interagency Monitoring of Protected Visual Environments (IMPROVE) program and conducted fine particulate monitoring at the park. Among other measurements, IMPROVE provides data on $PM_{2.5}$ and PM_{10}. In addressing air pollutant emissions from fires managed for multiple objectives, the U.S. Environmental Protection Agency considers $PM_{2.5}$ and PM_{10} as the primary indicators of public health impacts (U.S. Environmental Protection Agency 2018). Based on NPS Air Resources Division benchmarks, impacts to visibility warrant moderate concern at the park.

3.3.1.4 *Designated Areas and Sensitive Areas*

Designated areas are critical areas in Washington State designated by the Department of Ecology that are currently subject to increased levels of air pollution (Figure A.5). These areas are Port Angeles, Spokane, Grays Harbor, Raymond, and the Interstate-5 corridor from Bellingham south to Vancouver (DNR 1998).

Smoke sensitive areas are special areas in and near the park where elevated concentrations of pollutants from smoke may cause human health or environmental impacts. Smoke sensitive areas are located outside of designated areas; communities and major roadways close to the park are smoke sensitive areas that are of concern for air quality because they include areas of heavy recreational use and population centers. Additional smoke sensitive areas may be identified and added to the Fire Management Plan as they are designated.

RCW 70.94.6538 states that the DNR would condition the issuance of burn permits to comply with air quality standards such that burning shall not cause the state air quality standards to be exceeded in the ambient air up to 2,000 feet above ground level over Department of Ecology-designated areas. Air quality standards shall be established and published by the Department of Ecology which shall also establish a procedure for advising the DNR when and where air contaminant levels exceed or threaten to exceed the ambient air standards over such critical areas. The DNR shall set forth smoke dispersal objectives to minimize any air pollution from such burning and the procedures necessary to meet those objectives.

3.3.2 Environmental Consequences

3.3.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Wildfire suppression would be utilized in the Exclusion FMU. The use of a full suppression strategy would reduce the time that a wildfire burns, thereby reducing health and environmental impacts of poor air quality when compared to a wildfire managed for multiple objectives.

A full suppression strategy in non-wilderness areas requires fire crews that create exhaust emissions from vehicles, aerial resources, and equipment. This strategy requires an aggressive initial attack, which would likely use more vehicles, aerial resources, and equipment and generate more exhaust emissions than a wildfire that is uncontrolled, confined, or contained. A confine-and-contain strategy that attempts to limit the overall extent of the fire through fuel breaks may have higher combustion emissions and visibility impacts than a wildfire that is fully suppressed, because the fire would burn longer. However, this strategy could have lower exhaust emissions than a wildfire that is fully suppressed if fewer vehicles, aerial resources, and equipment are required. The use of a point protection strategy focuses suppression actions on individual natural/cultural values that are at risk and would likely have higher combustion emissions and visibility impacts than full suppression or confine-and-contain approaches because a larger portion of the fire would burn longer. This strategy may have lower exhaust emissions than the suppression or confine-and-contain approaches if fewer crew resources are required. In wilderness areas, a full suppression strategy would use fire crews with only hand tools (not power equipment) to suppress the fire, therefore impacts to air quality from vehicles, aerial resources, and power equipment would be avoided.

Suppression exhaust impacts would last for only the duration of the suppression activities and related crew travel and equipment transport. Impacts from exhaust pollution would be highest near the activity being conducted, or near vehicles used for travel, but would be relatively small and localized when compared to continuous, long-term exhaust emissions. Aircraft would use more fuel than other vehicles or equipment and would emit more exhaust pollutants. Combustion and visibility impacts occur primarily during the time a wildland fire is burning. For fires occurring in average years, past fire history suggests the duration of the fire would include 10 to 15 active burn days over a 3-month period, therefore the impacts would occur through this duration.

Suppression strategies reduce the time that a fire burns and would reduce air quality emissions, including greenhouse gases, in the short term. However, a full suppression strategy may result in increased fuel loads over the long term, which could raise the potential for a high-intensity, stand replacement fire that is typical of this infrequent fire regime. Smoke

impacts increase as fire size and intensity increase, and as fuel backlog is consumed (Schweizer and Cisneros 2014). High-intensity stand replacement fires typically have greater combustion and visibility impacts on air quality than other types of fires, but they occur infrequently, with long intervals between fires.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Tactical actions for multiple objective management strategies include point protection of sensitive resources, managing part of the wildfire for suppression while monitoring other parts of the wildfire, and establishing a planning area in which the wildfire can be managed for a variety of objectives. The range of strategies that are available under this management action would result in a range of impacts to air quality, depending on which strategies are chosen. These impacts would be consistent with those discussed previously for suppression only wildfire response; however, fewer aggressive suppression actions would need to be employed, reducing adverse impacts of suppression on air quality.

Managing wildfires for multiple objectives has the potential to contribute more particulate matter to, and reduce visibility in, local and regional airsheds due to the lack of control over weather and atmospheric conditions for the duration of the event. Managed wildfire ignitions are unpredictable as to when they occur and in terms of how long they last. Visibility would possibly be compromised, depending on the atmospheric conditions, thereby adversely impacting the park's AQRVs. The impact of emissions on visitors and the local community would depend on fire size, fuel, and weather conditions (especially conditions for dispersion of smoke), and an individual's sensitivity to smoke.

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs. In the event that all fires are contained to adhere to the acreage limit, due to the small scale for managed wildfire under the no action alternative, the impacts to air quality are expected to be localized and short-term, lasting for only the duration of the wildfire. If wildfires occur in steep terrain, hazards to firefighters may preclude suppression to adhere to habitat limits; if fires exceed habitat limits, emission impacts would increase with fire size.

The primary purpose of managing natural wildfires is to restore (and ultimately maintain) conditions which support the natural fire regime of fire-adapted ecosystems. While this would generate short-term particulate and visibility impacts, this action allows natural processes to perpetuate within the park. In the long term, particulate emission levels would be expected to drop as a result of a healthier and more resilient forest ecosystem. Large wildfires would occur infrequently, through proactive fire and fuels management, better resembling the infrequent fire regime that is characteristic of the wet mixed conifer forest type.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Exhaust pollutants (e.g., SO_2, NO_x, CO, PM, and hazardous air pollutants) would be emitted from all vehicles used for crew transport; motorized equipment such as chippers, front-end loaders, feller bunchers, helicopters, and airplanes; and manual equipment such as chainsaws, weed trimmers, and leaf blowers.

Mechanical and manual fuel reduction would be limited to a maximum of 200 acres per year in wilderness and non-wilderness areas (combined). Impacts would last for only the duration of the fuel reduction treatment and related crew travel. Impacts from exhaust pollution would be highest near the activity being conducted, or near vehicles used for travel, but due to the limited extent of the treatments under the no action alternative, emissions would be relatively small and localized when compared to continuous exhaust emissions. Aircraft would use more fuel than other vehicles or equipment and would emit more exhaust pollutants.

Mechanical and manual fuel reduction is generally successful in meeting short-term fuel reduction objectives and in changing stand structure and fuel beds such that treated stands are more resistant and resilient to high-intensity wildfire. The reduction of the potential for extensive high-intensity fires and the lowering of associated air quality impacts may improve overall air quality in the long term.

IMPACTS FROM PILE BURNING

The following impacts to air quality would result from the use of pile burning:

- Combustion emissions, as described previously, would occur from one or more small-point source debris piles (pile burning). Pile burning would likely have lower combustion impacts to air quality than broadcast burning.
- Local visibility reduction from smoke could occur near pile burning.
- Pile burning would typically have lower impacts to visibility and reduced combustion emissions when compared to wildland fire, because it would occur under carefully planned and controlled conditions, and because smoke management practices outlined in the DNR Smoke Management Plan (1998) would be adhered to, and MIST would be applied.
- Exhaust pollutants (e.g., SO_2, NOx, CO, PM, and hazardous air pollutants) would be emitted from vehicles and aerial resources used for the crew who are required to set and manage the burning. Vehicle and aerial resource exhaust impacts would last for only the duration of the action and related crew travel and equipment transport. Impacts from exhaust pollution would be relatively small and localized when compared to continuous, long-term exhaust emissions. MIST would be applied in order to reduce impacts to air quality from suppression techniques. Vehicle use would be limited to non-wilderness areas only.
- Pile burning normally occurs in only the winter months when visitor numbers are low. Burning at this time of year eliminates smoke impacts to visitors and staff. Piled material undergoes a curing process in order to be dry enough to burn in winter months. This dried material burns relatively clean with lower emissions. Because of the small size of treatments, emissions from pile burning would have a short-term local impact but would not contribute to regional particulate matter levels.

Pile burning would allow the park to reduce fuels around structures and other sensitive areas and reduce the chance for high-intensity, long-duration fires, and lower the associated long-term air quality impacts. Pile burning are implemented through a prescribed fire burn plan. The burn plan identifies measurable objectives and prescriptions that define the burn, potential hazards, personnel needs and safety, conditions under which the fire can be ignited (e.g., certain weather conditions), monitoring, and post-burn activities. Prescribed fires are carefully planned and closely controlled, and because smoke management practices are implemented, air quality impacts to health and the environment are typically lower than those described for wildfire. Pile burning would be implemented in only 275 acres per year of the non-wilderness portion of the park over 5 years. The impacts from pile burning under the no action alternative are therefore localized and would last for only the duration of the activity.

IMPACTS FROM BROADCAST BURNS

Under the no action alternative, no more than 125 acres of broadcast burning would occur in the non-wilderness portion of the park over a 5-year period. No more than 65 acres would be subject to broadcast burning in a given year. The park would take measures to manage smoke impacts resulting from prescribed fire. Prior to implementing a prescribed fire, a prescribed fire plan would be written that meets the requirements established in the Interagency Prescribed Fire Planning and Implementation Procedures Guide (Product Management System [PMS] 484; National Wildfire Coordinating Group 2017). Additionally, personnel responsible for managing prescribed fires would be trained in emission reduction techniques as outlined in the National Wildfire Coordinating Group Smoke Management Guide (Hardy et al. 2001) and the DNR Smoke Management Plan (DNR 1998), and continuous monitoring would be required throughout the burn.

Pre-burn planning and agency coordination would help guarantee that appropriate conditions exist during implementation of a prescribed fire and the likelihood for lower air emissions, such as smoke, to migrate away from the site-specific burn area. Prescribed fires would be carefully evaluated to consider smoke dispersal into nearby designated areas and smoke sensitive areas (see Figure A.5). The effects to air quality from prescribed fire would be short-term and localized near the prescribed fire area, including temporary impairment of visibility and health effects to sensitive receptors. The duration of the impact would coincide with the duration of prescribed fire activities, which due to the small scale would be only 1 to 2 days. Prescribed fires could improve the success of wildfire suppression operations by creating a mosaic of stand structures that enable more effective containment of wildfire, thereby resulting in long-term beneficial impacts to regional air quality.

Cumulative Impacts

The geographic extent for analysis of cumulative impacts on air resources is the local airshed. The duration of the cumulative impact would coincide with the duration of the concurrent events contributing to impaired air quality. Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA.

Military, private, and commercial overflights would cumulatively impact air quality within the airshed. These aircraft would primarily generate emissions through the use of equipment with combustible engines. These emissions would be limited to the duration of the flight within the airshed.

Under alternative A, prescribed fire activities would be allowed on 65 acres annually within the non-wilderness portion of the park. Cumulative impacts to air quality could occur if prescribed fire in the park coincides with either high wildfire activity locally or regionally, or if prescribed fire or wildfire for multiple objectives is happening concurrently on the neighboring Olympic National Forest. Smoke from managed fires, originating in the park, the National Forest, or as far north as British Columbia, could have an adverse cumulative effect on visitors in the park and the public in the local and regional airsheds, including designated areas and smoke sensitive areas. Managing natural wildfires for multiple objectives requires constant communication and coordination with DNR and ORCAA. During times of high wildfire activity, the DNR and ORCAA may discourage managing new fires and would encourage full suppression. Smoke impacts to local airsheds are monitored, advisories are given, and if air quality approaches unhealthy levels regionally, fires may be suppressed.

Long-term beneficial impacts from actions on the National Forest would include restored native habitat, increased habitat heterogeneity, and improved stand structure, thereby improving forest resiliency to a high-intensity wildfire over large areas that would contribute adverse impacts to air quality. Road improvements would contribute short-term localized emissions to the airshed, due to engine combustion from more vehicles and motorized equipment during the construction work.

Actions to improve ecosystem functioning and resiliency, for example the Elwha River Ecosystem Restoration project, provide overall beneficial impacts to air quality by improving forest health and resiliency within the park and reducing the potential for emissions resulting from high-intensity wildfire occurring across large areas. These actions, combined with actions in the park to restore forest health through fire management, would cumulatively improve air quality in the airshed. Overall, these actions would contribute short- and long-term impacts, which would be both adverse and beneficial to air resources.

The cumulative effects of the no action alternative (alternative A) to air quality would be sporadic and short-term, corresponding with the duration of all fire events. Adhering to the requirements of the *Unified Guidelines and Procedures*, National Wildfire Coordinating Group (2017) prescribed fire policy, and the prescribed fire plan template would mitigate smoke impacts. Impacts from the no action alternative plus impacts from the past, present, and reasonably foreseeable future actions described previously would result in short-term adverse cumulative impacts. The incremental impacts of the no action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring in the airshed.

3.3.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

The air quality impacts from wildfire, either an event that is targeted for suppression or managed as wildfire for multiple objectives, are the same as described previously under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in the Wilderness and Non-Wilderness FMUs, as conditions allow. Compared to the no action alternative, the preferred alternative would increasingly use managed fire for multiple objectives, adding slightly more emissions into the airshed. However, through

adherence to the DNR Smoke Management Plan and use of MIST, most adverse impacts to air quality would be mitigated, and impacts would be short-term, lasting for only the duration of the wildfire. By increasing the scope of fire management staff to manage fire for multiple objectives, residual stands would exhibit greater structural heterogeneity, resulting in reduced risk for high-intensity wildfire to spread across extensive portions of the park, which would otherwise generate larger-scale impacts to air quality within the greater airshed.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments are as described in detail previously under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. Manual or mechanical fuel treatments may be used in the Wilderness FMU in accordance with the PMRA when park infrastructure is at immediate risk from wildfires. Given the small-scale application of manual and mechanical treatments, impacts to air quality from exhaust emissions would be localized and short-term, lasting for only the duration of the treatment.

IMPACTS FROM PILE BURNING

Similarly, air quality impacts from pile burning are as described previously under the no action alternative. Under the preferred alternative, 20 acres per year of pile burning would occur within the Non- Wilderness FMU. The small-scale application of pile burning within the park would contribute negligible localized emissions to the airshed, for the duration of the activity.

No broadcast burning would be allowed within the park without additional environmental review and compliance. Without prescribed fire, the addition of smoke emission to the airshed would not occur.

Cumulative Impacts

Cumulative impacts to air quality under the preferred alternative would be the same as those described for the no action alternative except that fewer acres would be treated with manual or mechanical treatment, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative, therefore broadcast burns would not contribute incrementally to cumulative impacts (both adverse and beneficial) to air quality under this alternative.

Impacts from the preferred alternative plus impacts from the past, present, and reasonably foreseeable future actions described previously would result in short-term adverse cumulative impacts and long-term beneficial cumulative impacts to air resources. The incremental impacts of the preferred alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within the airshed.

3.3.2.3 *Conclusion*

Impacts to air quality resulting from suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives, except that fewer acres would be treated with manual or mechanical treatment under the preferred alternative, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative (additional compliance would be required), therefore smoke emissions would be lower than under the no action alternative. The management of wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative. This would result in increased emissions that contribute to poor air quality in the short term but would result in increased stand heterogeneity over the long term, providing opportunities for fire managers to contain future wildfires and prevent stand replacement fire spread across the park. In some years however, fewer than 1,200 acres of fire may be managed for resource objectives under the preferred alternative, and therefore opportunities to increase stand structural diversity would not be fulfilled, raising the potential risk of high-intensity, stand replacement wildfire impacting air quality over larger areas. Air quality impacts would also increase under the no action alternative, if acreage limits for wildfire managed for multiple objectives are exceeded; fire may resist containment within habitat acreage limits due to risk to firefighter safety or fires burning in steep inaccessible terrain.

3.4 VEGETATION

3.4.1 Affected Environment

In the Olympics, vegetation patterns and fire regimes reflect environmental gradients of moisture and temperature. Moisture increases from east to west and from lower to higher elevations. Temperature decreases from lower to higher elevations. Slope and aspect affect these variables as well.

Because of similarities in fire regimes and also the mosaic of vegetation associations found at all elevations, the park's woody plant associations are lumped into six vegetation zones for this analysis, based on dominant species in the highest level of the canopy (Agee 1993; Henderson et al. 1989)
(Figure A.6). Table 3.3 presents vegetation zones with their corresponding vegetation types and elevational ranges. Appendix G contains a description of each vegetation zone within the park. Detailed vegetation maps and aerial photographs appropriate to project-level planning are available at park headquarters.

Table 3.3. Vegetation Zones, Corresponding Dominant Tree Species, and Typical Elevational Range in Olympic National Park

Vegetation Zone	Dominant Tree Species	Elevation
Sitka Spruce Zone	Sitka spruce (*Picea sitchensis*)	Typically below 600 feet
	Western hemlock (*Tsuga heterophylla*)	
	Western redcedar (*Thuja plicata*)	
	Red alder (*Alnus rubra*)	
	Bigleaf maple (*Acer macrophyllum*)	
Western Hemlock Zone	Western hemlock	Elevations extend from about 500 to 2,000 feet on the west side of the park and from sea level to 4,000 feet on the east side
	Douglas-fir (*Pseudotsuga menziesii*)	
	Western redcedar	
Douglas-fir Zone	Douglas-fir	Middle elevations in the upper Dungeness River drainage
	Lodgepole pine (*Pinus contorta*)	
	Madrone (*Arbutus* spp.)	
Silver Fir Zone	Pacific silver fir (*Abies amabilis*)	Throughout the interior of the park, generally at middle elevations
	Western hemlock	
	Douglas-fir	
	Alaska yellow-cedar (*Callitropsis nootkatensis*)	
Vegetation Zone	**Dominant Tree Species**	**Elevation**
Mountain Hemlock Zone	**Pacific silver fir**	**Generally above 3,500 feet**
	Western hemlock	
	Mountain hemlock (*Tsuga mertensiana*)	
	Alaska yellow-cedar	
Subalpine Fir Zone	Subalpine fir (*Abies lasiocarpa*)	Generally above 4,000 feet to treeline
	Douglas-fir	
	Lodgepole pine	

Source: NPS (2008a)

Special-Status Plants

There are nine endemic plant species and more than 50 rare or sensitive (state-listed) plant species within Olympic National Park. At this time, there are no known federally listed special-status vascular plants within the park, however,

whitebark pine (*Pinus albicaulis*) is a candidate species for listing as threatened. The list of rare or sensitive plant species will be reviewed and revised as necessary on an annual basis to ensure current information for each fire season (NPS 2008a). In addition, the status of Alaska yellow-cedar (*Callitropsis nootkatensis*) is currently under review by the USFWS to determine whether it is a candidate for listing under the Endangered Species Act. In 2015, the USFWS issued a 90 day review finding that there is substantial evidence that the species may warrant listing.

Nonnative, Invasive Species

Approximately 246 species of nonnative plants are found within Olympic National Park, representing approximately 18.5% of the known park flora (by number of species). 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 park nonnative plants (60%) are perennials, which are the most persistent and difficult plants to control or eradicate. Attempts to limit species invasion by hand pulling, use of select herbicides and other techniques on known infestations have had limited success. While the majority of nonnative plants are found in disturbed frontcountry sites, nonnative plants occur throughout all geographic areas of the park and in all elevation zones (NPS 2008a).

The park has used debris burning to dispose of piles of nonnative plants that were controlled by pulling or cutting. This practice of using debris piles to dispose of nonnative, invasive species would continue under both alternatives.

3.4.2 Environmental Consequences

3.4.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Suppression activities used in the event of a wildfire would have adverse impacts on vegetation. Removal of vegetation along firelines and fuel breaks would result in the direct loss of individual plants; however, impacts are not expected to rise to population-level effects. Some trampling of vegetation could occur during suppression activities from firefighters and equipment, and vehicles could crush or remove vegetation in localized areas. Suppression actions could also contribute to the spread of invasive nonnative species through transport on firefighting equipment and the use of nutrient-rich retardant. Mitigation measures (see Appendix D) to inspect all equipment and post-fire BAER/BAR treatments would be implemented to mitigate this threat. MIST would be employed during a wildfire and resource advisors would work to mitigate impacts to wetlands, plant communities, and special-status plants. Adverse impacts of suppression actions on vegetation are generally expected to last for only the duration of the wildfire and for one to two growing seasons post-fire for smaller vegetation. Post-fire impacts would be longer term in the case of large tree removal for fireline construction. Impacts to vegetation from high-intensity wildfire have the potential to be widespread and long lasting, due to removal of large swaths of vegetation and adverse impacts to seed banks, soils, and hydrology.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

The use of wildfire would promote a naturally functioning ecosystem. Direct impacts to vegetation would occur from the removal of vegetation, though much of the park's vegetation cover has adapted to fire. Removal of vegetation through the use of wildfire for multiple objectives would have short-term, minor effects on vegetation. These adverse impacts would be expected to last one or two vegetation growing seasons to allow smaller vegetation to become reestablished after the wildfire event. Longer-term impacts would occur where large trees are lost to wildfire. Fire-tolerant and fire-resistant species would recover over time.

The use of wildfire for multiple objectives can enhance the cycle of nutrients by releasing nutrients bound in dead plant material, making them available for new plant growth. While fire encourages new growth of many plant species, it can also alter plant community composition. Fire can be used to clear plants from a landscape and, when used in conjunction

with other management tools, to negatively impact nonnative plants or other invasive species that dominate certain habitats to the extent that habitat quality is compromised. The fire regime in the park is characterized by infrequent fires ranging from low to high intensity. In the cooler, moister vegetation zones (Sitka Spruce, Silver Fir, and Mountain Hemlock), fires have been much less frequent than on drier or warmer types (Western Hemlock, Subalpine Fir, or Douglas-fir). This fire regime has not been heavily influenced by fire management policies; therefore, managing wildfire for multiple objectives would perpetuate a natural fire regime and would have long-term direct beneficial effects on vegetation.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Under the no action alternative, a maximum of 200 acres per year would be manually or mechanically treated. Manual fuel treatments would generally be used to create defensible space around developed areas and park infrastructure. In wilderness, manual and mechanical treatments may be used in accordance with the PMRA when wilderness infrastructure is at immediate risk from wildfires. Impacts to vegetation from manual and mechanical treatment include the direct removal of limited vegetation in localized areas, the limbing of larger trees, and the thinning of dense tree stands. Additionally, mechanical treatment impacts small, localized areas as a result of increased erosion following vegetation removal or compaction of soils from equipment. However, based on the equipment likely to be used and MIST-related actions listed in Appendix D that would be implemented to reduce erosion and compaction, subsequent adverse impacts to vegetation, including invasive species encroachment, are expected to be minimal and short-term. Park resource specialists would be involved during manual and mechanical fuel treatment planning to ensure that treatments do not conflict with objectives for the protection of special-status plant populations, thereby minimizing impacts to these species.

IMPACTS FROM PILE BURNING

Under the no action alternative, 275 acres per year of pile burning would occur over 5 years. Pile burning would remove piles of vegetation generated by manual or mechanical treatment, thereby reducing fuel loading that creates wildfire hazards around developed areas and infrastructure. If a wildfire occurs under reduced fuel conditions, there would be fewer fuels to support a high-intensity fire, making wildfire suppression more easily attainable with fewer vegetation-damaging suppression tactics required. The likelihood of direct consumption of organic matter is reduced in lower-intensity fires.

IMPACTS FROM BROADCAST BURNS

Areas of denser vegetation may be removed to reduce fuel loads prior to prescribed broadcast burns, resulting in a loss of individuals and potential impacts to species populations on a localized level. The use of prescribed broadcast burns would result in short-term adverse effects to vegetation, via removal of individuals or local populations, and in long-term beneficial impacts to vegetation communities through maintaining ecological function and supporting native species. Additionally, several vegetation communities in the park are fire-adapted and the use of broadcast burns would restore historic and more natural conditions in these areas. Prescribed fire improves soil nutrient cycling and in turn promotes plant productivity. Prescribed fire helps thin encroaching scrub/shrub components, thereby reducing competition for limited resources and restoring native vegetation structure and composition. Prescribed fire does have potential to contribute to the spread of invasive nonnative species through transport on firefighting apparatuses. MIST-related actions listed in Appendix D, such as washing and inspecting all apparatuses prior to a prescribed fire, would be implemented to avoid and mitigate this threat. Additionally, in some instances, small sections of a prescribed fire may burn too hot, leading to excessive mortality of older trees, development of brush thickets, and increased susceptibility to invasive species.

Cumulative Impacts

The geographic extent for the analysis of cumulative impacts on vegetation is the park boundary and adjacent lands in the Olympic National Forest. The temporal scope of cumulative impacts on vegetation is approximately one to two growing seasons when considering the short-term impacts from fire management activities, and hundreds of years when considering the average fire return interval in the park. Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA. Cumulative impacts to vegetation could occur as a result of the no action alternative and other actions (e.g., development, fire management

activities, or prescribed fire conducted within or adjacent to the park, and trail and road maintenance in the park). The cumulative effects of removing individual plants is not expected to rise to population-level effects. While broadcast burns associated with other agencies could temporarily impact vegetation, such activities are expected to provide long-term benefits through improved ecosystem functioning, maintenance of historic vegetative conditions, and improved resilience to wildfire across a broader area. The no action alternative would incrementally contribute to cumulative short-term adverse and long-term beneficial impacts to vegetation.

3.4.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

The vegetation impacts from wildfire suppression are as described previously under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

The vegetation impacts from wildfire for multiple objectives are as described previously under the no action alternative. Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in Wilderness and Non-Wilderness FMUs, as conditions allow.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments are as described in detail previously. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU.

IMPACTS FROM PILE BURNING

The vegetation impacts from pile burning are as described previously under the no action alternative. Under the preferred alternative, a maximum of 20 acres per year of pile burning would occur within the Non-Wilderness FMU. No broadcast burning would be allowed within the park without additional environmental review and compliance. A lack of prescribed fire would preclude beneficial impacts to vegetation that may result from prescribed fire's addition of ash, organic matter, and nutrients to the soil in any areas that may have been treated.

Cumulative Impacts

The geographic and temporal scope of the cumulative impacts analysis for vegetation is described under the no action alternative. Similarly, the past, present, and reasonably foreseeable future actions that may impact vegetation are described under the no action alternative. As stated previously, the past, present, and reasonably foreseeable future actions would contribute short- and long-term adverse and beneficial cumulative impacts to vegetation.

Cumulative impacts of the preferred alternative would be the same as those for the no action alternative, with fewer planned management impacts as the acreage of planned treatments are reduced and broadcast burning would not occur. The preferred alternative would contribute short-term adverse impacts to vegetation when added to past, present, and reasonably foreseeable future actions, but would provide long-term beneficial impacts by increasing the opportunity for managing wildfire for multiple objectives. The incremental impacts of the preferred alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within plant communities in the park.

3.4.2.3 *Conclusion*

The effects on vegetation and sensitive plants as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives. However, the beneficial effects of managing wildfire for multiple objectives could occur across a larger area under the preferred alternative, which would result in increased heterogeneity of stand structure, which would reduce the potential for high-intensity wildfire to impact extensive areas of the park, improving forest resiliency over the life of the FMP. Under the preferred alternative, the impact of managing wildfire for multiple objectives would result in short-term adverse impacts

and substantial long-term beneficial impacts to plant communities. No broadcast burning would be allowed within the park under the preferred alternative without additional environmental review and compliance.

3.5 WILDLIFE

3.5.1 Affected Environment

Wildlife populations on the Olympic Peninsula have been shaped largely by geographic isolation of the peninsula. From dense, mixed-conifer forests, to the rock slopes in subalpine meadows, the park is home to a variety of fish, birds, and other wildlife throughout these diverse habitats (NPS 2017). It is estimated that there are approximately 300 avian, 65 mammalian, 13 amphibian, 29 freshwater fish, and 4 reptilian species on the Olympic Peninsula (NPS 2008a). See Appendix H for a detailed list of species that may occur within the park.

3.5.2 Environmental Consequences

3.5.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Fish

Fire suppression activities are not expected to result in direct effects to fish species. Removal of vegetative cover may cause a decrease in habitat quality due to increased water temperatures, increased suspended sediment, and decreased dissolved oxygen, which could cause displacement of individuals to unburned areas. However, displacement of individuals is expected to be temporary, and with MIST-related actions listed in Appendix D designed to mitigate impacts to water quality and implementation of post-fire BAER/BAR treatments, these effects would be minimized. Fish may also be directly and/or indirectly impacted from water removal from rivers needed for fire suppression. These impacts would be minimized with implementation of MIST-related actions listed in Appendix D designed to mitigate impacts to special-status fish species.

Mammals

During fire suppression activities, mammals may be disturbed by firefighters, use of motorized equipment, and water applications. The duration of this disturbance would be limited to the duration of fire management activities. Adverse effects to individuals are expected to be short-term and not rise to population-level impacts.

Birds

During fire suppression activities, birds may be temporarily displaced by disturbance resulting from firefighters, use of motorized equipment, and water applications. Nestling or fledgling birds may be lost through direct mortality during wildfire and suppression activities. Adult birds can easily escape disturbance and fire through flight. The duration of impacts would be limited to the duration of fire management activities. Permanent adverse effects to populations would not be expected to occur as a result of wildfire suppression.

Reptiles and Amphibians

During fire suppression activities, reptile and amphibian species may be temporarily displaced by disturbance resulting from firefighters, use of motorized equipment, and water applications. Suppression activities may result in trampling and crushing of individuals. The duration of these effects would be limited to the duration of fire management activities. Permanent adverse effects to populations would not be expected to occur as a result of these management activities.

Invertebrates

Impacts to invertebrates, particularly the butterfly species described previously in Section 3.5.1, would be similar to other mobile wildlife. Butterflies and other invertebrates may be temporarily displaced during suppression activities, but these impacts are expected to be short-term.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

Fish

Fire can result in fish mortality, though few studies have documented such direct effects (Rinne and Jacoby 2005). Severe fire and heavy fuel and slash buildup in riparian areas are predisposing factors for direct fish kills resulting from fire (Rinne and Jacoby 2005). Key factors in immediate mortality to fish and other aquatic species include size of the riparian area, fuel load present in the riparian area, severity of fire, and size of aquatic habitat (e.g., stream) (Rinne and Jacoby 2005). For example, a small stream with neighboring high fuel loads and high-severity fire is most likely to experience immediate aquatic species mortality primarily due to an increase in water temperature. Where such conditions exist in the park, if fire is not effectively contained, such impacts have potential to occur.

Increased suspended sediment loads from rain events over areas covered in ash could degrade the water quality of fish and aquatic species habitat. Much of the sediment loss can occur the first few years after a wildfire, though in some cases, sediment accumulations may take decades or even longer to recover to pre-fire conditions. The recovery of aquatic communities is often dependent on the presence of intact communities upstream and downstream from the burned areas, and a majority of the fires would burn themselves out in moist streamside areas, providing a natural buffer strip that would filter out products of erosion before they entered the stream. In the short-term, excess fine sediment can fill in pore spaces between cobbles where fish lay their eggs and in some cases, clog and abrade fish gills and suffocate eggs and aquatic larvae living on the bottom. Live fish can rapidly reoccupy fire-affected areas when their movements are not limited by barriers such as poorly designed road crossings and culverts, diversions, or dams.

There can also be a dramatic increase in in-stream nutrient levels the first year after a burn. Excess amounts of nutrients can cause algae blooms, which, when alive, decrease light penetration and, when dead and decomposing, decrease amounts of dissolved oxygen available in aquatic habitats. The introduction of fire retardant chemicals into water bodies can reach levels that are toxic to aquatic organisms. Fire retardants typically contain large amounts of nitrogen and phosphates, which could adversely impact aquatic habitats when fire-suppressing drops are made close to streams.

The use of wildfire for multiple objectives would have short-term adverse effects on fish and other aquatic species, and their habitat. Long-term benefits to fish and other aquatic species would occur due to the creation of a more heterogenous stand structure across the landscape, which mitigates the potential for large-scale, high-intensity stand replacing wildfire with accompanying adverse post-fire effects.

Mammals

Mammals, when mobile, can escape the heat and smoke of wildfire. Juveniles or litters may be killed by fire, but breeding adults likely would survive and reproduce in the same year or in subsequent years depending on the species and season. Individuals in less-mobile life stages (juvenile or roosting) and less-mobile, small mammal species could be adversely affected by the use of wildfire for multiple objectives. Based on the park's fire history, it is most likely that suitable and available habitat for many wildlife species would persist in other areas of the park during wildfire management events. Foraging opportunities may decrease for some species during the disturbance event, but may increase following fire. Volant mammals (bats) are often capable of escaping fire through flight (hibernating bats may be able but to a lesser extent) (Perry 2011). Impacts may include effects to habitat, including loss of cover and suitable foraging habitat, and temporary displacement of individuals (Perry 2011).

New growth in burned areas can provide increased forage quality and availability for wildlife. The use of wildfire for multiple objectives would provide long-term beneficial impacts to wildlife that may result from increased plant productivity, increased mosaic of stand ages and open patches, and reduced incidents of intense wildfire that removes overstory vegetation over large expanses. Over the long term, impacts of managed wildfire on vegetation are expected to result in improved ecosystem functioning and increased habitat diversity.

Birds

Wildfires managed for multiple objectives would be allowed to continue to burn, but are managed to prevent spread in certain directions or reduce intensity. Potential impacts to birds as a result of managed wildfire would be similar to those described for mammals—short-term adverse and long-term beneficial. During wildfire management activities, birds may be temporarily displaced by disturbance resulting from firefighters, use of motorized equipment, and the presence of wildfire. Nestling or fledgling birds may be lost through direct mortality during these managed events, especially during the migratory bird nesting season. Adult birds can easily escape disturbance and fire through flight. The duration of impacts would be limited to the duration of fire management activities. Permanent adverse effects to populations would not be expected to occur when using wildfire for multiple objectives.

Reptiles and Amphibians

Reptiles and amphibians have species-specific adaptations that allow them to avoid impacts from fire, including burrowing and selection of wetter habitats less prone to wildfire. Many reptiles and amphibians (e.g., some salamander species) depend on coarse woody debris and understory herbaceous vegetation to provide cover. Some species may depend on herbaceous cover to attract prey. Wildfire may result in consumption of this important habitat component for a number of growing seasons, causing adverse impacts to these habitat specialists (Rochester et al. 2010). Low-intensity fire may reduce soil moisture content through elimination of leaf litter and increase in light penetrating the soil surface. Reductions in litter mass, depth, and moisture may result in a decrease in some herpetofaunal species (e.g., terrestrial salamanders) as they depend on these habitat features for respiration and foraging. Fire would result in an increase in areas of early seral vegetation, benefitting species that select for more open and disturbed habitat (Rochester et al. 2010). Overall, effects to reptiles and amphibians as a result of wildfire are expected to be minimal and short term (temporary), adverse, and beneficial, as wildfire for multiple objectives would be managed to minimize effects to species.

Invertebrates

Impacts to invertebrates, particularly the butterfly species described in Section 3.5.1, would be similar to other mobile wildlife. Habitat loss would occur as a result of fire; however permanent adverse effects to populations would not be expected to occur. Over the long term, impacts of managed wildfire on vegetation are expected to result in improved ecosystem functioning and increased habitat diversity, particularly for pollinators.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Under the no action alternative, a maximum of 200 acres per year would be manually or mechanically treated. The use of manual and mechanical treatments (e.g., mowing and use of chainsaws) may cause noise or disturbance temporarily displacing wildlife. However, displacement is expected to be minimal and short lived. Vegetation management through mechanical treatment is discrete and targeted. In most cases, wildlife displaced from habitat could use adjacent habitats or undisturbed habitats elsewhere in the park. If young are present (e.g., in nests), they may be injured or killed during mechanical treatment.

Manual and mechanical treatments are not expected to result in effects to fish and other aquatic species. Removal of vegetative cover may cause a decrease in habitat quality due to increased water temperatures, increased suspended sediment, and decreased dissolved oxygen, which could cause displacement of individuals to unburned areas. However, displacement of individuals is expected to be temporary. Manual and mechanical treatments would generally not occur in wetlands or riparian areas, thereby minimizing adverse impacts to fish and other aquatic wildlife.

IMPACTS FROM PILE BURNING

Under the no action alternative, 275 acres per year of pile burning would occur over 5 years. Pile burning would occur in locations within the Non-Wilderness FMU. A burn plan for each fire would be prepared in advance, describing its objectives, fuels, size, the precise environmental conditions under which piles would burn, and conditions under which fires may be suppressed. Pile burning may temporarily displace wildlife, but these effects would be localized and short-term. Pile burning would generally not occur in wetlands or riparian areas, thereby minimizing adverse impacts to fish and other aquatic wildlife.

IMPACTS FROM BROADCAST BURNS

Under the no action alternative, no more than 125 acres of broadcast burning would occur in the non-wilderness portion of the park over a 5-year period. No more than 65 acres would be subject to broadcast burn in a given year.

Fish

Broadcast burns are not expected to be a threat to fish-bearing streams. Consideration of fish-bearing streams would be taken when planning prescribed fire, and during implementation of prescribed fires care would be taken to avoid streams and rivers. Fish and aquatic habitats could be adversely affected due to small amounts of short-term sedimentation from ash from broadcast burns. With implementation of measures designed to minimize the severity of prescribed fire and the resulting effects to aquatic resources, adverse impacts to fish and other aquatic species are expected to be negligible and short-term, if impacts occur.

Mammals

The temporary effects to mammals as a result of broadcast burns would be similar to those from wildfire (e.g., displacement). Prescribed fire provides varied habitat structure suiting a diverse wildlife assemblage and providing benefits to many species over the long term. Some species may use the encroaching vegetation for cover; therefore, prescribed fire could have adverse impacts for species using this habitat. It is expected that such species would be able to use other habitat in adjacent areas. Mitigation actions to minimize the severity of broadcast burns (e.g., development of site-specific prescribed fire plans and involvement of park wildlife specialists in fire management activities) would limit adverse impacts to mammals to the short-term.

Birds

Effects to birds as a result of prescribed broadcast burns are similar to those from wildfire. Some bird species would benefit in the long term from improved habitat created through the use of prescribed fire, e.g., the stimulation of growth and seed production of food plants for birds and other wildlife. Some bird species may use the encroaching habitat for cover; therefore, prescribed fire could have adverse impacts for species using this habitat. However, these species would be able to use other habitat in adjacent areas. The varied habitat structure created through broadcast burns would suit a diverse wildlife assemblage and provide benefits to many bird species. If young are present (e.g., in nests), they may be injured or killed during broadcast burning. Due to best management practices to minimize the severity of prescribed fire, including the development of site-specific prescribed fire plans and the involvement of park specialists in fire management activities, overall adverse impacts to bird species would be short-term.

Reptiles and Amphibians

Effects to reptiles and amphibians as a result of prescribed broadcast burns would be similar to those described previously for wildfires. However, broadcast burns create a mosaic of habitat, benefiting many reptile and amphibian species over the long term. Due to best management practices to minimize the severity of broadcast burns (e.g., development of site-specific prescribed fire plans and involvement of park wildlife specialists in fire management activities), adverse impacts to amphibians and reptiles would be short-term.

Invertebrates

Impacts to invertebrates from prescribed burns would be similar to those described for wildfire. Habitat loss would occur as a result of fire; however permanent adverse effects to populations would not be expected to occur. Management consideration would be given to determine the best method of preserving butterflies and their nectar source. Any manipulation of the prairies is pending further analysis.

Cumulative Impacts

Most wildlife are capable of escaping impact sources and can occupy adjacent habitat during disturbance and until habitat is restored. However, cumulative impacts to wildlife could occur under the no action alternative. These impacts could occur if mechanical treatments, wildfire, or broadcast burns occur simultaneous to development or planned/unplanned ignitions in adjacent areas. Such circumstances could compound the effects of temporary displacement on wildlife species by rendering habitats to which disturbed wildlife could escape also temporarily unsuitable. This could result in additional expenditure of energy and increased breeding and foraging competition. However, surviving individuals would be expected to repopulate disturbed areas over time. Species in less-mobile life stages (juvenile or nestling), and less-mobile species (small mammals, amphibians, and reptiles) could be cumulatively impacted by mechanical treatment and/or fire management through direct injury or mortality if they are experiencing similar effects from simultaneous activities.

Under the no action alternative, broadcast burns would be allowed on up to 65 acres annually within the non-wilderness portion of the park. Broadcast burns carried out by the NPS would avoid sensitive resources through the use of MIST-related actions listed in Appendix D, thereby not contributing to adverse cumulative effects to such resources. Prescribed fire may contribute beneficially to habitat quality of all wildlife within and surrounding the park.

3.5.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

Impacts to wildlife from wildfire suppression are as described under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Impacts to wildlife from the use of wildfire for multiple objectives, are as described under the no action alternative. Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in the Wilderness and Non-Wilderness FMUs, as conditions allow.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments are as described in detail under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. Within the Wilderness FMU, manual and mechanical treatments may be used in accordance with the PMRA when park infrastructure is at immediate risk from wildfire until final decisions are made in the Wilderness Stewardship Plan.

IMPACTS FROM PILE BURNING

Impacts to wildlife from pile burning are as described under the no action alternative. Under the preferred alternative, a maximum of 20 acres per year of pile burning would occur within the Non-Wilderness FMU annually. No broadcast burning would be allowed within the park without additional environmental review and compliance.

Cumulative Impacts

Cumulative impacts to wildlife under the preferred alternative would be the same as those described for the no action alternative, except that fewer acres would be treated with manual or mechanical treatment, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative,

therefore broadcast burns would not contribute incrementally to cumulative impacts (both adverse and beneficial) to wildlife under this alternative.

3.5.2.3 *Conclusion*

The effects on wildlife as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives. However, the beneficial effects of managing wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative, which would result in increased heterogeneity of stand structure and increased habitat diversity, and reduced potential for high-intensity wildfire to impact extensive areas of the park, improving forest resiliency over the life of the FMP. Under the preferred alternative, the impact of managing wildfire for multiple objectives would result in short-term adverse impacts and substantial long-term beneficial impacts to wildlife. No broadcast burning would be allowed within the park under the preferred alternative without additional environmental review and compliance.

3.6 THREATENED, ENDANGERED, AND SPECIAL-STATUS SPECIES

3.6.1 Affected Environment

Federally Listed Species

Federally Listed Fish

There are four species of federally listed fish that have been documented within Olympic National Park: Coastal-Puget Sound bull trout (*Salvelinus confluentus*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Lake Ozette sockeye salmon (*Oncorhynchus nerka*), and Puget Sound steelhead (*Oncorhynchus mykiss*). All of these species are listed as threatened under the Endangered Species Act and are described in Appendix H.

In addition, there are two federally threatened fish with designated critical habitat within a few miles (downstream) of the park boundary: Hood Canal summer chum salmon (*Oncorhynchus keta*) and eulachon (*Thaleichthys pacificus*). Neither of these fish species have been documented within the park boundary and therefore neither are included in this assessment, because it is unlikely that fire management activities will affect them.

Other Federally Listed Species

In addition to the fish species described previously, the Taylor's checkerspot butterfly (*Euphydryas editha taylori*), the northern spotted owl (*Strix occidentalis caurina*), and the marbled murrelet (*Brachyramphus marmoratus*) are listed as federally threatened species with suitable habitat and documented presence in the park. All of these species are described in Appendix H.

Within the park, fires that occur up to 3,500 feet (1,064 m) in elevation are of particular interest because most of the northern spotted owl and marbled murrelet habitat occurs within this range. Fifteen fires in the past 10 years occurred within northern spotted owl and marbled murrelet habitats. During those fires, approximately 1,700 acres of habitat were burned with moderate to high intensity (NPS, Rankin, pers. comm., 2018).

Critical Habitat

Federally Listed Fish

All four of the federally listed fish species described previously have designated critical habitat within the park (Figure A.7). Critical habitat for bull trout was designated for the Coastal-Puget Sound population of bull trout on the Olympic Peninsula, in marine and stream/shoreline habitat (effective October 26, 2005). Effective January 2, 2006, critical habitat was designated for 12 Evolutionary Significant Units of West Coast salmon. Included in this designation was critical habitat for the Lake Ozette sockeye salmon, Hood Canal summer chum, and the Puget Sound Chinook salmon. Critical habitat for Chinook salmon is designated to include all marine, estuarine, and river reaches accessible to listed Chinook

salmon in the Puget Sound. Critical habitat for the Puget Sound steelhead within the park is located in the Elwha, Gray Wolf, and North Fork Skokomish watersheds.

In addition to the critical habitat, the park also includes Essential Fish Habitat (EFH) for salmon. The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires federal agencies to consult with the NMFS on activities that may adversely affect EFH. Freshwater EFH in Olympic National Park includes all streams, rivers, lakes, ponds, and wetlands that support Puget Sound/Strait of Georgia coho salmon, Puget Sound Chinook salmon, and Puget Sound pink salmon.

Other Federally Listed Species

The park does not contain critical habitat for Taylor's checkerspot butterfly, marbled murrelet, or northern spotted owl, although critical habitat for these species does occur on adjacent National Forest lands.

Other Special-Status Species

The Puget Sound/Strait of Georgia coho salmon is a federal species of concern under the ESA with EFH. This species was classified as a Species of Concern on April 15, 2004. They can be found in the Quinault, Queets, Quillayute, and Elwha River basins within the park. The ESU includes all naturally spawned populations of coho salmon from drainages of Puget Sound and Hood Canal and the eastern Olympic Peninsula (east of Salt Creek), and other areas outside of the Olympic Peninsula. In the park, adult fish enter the rivers from September through early January, with some arriving as late as February. Spawning takes place from October into January, primarily in side channel habitats. Juveniles live for about a year in the river systems before migrating to the ocean from late March through mid-June.

Populations of the Puget Sound pink salmon have been identified in the Dosewallips, Duckabush, and Elwha Rivers within Olympic National Park. Pink salmon have also been observed periodically in the Skokomish River on Hood Canal and the Bogachiel River. Pink salmon have a fixed 2-year life cycle, the shortest life span among Pacific salmon (Washington Department of Fish and Wildlife 2018). River entry for pink salmon occurs from July to October in Washington, and spawning generally occurs from August to October. Freshwater EFH for Puget Sound pink salmon consists of spawning and incubation, juvenile migration corridors, adult migration corridors, and holding habitat (NMFS 2007). Additional special-status fish include the Dolly Varden (*Salvelinus malma*), which is listed as Proposed Similarity of Appearance to the ESA-listed Coastal-Puget Sound population of bull trout (USFWS 2018b).

In addition to the federally listed threatened and endangered fish species, critical habitat, and EFH, Olympic National Park includes some of the last remaining intact habitat for populations of Washington State-listed species. These include the Olympic mudminnow (*Novumbra hubbsi*), Pacific lamprey (*Lampetra tridentata*), and river lamprey (*Lampetra ayersi*). Species of special concern to the park include the Beardslee rainbow trout (*Oncorhynchus mykiss irideus*) and Crescenti cutthroat trout, as they are endemic to the park and are considered a keystone species in the Lake Crescent ecosystem (NPS 2008a).

Other wildlife species with the potential to occur within the park that are given special conservation status by Washington State are the bald eagle (*Haliaeetus leucocephalus*), Olympic pocket gopher (*Thomomys mazama melanops*), and fisher (*Pekania pennant*). The endemic Olympic marmot (*Marmota olympus*) is listed as a candidate species by the State of Washington (NPS 2008a).

3.6.2 Environmental Consequences

The Endangered Species Act prohibits harm to any species of fauna or flora listed by the USFWS and NMFS as being either threatened or endangered. The NPS has initiated formal consultation with the USFWS and NMFS on the potential for FMP actions to affect the federally listed species within the park (NPS, Miller, pers. comm., 2018).

Special-status species impact determinations are formally determined under the Endangered Species Act (Section 7). 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).

3.6.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Federally Listed and Special-Status Fish

Impacts to federally listed and special-status fish and their critical habitat from wildfire suppression would be the same as those described for other fish species in Section 3.5.2. Impacts would be more pronounced during spawning season. With implementation of MIST-related actions listed in Appendix D designed to mitigate impacts to these species, these impacts would be minimized.

Other Federally Listed and Special-Status Species

Impacts to marbled murrelet, northern spotted owl, checkerspot butterfly, and other special-status species from wildfire suppression activities would be the same as those described for mammals, birds, and invertebrates in Section 3.5.2. With implementation of MIST-related actions listed in Appendix D designed to mitigate impacts to these species, these impacts would be minimized.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Federally Listed and Special-Status Fish

Impacts to federally listed fish and their critical habitat from managing wildfire for multiple objectives would be the same as those described for other fish species in Section 3.5.2. Impacts would be more pronounced during spawning season.

Other Federally Listed and Special-Status Species

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet suitable habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined); thereby minimizing impacts to these species. Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs. General impacts to marbled murrelet, northern spotted owl, checkerspot butterfly, and other special-status species from managing wildfire for multiple objectives would be the same as those described for other mammals, birds, and invertebrates in Section 3.5.2. Impacts to these species from wildfire management would be reduced with implementation of MIST-related actions designed to mitigate impacts to these species (see Appendix D). Furthermore, management of wildfire for multiple objectives would lead to a more diverse habitat and improved ecosystem functioning in the long-term, which would benefit special-status species, particularly the Taylor's checkerspot butterfly.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Federally Listed and Special-Status Fish

Impacts to federally listed and special-status fish and their critical habitat from manual and mechanical fuel treatments would be the same as those described for other fish species in Section 3.5.2.

Other Federally Listed and Special-Status Species

General impacts to marbled murrelet, northern spotted owl, checkerspot butterfly, and other special-status species from manual and mechanical fuel treatments would be the same as those described for other mammals, birds, and invertebrates in Section 3.5.2. However, under the no action alternative, a maximum of 200 acres per year would be manually or mechanically treated in the Exclusion, Conditional, and Wildland Fire Use FMUs, thereby minimizing impacts to northern spotted owls and marbled murrelets and their habitat.

IMPACTS FROM PILE BURNING

Federally Listed and Special-Status Fish

Impacts to federally listed and special-status fish and their critical habitat from pile burning would be the same as those described for other fish species in Section 3.5.2.

Other Federally Listed and Special-Status Species

General impacts to marbled murrelet, northern spotted owl, checkerspot butterfly, and other special-status species from managing wildfire for multiple objectives would be the same as those described for other mammals, birds, and invertebrates in Section 3.5.2. However, under the no action alternative, up to 200 acres per year of pile burning would occur would be limited to no more than 75 acres over 5 years in non-wilderness areas of the Exclusion, Conditional, and Wildland Fire Use FMUs, thereby minimizing impacts to northern spotted owls and marbled murrelets and their habitat.

IMPACTS FROM BROADCAST BURNS

Federally Listed and Special-Status Fish

Broadcast burns are not expected to be a threat to fish-bearing streams. Consideration of fish-bearing streams would be taken when planning prescribed fires, and during implementation of prescribed fires, care would be taken to avoid streams and rivers. Fish and aquatic habitats could be adversely affected due to small amounts of short-term sedimentation from ash from broadcast burns. With implementation of MIST-related actions (see Appendix D) designed to minimize the severity of prescribed fire and the resulting effects to aquatic resources, adverse impacts to special-status fish are expected to be negligible and short-term, if impacts occur.

Other Federally Listed and Special-Status Species

General impacts to federally listed and special-status species from broadcast burns would be the same as those described for other mammals, birds, and invertebrates in Section 3.5.2; however, under the no action alternative, no more than 125 acres of broadcast burning would occur in the non-wilderness portion of the park over a 5-year period and no more than 65 acres would be subject to broadcast burns in a given year. Since marbled murrelet and northern spotted owl habitat occurs primarily in wilderness, these species would not be directly impacted by broadcast burning under this alternative.

Cumulative Impacts

Cumulative impacts to federally listed and special-status species under the no action alternative would be the same as those described for general wildlife in Section 3.5.2.

Section 7 Effects Determination Summary

Based on the analysis, under alternative A, actions related to managing wildfire for multiple objectives *may affect, are likely to adversely affect* threatened fish, bird, and checkerspot butterfly species. For wildfire suppression, the impact determination on federally threatened fish and checkerspot butterfly species is *may affect, not likely to adversely affect*; and on federally threatened bird species the impact determination is *may affect, likely to adversely affect*. For pile burning, there would be *no effect* on federally threatened fish species and *may affect, not likely to adversely affect* federally threatened bird and checkerspot butterfly species. For manual and mechanical treatments, the impact determination on federally threatened fish species is *no effect*; and on federally threatened bird and checkerspot butterfly species the impact determination is *may affect, not likely to adversely affect*. For broadcast burning, the impact determination on federally threatened fish species would be *may affect, not likely to adversely affect*; and there would be *no effect* on bird and checkerspot butterfly species. There would be *no effect* on designated critical habitat.

3.6.2.2 *Alternative B: Preferred Alternative*

Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in the Wilderness and Non-Wilderness FMUs, as conditions allow. Adverse impacts to marbled murrelet and northern spotted owl habitat from wildfire managed for multiple objectives would be greater under this alternative; however, the long-term beneficial impacts resulting from a more diverse ecosystem would also be greater. Impacts to federally listed and special-status species from wildfire, either an event that is targeted for suppression or managed as wildfire for multiple objectives, are the same as those described for general wildlife in Section 3.5.2.

Impacts to special-status species from pile burning would be the same as those described for birds and invertebrates in Section 3.5.2; however, under the preferred alternative, up to 20 acres per year of pile burning would occur within the park annually in the Non-Wilderness FMU, thereby minimizing impacts to marbled murrelet and northern spotted owl as their habitat is primarily found within the Wilderness FMU.

Similarly, impacts to special-status species from manual and mechanical treatments would be the same as those described for other mammals, birds, and invertebrates in Section 3.5.2. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. In the Wilderness FMU, manual and mechanical treatments would be used in accordance with the PMRA when park infrastructure is at immediate risk from wildfire, thereby minimizing impacts to marbled murrelet and northern spotted owl habitat.

No broadcast burning would be allowed within the park without additional environmental review and compliance.

CUMULATIVE IMPACTS

Cumulative impacts to federally listed and special-status species under the preferred alternative would be the same as those described for general wildlife in Section 3.5.2.

Section 7 Effects Determination Summary

Based on the analysis, under the preferred alternative, fire management activities *may affect, are likely to adversely affect* threatened fish and bird species (Table 3.4). The effect determination for the Taylor's checkerspot butterfly species is *may affect, not likely to adversely affect* (see Table 3.4). Proposed fire management activities *may affect, are likely to adversely affect* critical habitat for the federally listed fish species (see Table 3.4).

Table 3.4. ESA Section 7 Effect Determinations for Federally Listed Species within the Park

Species	Effects Determination on the Species	Effects Determination on Critical Habitat or EFH
Marbled murrelet (*Brachyramphus marmoratus*)	May affect, likely to adversely affect	Not applicable (none in action area)
Northern spotted owl (*Strix occidentalis*)	May affect, likely to adversely affect	Not applicable (none in action area)
Bull trout (*Salvelinus confluentus*)	May affect, likely to adversely affect	May affect, likely to adversely affect
Puget Sound Chinook salmon (*Oncorhynchus tshawytscha)*	May affect, likely to adversely affect	May affect, likely to adversely affect
Puget Sound Steelhead trout (*Oncorhynchus mykiss*)	May affect, likely to adversely affect	May affect, likely to adversely affect
Lake Ozette sockeye salmon (*Oncorhynchus nerka*)	May affect, likely to adversely affect	May affect, likely to adversely affect
Taylor's checkerspot butterfly (*Euphydryas editha taylori*)	May affect, not likely to adversely affect	Not applicable (none in action area)

Essential Fish Habitat Effects Determination Summary

Although there would be long-term beneficial impacts to EFH for Pacific Coast salmon by allowing natural processes to occur, the preferred alternative would have an adverse effect on EFH based on information provided in the analysis of effects presented in the ESA portion of this document. However, the adverse effects could be partially mitigated through MIST-related actions found in Appendix D.

The preferred alternative to revise the Olympic National Park FMP would result in an *adverse effect* on EFH for Pacific Coast salmon.

3.6.2.3 *Conclusion*

The effects on threatened, endangered, and special-status species as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives. However, the beneficial effects of managing wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative, which would result in improved forest resilience to large-scale, high-intensity wildfire and beneficial impacts to species' habitat over the life of the FMP. Under the preferred alternative, the impact of managing wildfire for multiple objectives would result in short-term adverse impacts and substantial long-term beneficial impacts to special-status species and their habitat. No broadcast burning would be allowed within the park under the preferred alternative without additional environmental review and compliance.

3.7 WATER QUALITY

3.7.1 Affected Environment

River and stream resources within the park include river-cut canyons, examples of glacially eroded canyons, active glaciers, mountain lakes, and coastal lands along the Pacific Ocean. Olympic National Park has 11 major rivers that radiate from the core of the Olympic Mountains. These rivers include the Skokomish, Duckabush, Dosewallips, Dungeness, Morse, Elwha, Sol Duc/Quillayute, Bogachiel, Hoh, Queets, and Quinault. Portions of two other watersheds, the Hamma Hamma and Calawah, also lie within the park, and there are parts of five other watersheds that flow through the park's coastal strip. In addition to major rivers, Olympic National Park has two large low-elevation lakes (Crescent and Ozette), 850 mountain lakes, and about 4,000 miles of rivers and streams (NPS 2017).

The park's rivers are relatively unimpaired, although habitat alterations downstream of the park boundary have an effect on conditions within the park. For example, the hydroelectric project in the Skokomish River Basin blocks access of anadromous fish to the North Fork Skokomish River in the park. In September 2011, removal of two dams on the Elwha

River was initiated and completed in 2014. Removal activities have had a significant beneficial impact on water quality and aquatic habitat, within the park and downstream of the park to the nearshore environment. Additionally, the natural function of a number of rivers and streams in the developed areas of the park has been altered by the presence of roads, campgrounds, and other infrastructure within the floodplain (NPS 2017).

3.7.2 Environmental Consequences

3.7.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Effects on water quality from fire suppression strategies have the potential to be more severe than from other fire management techniques depending on the intensity of the fire and the location of the fire in relation to perennial streams or riparian areas. These effects are related to maintenance of roads, construction of firelines with hand tools or heavy equipment, installation of water tanks, installation of fire camps, trampling of soils by personnel and equipment at firelines and camps, and use of aerial water drops or chemical suppressants or retardants. These effects on water quality are generally from runoff as soils disturbed by these activities erode.

Fire suppression strategies generally require the use of a fireline. Fireline construction may result in soil erosion, increased sedimentation, and alteration of spatial drainage patterns. The risk of this impact is greater along steep-sloped banks that are adjacent to streams. These potential impacts would be greatly reduced by using the MIST-related actions that are identified in Appendix D, and designed to reduce impacts to water resources.

The use of chemical suppressants may be necessary to manage wildfire. The park would adhere to Interagency Standards for Fire and Fire Aviation Operations (updated annually) for use of suppression chemicals such as foam and retardant (DOI and USDA 2016). Use of chemical suppressants can have direct effects if the chemicals enter surface water. Aircraft delivering chemical drops would avoid hitting water. If chemical suppressants and retardants enter surface water, they could have moderate to substantial adverse effects on water quality depending on the water body; the effects would likely be short-term and would persist until high flows dilute any remaining chemicals.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

Water resources, including water quality, can be affected by wildfires and fire management activities. Small fires and fires of low intensity would be expected to have little effect on water quality. Fires that become large could have adverse and short- to long-term effects on water quality due to increased ash and woody debris deposited into water bodies and their floodplains. This type of deposition could increase turbidity downstream from the fire. Loss of vegetation could lead to increased erosion and sediment loading in surface water resources in the park. However, these effects are considered normal and natural in fire-adapted ecosystems and would be within the normal range of variability. These adverse impacts would be expected to last one or two vegetation growing seasons to allow the vegetation to become reestablished after the wildfire. It is when high-intensity fires burn large portions of a watershed that impacts could cause substantial adverse effects, which last longer than one to two growing seasons. A wildfire event that impacts large areas of the watershed could cause sediment loading that is higher than historic rates; thereby changing the transport capacity of the affected channels. These events could cause changes in hydrologic conditions, such as shifting channels that may require a substantial duration of time for recovery.

Higher-intensity stand replacement wildfires are expected to cause more sedimentation and ash flow into lakes and streams following heavy rain events because more vegetation has been removed and would take longer to reestablish and stabilize bare soils. Soils that are severely burned also may become hydrophobic, which in turn can increase runoff, suspended sediments, and ash into lakes and streams. Wildfire within riparian and floodplain areas may remove vegetation that traps sediment in runoff from adjacent upland systems, increasing chances for water quality degradation.

Removal of streamside vegetation could also cause increases in water temperatures resulting from losses of shade and a reduction in cover habitat for fish.

Due to the small scale for managed wildfire under the no action alternative, the impacts to water quality are expected to be localized and short-term, lasting for only the duration of the wildfire.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Manual and mechanical reduction of fuel would not generally be conducted adjacent to water resources, including floodplains. If they were conducted near water sources, the potential direct adverse impacts of manual and mechanical fuel reductions would include trampling of stream banks or similar disturbances by felled and/or dragged trees and by foot or equipment traffic. These effects can be mitigated by avoidance, where possible, and immediate rehabilitation. The indirect adverse effects of manual and mechanical fuel reduction may slightly increase stream flow since there would be less vegetation and thus less transpiration on the treated area.

IMPACTS FROM PILE BURNING

Pile burning would generally not be conducted adjacent to water resources. Impacts to water quality from pile burning would be negligible.

IMPACTS FROM BROADCAST BURNS

Impacts from prescribed broadcast burns may include increases in water temperature if shading vegetation is burned, increases in sediment if fire removes vegetation immediately adjacent to water sources, and increased stream flow since there would be less vegetation and thus less transpiration on the burned areas. The use of MIST-related actions described in Appendix D, the use of natural boundaries rather than constructed firelines, and post-fire rehabilitation of firelines would reduce the potential for water quality impacts during use of prescribed fire.

Cumulative Impacts

Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA. Cumulative impacts to water quality could occur as a result of the no action alternative and other actions (e.g., Elwha River Ecosystem Restoration project and Elwha Bridge Replacement, broadcast burns conducted within or adjacent to the park, and trail and road maintenance in the park). These actions combined with fire management activities would contribute to short-term adverse and long-term beneficial cumulative impacts to water quality.

3.7.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

Impacts to water quality from wildfire suppression are as described under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Impacts to water quality from the use of wildfire for multiple objectives are as described under the no action alternative.

Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in the Wilderness and Non-Wilderness FMUs, as conditions allow. Impacts to water quality from managing wildfire for multiple objectives are as described under the no action alternative; however, these impacts could occur across a larger area under the preferred alternative.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments are as described under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. In the Wilderness FMU, manual and mechanical treatments may be used in accordance with the PMRA when park infrastructure is at immediate risk from wildfire until final decisions are made in the Wilderness Stewardship Plan.

IMPACTS FROM PILE BURNING

Impacts to water quality from pile burning are as described under the no action alternative. Under the preferred alternative, a maximum of 20 acres per year of pile burning would occur within the Non-Wilderness FMU annually. No broadcast burning would be allowed within the park without additional environmental review and compliance.

Cumulative Impacts

Cumulative impacts to water quality under the preferred alternative would be the same as those described for the no action alternative, except that fewer acres would be treated with manual or mechanical treatment, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative, therefore broadcast burns would not contribute incrementally to cumulative impacts (both adverse and beneficial) to water quality under this alternative.

3.7.2.3 *Conclusion*

The effects on water quality as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives. However, the beneficial effects of managing wildfire for multiple objectives could occur across a larger area under the preferred alternative, which would result in increased heterogeneity of stand structure and reduced potential for high-intensity wildfire to impact water quality over extensive areas of the park. Under the preferred alternative, the impact of managing wildfire for multiple objectives would result in short-term adverse impacts and substantial long-term beneficial impacts to water quality. No broadcast burning would be allowed within the park under the preferred alternative without additional environmental review and compliance.

3.8 WILDERNESS CHARACTER

3.8.1 Affected Environment

The Wilderness Act of 1964 established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as “wilderness areas.” By law these wilderness areas “shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness” (16 USC 1131)

To ensure an enduring resource of wilderness, the Wilderness Act (section 4(c)) prohibits certain uses within wilderness: “there shall be no temporary road, no use of motor vehicles, motorized equipment, or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within such area.” The exception for utilizing these prohibited uses is only if they are “necessary to meet minimum requirements for the administration of the area for the purpose of this Act.”

Wilderness Character

The primary management mandate of the Wilderness Act for the federal agencies administering wilderness is to preserve the wilderness character of the area, while also administering the area “for such other purposes for which it may have been established;” the agencies are directed to do so in ways that preserve its wilderness character (Use of Wilderness Areas, section 4(b)). Wilderness character is not explicitly defined in the Wilderness Act. An interagency effort to provide direction related to wilderness character monitoring was developed, and the definition of wilderness character was derived

from the statutory definition of wilderness in section 2(c) of the Wilderness Act. Wilderness character, as described in the interagency strategy *Keeping It Wild 2* (Landres et al. 2015:7), is "a holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences in natural environments relatively free from the encumbrances and signs of modern society, and (3) symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature. Taken together, these tangible and intangible values define wilderness character and distinguish wilderness from all other lands."

The Qualities of Wilderness Character

According to *Keeping It Wild 2*, the conceptual definition of wilderness character cited previously is linked to a practical meaning of wilderness character by using a framework of "qualities," based on the Wilderness Act. Together, the qualities represent the primary tangible aspects of wilderness character. They link the statutory definition of wilderness to on-the-ground conditions in wilderness and the outcomes of wilderness stewardship. Monitoring the condition of these qualities over time assesses how attributes of wilderness character may be changing and whether the agencies are ensuring that wilderness character is preserved. Four of the wilderness character qualities apply to all wilderness areas: untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation. A fifth quality, other features of value, may or may not exist within a wilderness. The qualities of wilderness character are described below (Landres et al. 2015).

Untrammeled

The Wilderness Act defines wilderness as "an area where the earth and its community of life are untrammeled by man." Wilderness is essentially unhindered and free from the intentional actions of modern human control or manipulation. The untrammeled quality of wilderness character is preserved or sustained when actions to intentionally control or manipulate the components or processes of ecological systems inside wilderness (e.g., fire suppression) are not taken. The untrammeled quality is degraded by actions that intentionally manipulate the biophysical environment (e.g., interference in natural processes and energy flows).

The wildness and untamed nature of the Olympic Mountains was renowned for many years before the area was established as a national park, and its untrammeled quality was valued and emphasized even before the adoption of the term by the writers of the Wilderness Act. About 95% of the park was designated as the Olympic Wilderness in 1988, formally and legally recognizing the value of its wilderness character. To this day, the 876,447 acres of the park's wilderness (renamed the Daniel J. Evans Wilderness in 2017) has remained largely unhindered and free from modern human control. Although American Indians have lived in the wilderness for thousands of years and we do not fully understand the influence they had on the landscape, the wilderness of the Olympic Peninsula has received little noticeable anthropogenic manipulation.

Natural

The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." It is an area where wilderness ecological systems are substantially free from the effects of modern civilization. The natural quality of wilderness character is preserved when there are only indigenous species and natural ecological conditions and processes and may be improved by controlling or removing non-indigenous species or by restoring ecological conditions. The natural quality is degraded by human-caused change to the natural environment (i.e., human-caused effects on plants, animals, air, water, ecological processes, etc.).

All of the Daniel J. Evans Wilderness lies within Olympic National Park, thus the natural ecological conditions, processes, and indigenous species described under the natural resources issues and impact topics described in this EA also apply to the natural quality of wilderness character.

Various anthropogenic factors are affecting the Olympic ecosystem and thus affect the natural quality of wilderness character. These include habitat fragmentation from logging on surrounding lands; the poaching of cedar, salal, and moss; aircraft overflight noise that impacts the natural soundscape; and commercial fisheries that affect anadromous fish on their return to spawn in the wilderness. Wolves were extirpated in the early 1900s, which would have had top-down effects on the abundance and distribution of their primary prey of elk, as well as indirect influences on faunal and floral communities at lower trophic levels (NPS 2003, 2018d).

Undeveloped

The Wilderness Act defines wilderness as "an area of undeveloped Federal land… without permanent improvements or habitation." Wilderness is essentially without permanent improvements or the sights and sounds of modern human occupation. The undeveloped quality is preserved or sustained when modern structures, installations, habitations, motor vehicles, motorized equipment, or other mechanical transport is not used in wilderness. It is improved when these prohibited uses are removed or reduced.

While Olympic ranger patrols, trail maintenance, resource monitoring, and scientific research are important for responsibly managing the wilderness, the associated structures and installations are evidence of modern human occupation and influence. The administrative use of motorized equipment and mechanical transport for management activities, although permitted when it is the minimum requirement, in turn degrades the primitive nature of wilderness areas through the development, occupation, or modification of the land by humans (NPS 2018d).

Solitude or Primitive and Unconfined Recreation

The Wilderness Act defines wilderness as having "outstanding opportunities for solitude or a primitive and unconfined type of recreation." Wilderness provides outstanding opportunities for recreation in an environment that is relatively free from the encumbrances of modern society, and provides benefits and inspiration derived from self-reliance, self-discovery, physical and mental challenge, and freedom from societal obligations. The solitude or primitive and unconfined recreation quality of wilderness character is preserved or improved by management activities that reduce visitor encounters, reduce signs of modern civilization inside wilderness, remove agency-provided recreation facilities, or reduce management restrictions on visitor behavior. The solitude or primitive and unconfined recreation quality is degraded by sights and sounds of human activity (solitude), and by facilities that decrease self-reliant recreation and management restrictions on human behavior (primitive and unconfined). The ecological diversity of Olympic National Park wilderness provides an array of wilderness-supported opportunities. Within rainforest valleys, along coastal beaches, by high mountain lakes, and on glacier-covered peaks, visitors can experience solitude and enjoy personal challenge and self-reliance. However, lights from surrounding areas affect the night sky in wilderness, and aircraft, whether military, commercial, or administrative flights, are ongoing reminders of civilization. The presence of researchers and research installations in the wilderness impact visitors' solitude and sense of remoteness. Bridges, toilets, and technology reduce opportunities for self-reliance. Designated campsites, signs, and other recreational infrastructure in the wilderness protect valuable park resources but simultaneously confine recreational experiences (NPS 2003, 2018d).

Other Features of Value

The Wilderness Act states that wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This quality captures important elements or "features" of a particular wilderness that are not covered by the other four qualities and are truly unique and essential to the character of that wilderness. Typically, other features of value occur in a specific wilderness location, such as archeological, historical, or paleontological features; some, however, may occur over a broad area such as an extensive geological or paleontological area, or a cultural landscape. This quality is preserved when these "other features of value" are preserved. The other features of value quality is degraded by deterioration or loss of integral site-specific features of value.

The designated wilderness in the park has been part of the homeland to American Indians for over 14,000 years. Eight tribes continue to recognize a relationship to the park based on traditional land use, origin, beliefs, and ethnographic landscapes: the Lower Elwha Klallam Tribe, Jamestown S'Klallam Tribe, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Quinault Indian Nation, Hoh Tribe, Quileute Nation, and Makah Tribe (NPS 2003, 2018d).

While American Indian ties to this land are ancient and the designation of the area as wilderness is a modern concept, the relationship between American Indians and wilderness is an important component of the area's cultural heritage. Thus, American Indian resources associated with Olympic Peninsula tribes represent the other features of value within the park's wilderness. American Indian resources include archeological resources, ethnographic resources, and traditional cultural properties (note: there are currently no listed traditional cultural properties in the park).

Plants and animals, landscapes, and spiritual aspects that are fundamental to the culture of the surrounding tribes are vital elements of the park's wilderness character. Impacts on American Indian resources in the wilderness include illegal

harvest, high visitation in sensitive areas, park operations, rising sea levels, and other natural events such as floods and fires that could threaten American Indian resources and their associated sites.

Natural Role of Fire in Wilderness

The natural and historic role of fire in Olympic National Park's wilderness has been assessed and documented in fire research and the park's fire history records. Lightning-ignited fires have been found to be a natural process and have played a primary role in shaping the park's vegetation and ecosystem, although there are strong geographic gradients in fire frequency and severity (NPS 2003, 2018d).

Section 6.3.9 (Fire Management) of the NPS *Management Policies 2006* directs that "All fire management activities conducted in wilderness areas will conform to the basic purposes of wilderness…Guidance on the need to suppress wildland fire or to use some wildland fires to achieve desired future conditions should appear in the park's planning documents (for example, in the wilderness management plan and fire management plan)." Additionally, Director's Order 41 (Wilderness Stewardship), Section 6.7 (Fire Management), 2013, states that "In many NPS wilderness areas, fires resulting from natural ignitions are considered a natural process that contributes to ecosystem function and is necessary to maintain wilderness in an unimpaired condition."

Visitor Use in the Park's Wilderness

The Daniel J. Evans Wilderness has some of the highest overnight use of any NPS-managed wilderness or backcountry area, with 15,008 parties, 43,325 visitors, and 95,045 user nights (i.e., the number of visitors multiplied by the number of nights that visitors stay in wilderness) in 2014. The overnight wilderness use within the interior of the park accounted for approximately 55% of the total overnight wilderness use in 2014. The much smaller coastal wilderness portion (3.2% of the total wilderness acres) accounted for 45% of total overnight wilderness use.

3.8.2 Environmental Consequences

3.8.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Suppression activities would affect all of the wilderness character qualities (untrammeled, natural, undeveloped, solitude or primitive and unconfined recreation, and other features of value [i.e., American Indian resources]). Depending upon the level and area of suppression activity, the impact could be adverse and long-term.

Under alternative A, lightning-caused fires in the Exclusion FMU (including 275,894 acres of wilderness) would be suppressed to reduce the potential for wildfire to spread from or to adjacent lands. Within the Conditional and Wildland Fire Use FMUs (including 588,697 acres of wilderness) naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response.

Human-caused fire ignitions would be suppressed in all FMUs, where possible, which would reduce human effects on wilderness ecological systems and non-natural changes to the landscape, the plant community, and to soils.

Untrammeled

Suppression of wildfire in any of the park's wilderness would be a direct human manipulation of the biophysical environment, trammeling the wilderness. Trammeling impacts would be caused by activities such as fireline construction, relocation of fuels outside of the fireline, and suppressing fire with the use of portable pumps and hoselays, as well as aerial water drops, limbing trees, cutting vegetation, and burnout operations. Clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary.

Rehabilitation actions taken after a fire has been suppressed may also affect the untrammeled quality of wilderness character. Rehabilitation, though a positive effect on the natural quality, involves manipulation of the biophysical environment to repair resource damage caused by the fire suppression activities. Rehabilitation activities may include

erosion control on firelines, moving back soil/other natural materials, flush-cutting stumps, and removing woody material thrown into water courses during firefighting.

Natural

The suppression of lightning-caused wildfire in the park's wilderness would prevent natural-caused changes in plant community composition and forest structure changes from wildfires. Suppression tactics would impact the natural quality of wilderness character as described in the natural resources impact topics in Chapter 3.

The use of a full suppression strategy would typically keep wildfires small and reduce the duration of suppression activities in the wilderness that impact the natural quality of wilderness character. Suppression tactics from fireline construction and other firefighting activities (e.g., suppressing spot fires) would result in impacts to vegetation, soils, water flow patterns, and would potentially disturb wildlife. Other fire crew activities such as cross-country hiking to/from and within the fire planning area, and camping could result in impacts on vegetation from trampling (including long-term impacts on the more fragile heather-huckleberry plant community), impacts on wildlife from the presence of people in habitat (e.g., noise disturbance, dispersal of wildlife to other areas, habituation, human food acquisition), and impacts on water quality from human waste disposal or improper dishwashing, etc. Fire camps (i.e., on-site spike camps) often concentrate higher levels of use with much larger group sizes than the public is allowed, damaging area resources. If necessary, camps might be located in areas without previously established sites, creating long-lasting impacts on natural resources. The presence, or the unintended introduction of nonnative plants from firefighters and their equipment, could result in range expansion or new establishment of these species, especially where soil disturbance occurs.

Though lightning-caused ignitions are natural, they still result in smoke that affects air quality.

Noise impacts from aerial suppression would create the most widespread adverse impacts to the natural quality of wilderness character. Topography, vegetation, atmospheric pressure, and in the case of helicopters, speed of travel all affect the potential level of noise disturbance. In addition, the duration and fixedness of noise-creating activities and therefore the amount of time visitors or wildlife would experience noise impacts would vary by noise type and source. Fire managers would limit the use of aerial suppression resources over the wilderness, reducing noise impacts on wilderness character whenever possible. The impacts of helicopter noise on the natural soundscape and causing wildlife disruption would also be reduced when crews hike rather than fly to access wildfire areas and use stock or backpacks rather than aircraft to transport equipment, crew food, and gear. Any use of motorized equipment (e.g., chainsaws, motorized pumps) would also result in noise impacts to the natural soundscape and could potentially affect wildlife.

Water draws for bucket drops could impact fish and other aquatic species. Retardant use, though used only when human life and safety are under imminent threat, could result in impacts to vegetation, wildlife, and water quality. Allowing wildfires to burn could result in loss of old-growth habitat that is critical to threatened and endangered species such as the northern spotted owl and the marbled murrelet.

All suppression techniques would follow the PMRA and MIST guidelines, and resource advisers would participate in fire planning, to reduce impacts on wilderness character. Firefighting crews would practice Leave No Trace principles including proper methods for food storage, human waste disposal, camping at established sites or on durable surfaces, and minimizing travel on sensitive vegetation whenever possible. Fireline rehabilitation would mitigate resource impacts resulting from suppression activities.

Undeveloped

Some structures in the fire's path may burn down, reducing human development in the wilderness long-term or short-term (if the decision is made later to rebuild the structure).

Adherence to the guidance established in the Fire Management Plan PMRA (and included in WFDSS) for use of installations, motorized equipment, and helicopter landings should reduce any such use under all strategies to that which is the minimum requirement. Alternatives to the Wilderness Act 4(c) prohibitions would always be the first choice considered. If a prohibited use is found necessary, the tool or method causing the least impact would be selected to reduce impacts on the undeveloped quality of wilderness character. For example, gravity socks to operate sprinkler systems would be used where possible rather than motorized pumps, or foot or stock used to transport firefighting equipment or

crew gear rather than a helicopter. Negative impacts on the undeveloped quality include installations such as temporary radio repeaters, weather stations, remote cameras, temporary signs, flagging and other marking, sprinklers, and portable tanks; motorized equipment such as chainsaws and motorized pumps; and transport via helicopters for equipment, crew food and gear, crew travel, and fire mapping. The use of generators for powering communication would not be permitted unless other effective communication tools with less impact on wilderness character are not available, thus generators would rarely be used, rarely affecting the undeveloped quality.

Solitude or Primitive and Unconfined Recreation

Wildfire suppression involves personnel travelling to/from and being on-site within the wilderness thus increasing the chance of encounters with visitors. Trail or area closures due to wildfire would affect visitor opportunities for unconfined recreation. Use of installations, motorized equipment, and helicopters would impact visitors' solitude or primitive experience if exposed to their sights or sounds. The presence of spike camps and associated facilities (e.g., food storage devices, toilets) impact the primitive experience for visitors coming upon them. Constructed firelines, though rehabbed post-fire, may still be seen far into the future as a result of vegetation removal and log saw cuts, again impacting visitors' primitive experience. This negative impact may especially be true in the off-trail areas where visitors often expect no noticeable trace of human activity. New campsites and social trails may develop as a result of concentrated use at spike camps affecting visitors' primitive recreation experience.

Trail or area closures would redirect visitors away from locations with high fire-related human activity, enhancing visitor solitude by decreasing encounters with firefighting personnel. For suppression activities, guidelines for installations, motorized equipment, and helicopter use would be established under the PMRA to minimize impacts on visitors' solitude or primitive experience.

Other Features of Value

There could be infrequent but potentially major impacts to American Indian resources (i.e., archeological and ethnographic resources, and any future traditional cultural properties) from emergency fire suppression activities and/or high-severity fire behavior. See EA section 3.10, Archeological Resources, and Ethnographic Resources.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

Untrammeled

Though wildfire management for multiple objectives would likely include some suppression activities (e.g., fireline construction) at management points, in other areas of the fire natural processes would still be allowed to continue without human manipulation. Use of retardant that would also alter fire behavior would not be used unless human life and safety are under imminent threat. Pre-fire fuel treatment would not occur around wilderness structures, until point protection is specifically identified as necessary when wilderness infrastructure is at immediate risk from wildfire. Clearing of sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary.

Natural

Many lightning-caused ignitions would be allowed to burn, providing an array of positive natural effects that includes changes in plant community composition and forest structure, as well as creating new habitats (e.g., snags). Implementing a monitoring-only strategy for a wildfire would result in negligible impacts on the natural quality from personnel-related impacts as few, if any, staff would be present. The use of aircraft (helicopters, fixed wings, unmanned aircraft systems [UAS]) for monitoring, if selected as the minimum tool in wilderness, would result in noise impacts. Human-caused fire ignitions would usually be suppressed, reducing human effects on wilderness ecological systems from non-natural wildfires. All suppression tactics would follow the PMRA and MIST guidelines and resource advisers would actively

participate in fire planning to reduce impacts on wilderness character. Firefighting crews would practice Leave No Trace principles including proper methods for food storage, human waste disposal, camping at established sites or on durable surfaces, and minimizing travel on sensitive vegetation (especially heather-huckleberry in the subalpine) whenever possible. Noise impacting the natural soundscape and causing wildlife disruption would be reduced when crews hike rather than fly to access wildfire areas and use foot or stock instead of helicopters to transport equipment and crew's food and gear.

Undeveloped

Implementing a wildfire monitoring strategy rather than a suppression strategy would result in less necessity for use of Wilderness Act 4(c) prohibitions. Adherence to the guidance established in the Fire Management Plan PMRA (and included in WFDSS) for use of installations, motorized equipment, and helicopter landings should reduce any such use under a multiple objectives strategy to that which is the minimum requirement. Alternatives to the Wilderness Act 4(c) prohibitions would always be the first choices considered. If a prohibited use is found necessary, the tool or method causing the least impact on wilderness character would be selected: this includes installations such as temporary radio repeaters, weather stations, remote cameras, temporary signs, flagging and other marking, sprinklers, and portable tanks; motorized equipment such as chainsaws and motorized pumps; and transport via helicopters for equipment, crew food and gear, crew travel, and fire mapping. For example, gravity socks to operate sprinkler systems would be used where possible rather than motorized pumps; or foot or stock, rather than a helicopter, would be used to transport firefighting equipment or crew gear. The use of generators for powering communication would not be permitted unless other effective communication tools with less impact on wilderness character are not available, thus generators would rarely be used, rarely affecting the undeveloped quality.

Solitude or Primitive and Unconfined Recreation

Implementation of a wildfire monitoring strategy would likely be done with no staff presence or just a few individuals, so there would be a low chance for visitors to encounter fire staff in the wilderness. Trail or area closures would redirect visitors away from locations with high fire-related human activity, enhancing visitor solitude by decreasing encounters with firefighting personnel. There would be a continuum from multiple objectives to suppression strategies of increasing use of installations, motorized equipment, and helicopters that would impact visitors' solitude or primitive experience if exposed to their sights or sounds. The type, number, and use of installations, motorized equipment, and helicopters would be utilized under PMRA guidelines included in WFDSS to minimize impacts on visitors' solitude or primitive experience. There would be little use of installations, motorized equipment, and helicopters under a wildfire monitoring strategy.

Constructed firelines, though rehabbed post-fire, may still be seen far into the future as a result of vegetation removal and log saw cuts, again impacting visitors' primitive experience. This negative effect may especially be true in off-trail areas where visitors often expect no noticeable traces of human activity.

Other Features of Value

Impacts to American Indian resources from wildfire monitoring activities would be limited, compared to suppression activities. See EA section 3.10.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Under the no action alternative, in wilderness, manual and mechanical treatments may be used in accordance with the minimum requirements analysis. Manual/mechanical treatment would be used as a preventative measure to reduce hazard fuels around administrative sites, historic structures (40 of which are in wilderness), and other sensitive resources in accordance with the PMRA when wilderness infrastructure is at immediate risk from wildfires. Manual and mechanical treatments would be used on a maximum of 200 acres per year in wilderness and non-wilderness (combined) under the no action alternative.

Untrammeled

Manual and mechanical treatments would have a temporary adverse effect on wilderness due to trammeling. Actions would be limited to defensible space treatments which would be limited in extent. Impacts to the untrammeled quality of wilderness character would last for the duration of the treatment, no longer than 1 to 3 days per site.

Natural

Actions would be limited to defensible space treatments which would be limited in extent. Impacts to the natural quality of wilderness character would last for the duration of the treatment, 1–2 days per site and for one to two growing seasons, before vegetation recovers, with the exception of removed trees which would last over a longer duration. Adverse impacts can be partially mitigated by the use of MIST strategies and careful project timing.

Undeveloped

The use of any motorized equipment (e.g., chainsaws) for fuel treatment would impact the undeveloped quality of wilderness character.

Solitude or Primitive and Unconfined Recreation

Sights and sounds of motorized equipment would impact opportunities for solitude as the sense of remoteness from the sights and sounds of human activity would be affected. The post-treatment visual impacts from cut stumps and cleared vegetation would also cause impacts to this quality. Any required trail or area closures during the treatment would impair opportunities for primitive and unconfined recreation. Manual and mechanical treatments would be limited to defensible space treatments which would be limited in extent. Impacts to solitude would last for the duration of the treatment, no longer than 1 to 3 days per site.

Other Features of Value

Impacts to American Indian resources could occur during mechanical and manual treatments. Mitigation measures and direction from resource advisors would be followed in order to mitigate adverse impacts to sensitive resources during treatments. See EA section 3.10, Archeological Resources, and Ethnographic Resources.

IMPACTS FROM PILE BURNING

Under the no action alternative, 275 acres per year of pile burning would occur over 5 years. All treatments would be limited to the non-wilderness portion of the park. The potential use of pile burning in the wilderness would be addressed in the Wilderness Stewardship Plan or with a separate environmental compliance review and MRA. If smoke from pile burning is seen within the viewshed, dispersing into the wilderness areas from the frontcountry, this would adversely impact the opportunities for solitude or unconfined recreation quality of wilderness character for visitors seeking a primitive wilderness experience. The small-scale application of pile burning within the park means that most impacts would last for only the duration of the activity, which would be 1 to 2 days, with most burning scheduled to avoid the busy summer visitor season.

IMPACTS FROM BROADCAST BURNS

Broadcast burning under alternative A is allowed only in non-wilderness areas of the three FMUs. No more than 65 acres would be treated in 1 year. If smoke from broadcast burns is dispersed into and is seen within the viewshed of wilderness areas, this would adversely impact the opportunities for solitude or unconfined recreation quality of wilderness character for visitors seeking a primitive wilderness experience. The small-scale application of broadcast burning within the park means that most impacts would last for only the duration of the activity, which would be 1 to 2 days.

Cumulative Impacts

The geographic extent for the analysis of cumulative impacts on wilderness character extends from the park's wilderness boundary to include the wilderness areas within the adjacent Olympic National Forest. The temporal scope of cumulative

impacts on wilderness is the duration of the impacts which would coincide with suppression activities and planned fire management activities, a period of several days when considering impacts to the qualities of wilderness character, and approximately one to two growing seasons when considering the visual impacts from fire management activities. The exception to the one to two growing seasons would be the visual impacts from log saw cuts that would last many years. Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA.

Wildfire management actions proposed by the Olympic National Forest could cause cumulative short-term adverse impacts to the untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation qualities of wilderness character if those actions occur within wilderness areas. The national forest contains 88,151 acres of designated wilderness and five wilderness areas, and therefore a large portion of wildfire management is expected to impact wilderness units. Wilderness character would be impaired by the presence of forestry crews and equipment needed to implement actions, as well as smoke impacts from pile burning and prescribed fire on adjacent non-wilderness lands. These impacts, when combined with activities undertaken for ecological restoration within the park, may result in cumulative adverse impacts to wilderness character in the short term, but in the long term, these actions would improve ecological functioning in the park, improve vegetation health and vigor, and improve resilience to disturbances including wildfire, insect and disease infestations, and invasive species. Improvements to the natural resource would provide beneficial impacts to the natural quality of wilderness character.

If wildfires occur simultaneously in the park and in the adjacent national forest, suppression activities, particularly aerial suppression tactics, could cause short-term adverse impacts to the untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation qualities of wilderness character. Adherence to the PMRA and MIST guidelines would alleviate some adverse impacts to wilderness character.

The Pacific Northwest National Scenic Trail Comprehensive Plan (currently being developed by the USFS) would establish management objectives for the section of the trail that passes through the park. The plan is likely to include objectives to protect wilderness character from adverse impacts within the park and adjacent national forest wilderness, which would provide long-term beneficial impacts to wilderness character. The park's Wilderness Stewardship Plan would develop actions to preserve wilderness character. This would result in overall long-term beneficial impacts to the qualities of wilderness character.

Construction activities associated with future road improvements, for example those implemented as part of the Olympic Hot Springs Road geotechnical investigation, would impact wilderness character if activities are within the viewshed of wilderness areas. The impact would last for the duration of the construction activity. Existing overflights in the park combined with aerial suppression tactics used for fire management would cumulatively impact the natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation qualities of wilderness character. Whenever possible, fire managers would typically limit the use of aerial suppression tactics in wilderness areas, thereby reducing the cumulative impact of aircraft disturbance to wilderness character. The past, present, and reasonably foreseeable future actions would contribute short- and long-term adverse and beneficial cumulative impacts to wilderness character.

Impacts to wilderness character would occur under the no action alternative in the form of trammeling, noise, and human disturbance during suppression activities and other planned actions occurring in or within the viewshed of wilderness areas. Impacts from the no action alternative plus impacts from the past, present, and reasonably foreseeable future actions would result in short- and long-term adverse and beneficial cumulative impacts to wilderness character. The incremental impacts of the no action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within wilderness areas on the Olympic Peninsula.

3.8.2.2 *Alternative B: Preferred Alternative*

The impacts to wilderness character from wildfire, either an event that is targeted for suppression or managed as wildfire for multiple objectives, are as described under the no action alternative.

Alternative B differs from alternative A in that Olympic National Park would be divided into two FMUs: the Wilderness FMU (876,447 acres) and the Non-Wilderness FMU (46,204 acres) (see Figure A.4). Each FMU follows a set of management strategies which affect the level and extent of actions to be taken.

IMPACTS FROM WILDFIRE SUPPRESSION

In the Wilderness FMU (95% of the park), naturally ignited wildfire would be evaluated to protect, maintain, and enhance resources, and be allowed to function untrammeled in its natural ecological role to the extent practicable. Naturally ignited wildfires would be evaluated through a deliberative risk analysis and systematic decision-making process using WFDSS to determine the appropriate response. PMRA guidelines (see Appendix E) would be followed and applicable PMRA strategies incorporated into WFDSS for each fire. For a wildfire or portions of a wildfire in the Wilderness FMU, suppression actions are the same as described under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Impacts from managing wildfire for multiple objectives are as described in detail previously. Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park, per year over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use anywhere within the Wilderness FMU, as conditions allow. Compared to the no action alternative, the preferred alternative would increase the use of managed fire for multiple objectives, expanding some impacts to wilderness character over larger areas, and potentially for longer duration. However, because it is the intent of this alternative to allow lightning-caused wildfires within the wilderness unit to be managed under the monitor (only) strategy to the fullest extent possible, with natural processes allowed to proceed without human control/manipulation, the untrammeled quality of wilderness character would be enhanced over much of the wilderness. Through adherence to the PMRA and MIST guidelines, most adverse impacts to wilderness character would be mitigated, and impacts would be short-term, lasting only the duration of the wildfire. By increasing the use of managed fire for multiple objectives, a mosaic of stand structures would occur across burned acres, breaking up fuel continuity and mitigating larger-scale impacts to wilderness character in the park in the event that future fires require more intense suppression techniques for containment.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments are as described in detail previously under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. In the Wilderness FMU, manual or mechanical fuel treatments would be used in accordance with the minimum requirements analysis when wilderness infrastructure is at immediate risk from wildfires. Pre-fire fuel treatment would not occur around wilderness structures, until point protection is specifically identified as necessary for a structure during multiple objectives and wildland fire suppression strategies reducing impacts on the untrammeled and natural qualities of wilderness character. In the event that infrastructure is threatened, treatments would be limited to small-scale defensible space. Due to the small scale of treatments and adherence to the PMRA and MIST guidelines, impacts to the untrammeled, undeveloped, and solitude and primitive or unconfined recreation qualities of wilderness character within the Wilderness FMU would be limited.

IMPACTS FROM PILE BURNING

Impacts to wilderness character from pile burning are described under the no action alternative. Under the preferred alternative, a maximum of 20 acres per year of pile burning by fire would occur within the park annually but would be limited to the Non-Wilderness FMU. The potential for pile burning by fire in the Wilderness FMU would be addressed in the Wilderness Stewardship Plan or separate environmental compliance and MRA.

Smoke dispersing into the wilderness from pile burning may adversely impact the opportunities for solitude or primitive and unconfined recreation quality of wilderness character for visitors seeking a primitive wilderness experience. The small-scale application of pile burning within the park means that most impacts would last for only the duration of the activity, which would be 1 to 2 days during the low visitor season.

No broadcast burning would be allowed anywhere in the park without additional environmental review and compliance.

Cumulative Impacts

The geographic and temporal scope of the cumulative impacts analysis for wilderness character is described under the no action alternative. Similarly, the past, present, and reasonably foreseeable future actions that may impact wilderness

character are described under the no action alternative. As previously stated, the past, present, and reasonably foreseeable future actions would contribute short- and long-term adverse and beneficial cumulative impacts to wilderness character.

Cumulative impacts of the preferred alternative would be similar to those for the no action alternative. The preferred alternative would contribute negligible short-term adverse impacts to wilderness character when added to past, present, and reasonably foreseeable future actions, but would provide long-term beneficial impacts by increasing the opportunity for managing wildfire for multiple objectives. The incremental impacts of the preferred alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within wilderness areas on the Olympic Peninsula.

3.8.2.3 *Conclusion*

Impacts to wilderness character as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives, except that fewer acres would be treated with manual or mechanical treatment under the preferred alternative unless park infrastructure is at immediate risk from wildfire, and pile burning (which would occur in non-wilderness areas only) would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative (additional compliance would be required), therefore impacts to the qualities of wilderness character that are associated with restricted access, human activity, and smoke production during a broadcast burn would not occur. The management of wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative, which would result in increased adverse impacts to wilderness character in the short term; however, in the event of a lightning-caused ignition, natural processes would be allowed to proceed without human control/manipulation, and therefore the untrammeled quality of wilderness character would be enhanced over much of the wilderness. In some years, however, fewer than 1,200 acres of fire may be managed for resource objectives under the preferred alternative, and therefore the long-term beneficial impacts to wilderness character would not be realized. Impacts to wilderness character would also increase under the no action alternative, if acreage limits for wildfire managed for multiple objectives are exceeded (i.e., if fire resists containment within habitat acreage limits due to risk to firefighter safety or fires burning in steep, inaccessible terrain).

Given the small-scale application of treatments within wilderness areas under both alternatives, and adherence to the PMRA and MIST measures, impacts to all five qualities of wilderness character would be localized and short-term, lasting through only the duration of the treatment in the case of the untrammeled, undeveloped, and opportunities for solitude and primitive or unconfined recreation qualities, and for one to two growing seasons after treatments for impacts to the natural quality of wilderness character, with the exception of removed trees which would last over a longer duration. Allowing fire to burn naturally is an important process in the maintenance of unimpaired wilderness, in the long term enhancing the untrammeled and natural qualities of wilderness character. Targeted manual and mechanical treatments could also help preserve some American Indian resources within the park.

3.9 SOUNDSCAPES

3.9.1 Affected Environment

Natural sounds are increasingly recognized as an important component of resource conditions and visitor opportunities in national parks because, as a growing body of research suggests, anthropogenic noise can be disruptive to natural ecological processes and visitor experiences (McCusker and Cahill 2009). Research also indicates that anthropogenic noise intrusions can produce substantial changes in wildlife behavior, breeding, and species success (Rabin et al. 2006).

With greater knowledge and understanding of the important role the acoustic environment plays in overall ecosystem health and visitor enjoyment as well as the potential impacts of anthropogenic noise, protection of the acoustic environment has received growing attention by managers and policy makers (Newman et al. 2009). NPS *Management Policies* require the NPS to restore and manage park acoustical environments and soundscapes (NPS 2006). Acoustic resources include natural sounds (e.g., wind, water, wildlife, vegetation) and cultural and historic sounds (e.g., battle reenactments, tribal ceremonies). The acoustical environment is the combination of all the acoustic resources within a given area. According to the NPS, a soundscape is defined as the "total acoustic environment of an area," which includes natural and human sounds. According to Section 4.9 of NPS *Management Policies 2006*, the natural soundscape of a park

refers to the combination of all of the natural sounds occurring in the park, absent the human-induced sounds, as well as the physical capacity for transmitting those natural sounds (NPS 2006).

Natural sounds include sounds that are within and beyond the range that humans can perceive, and can be transmitted through air, water, or solid materials. Natural sounds are an important park resource and a critical component of the ecological communities that parks seek to preserve. Common natural sounds at Olympic National Park include bird calls; chipmunk chirps; and sounds produced by physical processes, such as wind rushing through vegetation, pouring rain, rivers, and waterfalls. Natural sounds and the opportunity to experience solitude are valued components of the visitor experience within the park. Over 70% of Americans say one of the most important reasons for preserving national parks is to provide opportunities to experience natural peace and the sounds of nature (Haas and Wakefield 1998). In another survey, 91% of respondents considered enjoyment of natural quiet and the sounds of nature to be compelling reasons for visiting national parks (McDonald et al. 1995). The preservation of the acoustical environment for the benefit of the visitor experience is further amplified in wilderness areas (Lynch et al. 2011), where managers are tasked to provide opportunities for solitude—part of one of the five qualities of wilderness character.

Noise is generally defined as unwanted or intrusive sound. Noise can adversely affect park resources or values, including but not limited to natural soundscapes, wildlife, wilderness character, and visitor experience. Primary sources of anthropogenic noise in national parks can include cars, buses, and other motorized vehicles, including recreational vehicles and their generators; aircraft; and park operations, such as the use of maintenance equipment. Human activities in Olympic National Park generate intermittent noise, including the use of mechanical or motorized equipment during management and maintenance activities; construction activities; administrative flights such as wildlife surveys, human waste removal, backcountry bridge construction, fire suppression activities; and visitor use activities (use of motor vehicles, recreational vehicles, people in campgrounds, etc.). In addition to these noise sources, traffic on U.S. Highway 101, as well as military and commercial overflights, introduce noise in the park that comes from outside the park boundary.

Parks are experiencing on-going acoustic challenges, from a variety of sources including air tours and equipment use. Such noise affects visitors' perceptions of solitude and tranquility and may interfere with how people rate landscapes in national parks (Weinzimmer et al. 2014). Increased human presence, loud talking and shouting, and other related sounds were found to substantially detract from the quality of the visitor experience (Weinzimmer et al. 2014), particularly if noise interferes with quiet activities such as bird watching or wildlife viewing.

In general, a growing number of studies indicate that animals, like humans, are stressed by noisy environments (Shannon et al. 2016). Wildlife use auditory communication and also rely on sounds to gather other environmental information (Lynch et al. 2011). Noise can interfere with animal acoustical awareness (Lynch et al. 2011); combined with other ongoing stressors to wildlife, noise impacts can have important implications for the health and vitality of wildlife populations within a park (Ware et al. 2015). Increasingly, careful consideration of the impacts of human-generated noise on wildlife is a critical component of management for healthy ecosystems in our parks.

The intensity of sound that is found is measured in decibels (dB). The A-weighted decibel (dBA) scale is commonly used to describe sound pressure levels because it reflects the frequency range to which the human ear is most sensitive. Throughout this section and in the analysis of impacts on soundscapes, all noise levels are expressed using dBA. Sound levels in national parks can vary greatly, depending on location, topography, vegetation, biological activity, weather conditions, and other factors. For example, background sound levels within a typical suburban area fluctuate between 50 and 60 dBA, while the crater of Haleakala National Park is intensely quiet, with levels around 10 dBA (NPS 2018d). Several examples of sound-pressure levels measured in national parks using the A-weighted scale are listed in Table 3.5.

Table 3.5. Common Sound Pressure Levels Recorded in National Parks

Decibel level (dBA)	Sound Science	Noise Level
10	Volcano crater (Haleakala National Park)	Very low
20	Leaves rustling (Canyonlands National Park)	Very low
40	Crickets at 5 meters (Zion National Park)	Low
60	Conversational speech at 5 meters (Whitman Mission National Historic Site)	Medium

Decibel level (dBA)	Sound Science	Noise Level
80	Motorcycle at 30 meters (Blue Ridge Parkway)	High
100	Thunder (Arches National Park)	High
120	Military jet, 100 meters above ground level (Yukon-Charley Rivers National Park)	High
126	Cannon fire at 150 meters (Vicksburg National Military Park)	High

Impacts on soundscapes are typically analyzed in terms of natural ambient sound levels and existing ambient sound levels. Natural ambient sound levels are defined as natural sound conditions found in an area, including all sounds of nature (i.e., wind, water, wildlife, etc.), and excluding all human and mechanical sounds. Existing ambient sound levels are defined as the composite, all-inclusive sound associated with a given environment, including human and mechanical sounds.

During winter (January–March) 2010, the NPS Natural Sounds and Night Skies Division (NSNSD), along with park staff, collected baseline acoustic data at the park. Five sites were sampled for approximately 30 days each. Data collected during this period are intended to help the park understand the effects of future noise impacts and inform future park planning, such as the forthcoming Wilderness Stewardship Plan (NPS 2010). The data in Table 3.6 show existing ambient sound conditions for the five locations in the park during wintertime and are not representative of overall ambient sound conditions for the park year-round. Ambient sound levels at Hurricane Ridge may be naturally lowered during winter due to the muffling effects of snow cover and were lower in winter 2010 due to a reduced visitor presence from a road washout for 5 weeks during the 38-day monitoring period.

Table 3.6. Summary of Olympic National Park Winter 2010 Ambient Sound Level Data

Site Name	Total Days	Existing Ambient					
		Daytime (7 a.m. to 7 p.m.)			Nighttime (7 p.m. to 7 a.m.)		
		LA_{eq} (dBA)	L_{50} (dBA)	L_{90} (dBA)	LA_{eq} (dBA)	L_{50} (dBA)	L_{90} (dBA)
Hurricane Ridge	**38**	**38.0**	**24.4**	**15.4**	**38.4**	**21.8**	**14.7**
Lake Crescent	26	44.8	35.1	31.5	45.1	32.4	28.6
Hoh River Trail	39	38.0	34.5	32.9	38.2	34.0	32.4
Third Beach Trail	40	46.0	36.7	26.7	45.7	36.7	30.5
Lake Ozette	35	47.6	32.4	21.7	47.6	33.8	22.1

• **LAeq**: The equivalent sound level determined by the logarithmic average of sound levels of a specific time period.

• **L50**: A statistical descriptor describing the sound level exceeded 50% of a specific time period (i.e., the median sound level).

• **L90**: A statistical descriptor describing the sound level exceeded 90% of a specific time period and only the quietest 10% of the sample can be found below this point.

Source: Lee and MacDonald (2016)

In addition to the baseline acoustic data collected in the park, the NPS NSNSD estimated the acoustic conditions of the park using predictions from a geospatial sound model. The national model predicts sound levels across large landscapes and may not reflect localized changes such as new access roads or development (Wood 2015). The NPS NSNSD examined the difference between the natural ambient sound levels and the existing sound levels as predicted by the model. The mean existing ambient daytime sound level at Olympic National Park during mid-summer was estimated to be 33.3 dBA (Wood 2015). At this sound level, the soundscape of the park would be considered relatively intact, although some areas along the coast and around popular visitor areas have higher ambient sound levels. The mean existing sound levels at the park are lower than the sound levels in nearby developed areas. The model predicts that the influence of human-caused sounds averages only 0.8 dBA, ranging from 0 to 13.8 dBA, above natural conditions (Wood 2015).

3.9.2 Environmental Consequences

3.9.2.1 *Alternative A: No Action*

Impacts from Wildfire Suppression

Wildfire suppression activities would cause short-term adverse impacts to the existing ambient sound levels in the park, through the increased use of power tools (including pumps, chainsaws, and other power equipment), noise and activity from firefighting staff during suppression operations, and aircraft support. Table 3.7 summarizes noise levels from several fire suppression activities that could occur in the park in the event of a wildfire.

Table 3.7. Average Wildfire Suppression Noise Levels

Suppression Activity/Equipment	dBA
Bulldozer	78.6
Fire engine	67.6
Helicopter	86.8
Heavy equipment	62.3
Leaf blower	80.8
Masticator/chipper	92.4
Pump	78.9
Chainsaw	89.5
Utility task vehicle (UTV)	73
Water tender	66.1

Note: Based on measurements in Broyles et al. (2017).

Noise generated from fire suppression activities in Table 3.7 exceed existing ambient levels by over 40 dBA. Noise from aircraft and other fire suppression activities may be disruptive to visitors, wildlife, and wilderness character up to several miles away, unless there is a topographic sound and visual barrier. These actions are likely to create short-term adverse impacts on the acoustic environment of the park by adding to existing ambient sound levels for the duration of the suppression activity. Impacts would last for the duration of the fire activity as well as for several weeks post-fire during monitoring and rehabilitation activities that may use vehicles and power equipment, such as chainsaws used by crews to remove hazard trees or in the construction of erosion control structures.

In the event of full suppression of an unplanned ignition, some noise is unavoidable, but NPS *Management Policies* require parks to "monitor mechanical noise that adversely affects opportunities to enjoy park soundscapes." Mitigation measures would be applied to minimize noise generated by park management activities by strictly regulating NPS use of noise-producing machinery, including aircraft and motor vehicles. The park may choose quieter tools for particular suppression actions when possible, such as a handsaw in place of a chainsaw in the wilderness. Generators may be replaced or supplemented by batteries or solar power. MIST-related actions and PMRA direction in wilderness, would be applied to reduce adverse impacts.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

The monitoring associated with managing wildfire for multiple objectives could involve the use of fixed-wing aircraft and helicopters for overflights and transportation of monitoring personnel. These flights would have short-term impacts to the acoustic environment and adverse impacts to visitors, wildlife, and wilderness character due to engine noise. By allowing

some fires to burn for multiple objectives, fewer aggressive suppression actions would be employed, reducing adverse impacts of suppression on soundscapes.

Adverse impacts would last for the duration of the fire management activities, which would typically be longer than most full suppression actions but less than 1 week in duration post-fire. Impacts would continue for several weeks post-fire if rehabilitation activities are required. Minimum tool requirements would be applied in wilderness to reduce adverse impacts. Due to the less-intense activity associated with management of wildfire for multiple objectives relative to full suppression, there would be less use of noise-generating equipment or firefighting crews.

Due to the small scale for managed wildfire under the no action alternative, the impacts to soundscapes from the use of equipment, aerial monitoring, and fire crew activity are expected to be localized and short-term, lasting for only the duration of the wildfire.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Under the no action alternative, a maximum of 200 acres per year would be manually or mechanically treated in wilderness and non-wilderness. Power tools and noise generated from fuel crews would contribute human-caused noise to the existing ambient sound levels, adversely impacting the acoustic environment. Some equipment, for example chainsaws, chippers, and heavy equipment, can generate from 60 to 90 dBA to the existing ambient sound levels (see Table 3.7). Most hazard fuel reduction work occurring in the wilderness would be accomplished using hand tools, but some work could require chainsaws or similar power tools. The decision of which tools to select in wilderness would be based on a minimum requirement analysis.

Mitigation measures would be applied to minimize adverse impacts to the acoustic environment. These would include limiting the hours of operation of motorized equipment from 9:00 a.m. to 5:00 p.m., protecting dawn, dust, and nighttime quiet; noisy equipment may be relocated away from noise-sensitive areas, or scheduled at times of the day or year when they would have the least impact on activities such as interpretive programs and/or wildlife; minimum requirement guidelines would be followed; and quiet technology would be used when appropriate. Noise would be a consideration when procuring and using park equipment. Prior to purchase, research would be conducted regarding the best available technology and the quietest equipment will be identified.

Given the small-scale application of manual and mechanical treatments, impacts to soundscapes from the use of power tools, vehicles used for access and crew transport, and noise generated from human activity would be localized and short-term, lasting for only the duration of the treatment.

IMPACTS FROM PILE BURNING

Under the no action alternative, in non-wilderness 275 acres per year of pile burning would occur over 5 years. Human activities associated with the construction and burning of piles would result in short-term adverse impacts to the acoustic environment within the park. The use of vehicles to access sites and hand and power tools used in the preparation of piles, would add to the existing ambient sound levels in the park for the duration of the activity. Adverse impacts would be mitigated by the seasonal nature of most pile burning activities, which coincide with low visitor volumes during the fall and winter seasons.

Given the small-scale application of pile burning, impacts to soundscapes would be localized around the treatment areas, and most adverse impacts to soundscapes would be alleviated through timing of activities outside of the busy summer season.

IMPACTS FROM BROADCAST BURNS

Under the no action alternative, no more than 125 acres of broadcast burning would occur in the non-wilderness portion of the park over a 5-year period. No more than 65 acres would be subject to broadcast burn in a given year.

Broadcast burning at the park may result in temporary, short-term adverse impacts to the acoustic environment as a result of increased human activity and presence of fire crews in the burn area, use of vehicles to transport crews and implement monitoring, and the use of some power tools to prepare treatment areas. The use of motorized equipment, crew transport,

helicopters, and other mechanized tools would contribute approximately 60 to 90 dBA to the existing acoustic environment for the duration of the activity. The duration of impacts would correlate to the duration of prescribed fire activities and post-burn monitoring and would be minimized using mitigation measures, including careful timing of activities outside of busy visitor periods, and careful consideration of tools that would contribute the least noise impacts.

The small scope of broadcast burning treatments means that adverse and beneficial impacts would be localized to the treatment areas and extending out to transport corridors used by vehicles and aerial support. In the long term (years to decades), fire management actions that create a more heterogenous stand structure would reduce the potential for high-intensity wildfires across expansive areas of the park that could potentially create more adverse impacts to soundscapes due to more aggressive suppression actions.

Cumulative Impacts

The geographic extent for the analysis of cumulative impacts on soundscapes is the park's acoustic environment, meaning the combination of all the acoustic resources within a given area—natural sounds and human-caused sounds—as modified by the environment. The temporal scope of cumulative impacts on soundscapes is the duration of the impacts which would coincide with the duration of prescribed fire or manual treatment activities, a period of several days when considering impacts to soundscapes. Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA.

Wildfire management actions proposed by the Olympic National Forest could cause short-term adverse impacts to soundscapes by contributing increased noise during suppression activities, particularly from the use of power tools and aerial support. Long-term beneficial impacts from actions on the National Forest would include restored native habitat and forest communities, thereby providing natural sounds within the acoustic environment. Construction activities associated with the U.S. Highway 101 Elwha Bridge Replacement project and activities associated with the Olympic Hot Springs Road geotechnical investigation would cumulatively increase vehicle and equipment noise to the acoustic environment surrounding the construction area, for the duration of the construction activity. In the long term, road improvements would increase visitor access, which would contribute human-caused noise to the existing ambient sound levels within the acoustic environment. Cars, motorcycles, and other motor vehicles are already dominant and pervasive noise sources in the park's transport corridors.

The Pacific Northwest National Scenic Trail Comprehensive Plan would establish management objectives for the section of the trail that passes through the park. These actions could help to manage users along the trail system. The impacts to soundscapes would depend on whether management objectives increase or decrease present user volumes, which would contribute to or deplete ambient sound levels within the park. General aviation, as well as commercial, military, fire and emergency, and scientific and maintenance flights occur over the park. Aircraft noise disturbs visitors, culturally sensitive areas, wilderness character, and wildlife. These activities combined with aerial suppression tactics used for fire management, would cumulatively impact soundscapes, especially in the wilderness areas where visitors seek solitude. Whenever possible, fire managers would typically limit the use of aerial suppression tactics in wilderness areas, thereby reducing the cumulative impact of aircraft disturbance to the acoustic environment.

The Wilderness Stewardship Plan would develop actions to protect wilderness character. This would result in beneficial impacts to soundscapes by improving the wilderness experience including solitude. Additional actions to improve ecosystem functioning, for example the Elwha River Ecosystem Restoration project, would contribute beneficial impacts to the acoustic environment by enhancing natural ambient sounds. These actions, combined with actions in the park to restore forest health through fire management, would cumulatively improve the natural soundscapes. Improvements to the natural resource would contribute to the natural ambient sound levels within the park for many decades.

Overall, these actions discussed above would contribute short- and long-term impacts, which would be both adverse and beneficial to the acoustic environment.

Impacts to soundscapes would occur under the no action alternative in the form of temporary, localized noise impacts from suppression activities, and mechanical and manual treatments. Impacts from the no action alternative plus impacts from the past, present, and reasonably foreseeable future actions described previously would result in short- and long-term adverse and beneficial cumulative impacts to soundscapes. The incremental impacts of the no action alternative would

contribute slightly to, but would not substantially change, the impacts that are already occurring within the acoustic environment of the park.

3.9.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

The impacts to soundscapes from wildfire, either an event that is targeted for suppression or managed as wildfire for multiple objectives, are described under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use in both FMUs, as conditions allow. Compared to the no action alternative, the preferred alternative would increase the ability to use managed fire for multiple objectives on additional acres, expanding impacts to soundscapes over a larger area, and potentially for a longer duration. However, through adherence to mitigation measures, MIST, and PMRA guidelines in wilderness, most adverse impacts to soundscapes would be mitigated, and impacts would be short-term, lasting for only the duration of the wildfire and potentially for several weeks post-fire if rehabilitation activities are required. By increasing the scope of managed fire for multiple objectives, stand heterogeneity would be increased, resulting in reduced potential for large-scale, stand-replacing wildfire to occur, which would otherwise result in larger-scale impacts to soundscapes in the park.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments would be as previously described under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. Given the small-scale application of manual and mechanical treatments, impacts to soundscapes from the use of motorized equipment, vehicle use to transport crew members, and increased human activity would be localized and short-term, lasting for only the duration of the treatment.

IMPACTS FROM PILE BURNING

Impacts to soundscapes from pile burning are described under the no action alternative. Under the preferred alternative, a maximum of 20 acres per year of pile burning would occur within the Non-Wilderness FMU annually. The small-scale application of pile burning within the park would contribute negligible localized impacts to existing ambient sound levels because of motorized equipment use in the preparation of burn piles and vehicles used to transport crews and equipment. Most impacts would last for only the duration of the activity.

No broadcast burning would be allowed within the park without additional environmental review and compliance. Without prescribed fire, the acoustic environment would not be impacted by noise generated from increased human activity and vehicle and equipment use.

Cumulative Impacts

The geographic and temporal scope of the cumulative impacts analysis for soundscapes is described under the no action alternative. Similarly, the past, present, and reasonably foreseeable future actions that may impact soundscapes are described under the no action alternative. As stated previously, the past, present, and reasonably foreseeable future actions would contribute short- and long-term adverse and beneficial cumulative impacts to the acoustic environment.

Cumulative impacts of the preferred alternative would be the same as those for the no action alternative, with fewer impacts from planned fire management as the acreage of planned treatments are reduced and broadcast burning would not occur. The preferred alternative would contribute negligible short-term adverse impacts to soundscapes when added to past, present, and reasonably foreseeable future actions, but would provide long-term beneficial impacts by increasing the opportunity for managing wildfire for multiple objectives, enhancing natural ambient sounds over the long term. The

incremental impacts of the preferred alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within the acoustic environment.

3.9.2.3 *Conclusion*

Impacts to soundscapes as a result of suppression activities, managing wildfire for multiple objectives, manual and mechanical treatments, and pile burning would be similar under both alternatives, except that fewer acres would be treated with manual or mechanical treatment under the preferred alternative, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative (additional compliance would be required), therefore impacts to soundscapes associated with equipment use and human activity during a broadcast burn would not occur. The management of wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative, which would result in increased adverse impacts to soundscapes in the short term but would result in greater fuel reduction and improved forest resilience to wildfire over the life of the FMP which would reduce adverse impacts to soundscapes in the long term. In some years, however, fewer than 1,200 acres of fire may be managed for resource objectives under the preferred alternative, precluding opportunities to create structural heterogeneity, which would improve containment of high-intensity, stand replacement wildfire that impacts acoustic environments over larger areas, due to the noise associated with fire management activities for such wildfire events. Soundscape impacts would also increase under the no action alternative, if acreage limits for wildfire managed for multiple objectives are exceeded; fire may resist containment within habitat acreage limits due to risk to firefighter safety or fires burning in steep inaccessible terrain.

3.10 CULTURAL RESOURCES

3.10.1 Affected Environment

The description of the affected environment for cultural resources was largely drawn from the 2008 General Management Plan (NPS 2008a), unless otherwise noted.

The park encompasses a diverse landscape of natural and cultural features that represent nearly 10,000 years of human history. The NPS is the steward of many of the nation's most important cultural resources, which are categorized as archeological resources, ethnographic resources, prehistoric and historic structures (the latter of which also include historic districts), cultural landscapes, and museum collections. The park protects cultural resources important on a regional and national level, encompassing prehistoric, historic-era, and even contemporary uses of park lands. These cultural resources include prehistoric and historic-era archeological sites, petroglyphs, homesteads, historic-era resorts, backcountry ranger stations, trail and wilderness shelters, and ethnographic sites such as plant gathering areas and ceremonial places. There are eight federally recognized tribes associated with the Olympic Peninsula, including the Lower Elwha Klallam Tribe, the Jamestown S'Klallam Tribe, the Port Gamble S'Klallam Tribe, the Makah Tribe, the Quileute Nation, the Hoh Tribe, the Quinault Indian Nation, and the Skokomish Indian Tribe.

Currently, Olympic National Park has within its cultural resources database over 650 archeological sites, 1,100 ethnographic sites, 31 cultural landscapes, and 16 historic districts (NPS 2008a). Cultural resources stewardship requirements are incorporated into the management standards for wilderness areas for those resources within designated wilderness, where historic preservation laws remain applicable, but must generally be administered to preserve the area's wilderness character pursuant to 16 USC 113(a)(3) (NPS 2006, 2008a).

The List of Classified Structures consists of an inventory of all historic and prehistoric structures with historical, architectural, or engineering significance in which the NPS has or plans to acquire any legal interest. Included are structures that individually meet, or are contributing elements of sites and districts that meet, the National Register of Historic Places criteria. Also included in the List of Classified Structures are other structures that have been moved or reconstructed, commemorative structures, and structures achieving significance within the last 50 years, all of which are managed as important cultural resources because of decisions reached through the planning process. The List of Classified Structures assists park managers in planning, programming, and recording decisions of appropriate treatment (NPS 2008a).

Please see Appendix I for a detailed description of cultural resources within the park.

3.10.2 Environmental Consequences

3.10.2.1 *Alternative A: No Action*

Because the park has not been surveyed in its entirety, it is possible that some unknown prehistoric resources and/or remains of historic resources (including structures and landscapes) would be impacted or lost during fire management actions under the no action alternative, particularly wildfire suppression and management of wildfire for multiple objectives. Therefore, coordination between fire management and the park's cultural resource staff would be of critical importance prior to implementation, particularly during wildfire suppression and managed use, to identify resources and mitigation methods as soon as possible.

Known cultural resources would continue to be managed and preserved under agency-wide mandates and policies to reach desired conditions under the no action alternative. Cultural resources in designated wilderness would be protected and maintained using methods that are consistent with preservation of wilderness character and values, and cultural resources requirements. Historic structures and cultural landscapes would continue to be surveyed, inventoried, and evaluated, and current preservation and maintenance of these resources would also continue.

Additionally, future management actions would continue to be carried out in consultation with associated tribes to prevent loss or degradation to important cultural and natural features as ethnographic resources, the relationship of Native practices, and the ecological health of the park's lands.

IMPACTS FROM WILDFIRE SUPPRESSION

Under the no action alternative, current management practices would continue in conformance with applicable laws and regulations for the protection and preservation of cultural resources. Cultural resources in the park would continue to be at risk from human-caused wildfires that could result in loss or damage to these resources, either directly by wildfire and related impacts, or from suppression activities.

The effects of wildfire on prehistoric resources are variable, but there is particular concern regarding impacts from wildfire to sites containing dense, surface-visible lithic scatters. The risk of wildfire effects on petroglyph sites is low as all known sites are outside of forested areas and are located along the coast. Direct impacts from wildfire to prehistoric resources, including artifact assemblages, features, and buried deposits, are functions of the temperature and duration of heating (also known as residence time). Greater fire severity can result in deeper soil heating from longer residence time and smoldering of surface litter, and also higher severity in terms of effects to surface and subsurface archeological resources (Ryan et al. 2012). Combustion, smoke, and ash (combustion byproducts), and heat-transfer mechanisms are factors that directly affect archeological resources during wildfire events. Indirect impacts to archeological resources include post-fire erosion and flooding, carbon contamination in subsurface deposits, and ground disturbance from fire-killed trees that fall (Ryan et al. 2012).

Historic-era archeological materials are often fire-sensitive as well. Extensive stand replacement wildfire, typical of the fire regime of much of the park, could result in the alteration and/or removal of important archeological sites, resulting in long-term adverse impacts if prehistoric and historic-era archeological resources are consumed by fire.

The effects of wildfire on ethnographic resources and the traditional landscape may vary widely. Wildfires can directly damage or destroy important traditional resources, including plant communities, archeological sites, prehistoric and historically used trails, springs, and sacred places. The loss of important plant resources impacts gathering areas and traditional activities important to cultural heritage. Additionally, the loss of access to ethnographic resources due to large-scale, high-intensity wildfire, hinders the ability of these groups to continue to maintain ancestral ties to the land through cultural traditions and affects the relationship between these resources and the associated group's body of practices and beliefs. Wildland fire could, depending on its severity of effects, also diminish the visual integrity of ethnographic resources valued by tribal groups, especially the damage to sacred and ceremonial areas. Consultation and coordination with tribal groups would continue under existing management to share knowledge about important ethnographic resources and to solicit tribal perspectives on their management and protection in the event of wildfire. As ethnographic resources include prehistoric and historic components, loss, damage, and other impacts to these resources would result in impacts to ethnographic resources as well.

Historic resources tend to be highly sensitive to fire, given they are often constructed of combustible materials (e.g., wood). Logging remains (e.g., stumps and associated logging equipment and railroad segments), mining features (e.g., objects made of wood such as boxes, tracks, etc.), as well as historic buildings and structures, are considered highly fire sensitive and are often destroyed if in the path of a wildfire. For this reason, historic resources—particularly in-use buildings—are often subject to individual fire-prevention treatments (e.g., vegetation removal, fire-resistant wrap, sprinkler systems, use of surfactants on nearby fuels), and wildfire suppression strategies would be implemented to minimize threats to known historic resources from a fire.

Full suppression of wildfires would attempt to minimize fire spread to the smallest possible size, which would provide immediate protection to archeological resources located outside the fire perimeter; however, this could also lead to more aggressive suppression activities in order to keep fire size small. In the event an unplanned ignition grows beyond containment, there is also the potential for adverse impacts to known and unknown cultural resources within the park. Wildfire suppression techniques, such as the construction of firelines (mechanical and by hand), cutting of vegetation for fire breaks and helispots, and burnout operations may cause direct impacts to surface and subsurface cultural materials due to soil disturbance and compaction. Additionally, mop-up activities, including extinguishing or removing burning material near firelines, felling snags, trenching logs, and treating spot fires and hot spots beyond the fireline, also have the potential for adverse impacts to cultural resources where they occur within wildfire burn areas.

Damage to plant communities, gathering areas, and sacred and ceremonial sites as a result of wildfire suppression may also occur, which could disturb, destroy, or alter ethnographic resources important to American Indian groups associated with the park. As ethnographic resources include archeological components, loss, damage, and other impacts to these resources from wildfire suppression activities would result in impacts to ethnographic resources as well.

For archeological and historic resources, while construction of firelines and removal of fuel around the resource would help minimize impacts from wildfire, these protection methods may not prevent spot fires from igniting outside the wildfire perimeter, which may still damage these resources even at a distance. Direct impacts from wildfire suppression activities may also result from the application of water and foam, as well as fire retardant which can stain and corrode historic buildings if not administered properly, and if they have the potential to damage archeological and historic materials when applied in a wildfire situation.

Full suppression of wildfires in cultural landscapes would attempt to contain fire spread as soon as possible, so that ignitions are suppressed before they are able to gain in size, which would provide immediate protection to culturally important landscape components located outside the fire perimeter. This would also minimize impacts if the wildfire were to occur within cultural landscapes where fires are successfully contained to a relatively small area. If a large wildfire grows substantially, there is potential for adverse impacts to cultural landscapes as firefighting efforts increase. Impacts from fire and suppression activities could result in loss or damage to the natural and cultural components, as well as to intangible attributes like viewshed and visual quality, that comprise culturally important landscapes. Under the no action alternative, all fires in the Exclusion FMU would be suppressed to protect frontcountry infrastructure and reduce the potential for wildfire to spread from or to adjacent lands. This would provide immediate protection to cultural resources located outside the fire perimeter in this FMU.

In the event of a wildland fire, measures would be taken to limit damages to cultural resources through the incorporation of MIST guidelines (see Appendix D) into the planning and implementation phases—including suppression and mop-up operations. Fire suppression activities would be conducted in coordination with a resource advisor and the park's cultural resources specialist(s). If cultural resources are threatened by an unplanned event, a cultural resource specialist or advisor would be consulted to help mitigate the impacts of fire management activities. Their direct involvement when choosing locations of staging areas, crew camps, and firelines would help avoid or minimize adverse impacts to cultural resources in the park.

Using these mitigation measures (see Appendix D), including coordination with cultural resource specialists in wildfire management decisions, the suppression of wildfire would minimize and avoid impacts to cultural resources to the extent that it is safe and practicable.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Management strategies for individual wildfires would be determined by implementing a risk analysis and evaluation of objectives (using WFDSS), and the decision to manage a wildfire would include consideration of impacts to cultural resources, as well as a variety of other factors (see Section 2.2.3).

Impacts from managing wildfire for multiple objectives would be the same as wildfire fire suppression where aggressive suppression is required on portions of the fire. However, managing naturally ignited wildfire for multiple objectives would accomplish predetermined resource management objectives in specific geographic areas. This would allow fire to function in its natural ecological range, maintaining historical fire regimes, and thereby protecting, maintaining, and enhancing resources, including where cultural resources are located. Using wildfire to treat vegetation would help create structural heterogeneity across the landscape, increasing opportunities for containment of future fires and therefore preventing adverse impacts to cultural resources from more aggressive suppression activities.

There is the potential of impacts to unknown, yet-to-be discovered cultural resources (including prehistoric and historic sites) in areas where wildfires burn vegetation, and there may be adverse effects from using wildfire for multiple objectives, as previously described for unplanned ignitions. This is particularly true if unknown resources are located where fires are allowed to burn. However, if a wildfire managed for resource benefit no longer meets the desired objectives, park staff would have the option of suppressing fires near known cultural resources to protect them.

The use of wildfire could also result in long-term beneficial impacts to cultural resources by allowing fire to function in its natural role. The use of wildfire for multiple objectives would help maintain fire-adapted environments and other unique habitats, which would benefit cultural landscapes as well as natural resources important to tribal groups, particularly where fire encourages regrowth and enhances ecosystem health.

Impacts to ethnographic resources and culturally important landscapes could include burned and scorched vegetation and unvegetated areas post-fire. Historically, vegetation in the park would burn infrequently, but with stand replacement, therefore depending on the intensity of the fire and suppression actions taken, smaller vegetation communities may take one to two growing seasons to several years to reestablish post-fire. Longer-term impacts would occur if large trees are lost to wildfire. In the long term, the reintroduction of fire into a fire-adapted landscape would provide beneficial impacts for the maintenance of ethnographic resources and cultural landscapes.

Under the no action alternative, managing naturally ignited wildfire for multiple objectives, including for resource benefits, would be implemented in only suitable species-specific habitat up to a maximum of 200 acres annually, with an additional allowance for up to 600 acres once every 5 years in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres of wildfire burn over 5 years would be allowed to be managed in the Conditional and Wildland Fire Use FMUs. This would result in potentially fewer impacts from wildfire suppression to cultural resources located in the treated areas within these FMUs where less-aggressive suppression activities would be required.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Fuel treatments under the no action alternative would include mechanical and manual methods, including the use of hand-operated power tools, hand tools, and specialist equipment to cut, clear, or prune vegetation. Use of large equipment—including boom trucks and front-end loaders—during mechanical treatment activities has the potential to impact cultural resources through damage from ground disturbance; however, large equipment would be restricted from travelling cross-country and in the wilderness, therefore, the potential to damage cultural resources in off-road areas is unlikely.

Manual and mechanical removal of ladder fuels would discourage fire moving from the ground into the forest canopy. Thinning dense stands of trees to reduce the continuity of fuels would strengthen natural barriers in and around sensitive resources. This would establish defensible space around cultural resources and reduce the likelihood of their ignition. As areas receive initial treatment, maintenance treatments would primarily rely on the use of hand tools and other manual methods. Because manual treatment does not include the use of motorized equipment, this method tends to be less intrusive and has a lower risk of damaging sensitive resources. Cultural resources would benefit from this enhanced protection.

Under the no action alternative, a maximum of 200 acres per year would be manually and/or mechanically treated in the park, with focus on the Exclusion FMU where the greatest concentration of park structures is located.

IMPACTS FROM PILE BURNING

Under the no action alternative, the NPS would identify sensitive cultural locations and protocols for burning near cultural resources or within culturally important landscapes. Cultural resources would be identified and located as part of the burn plan process, as appropriate. Section 106 compliance would be completed for applicable pile burning activities and identified cultural resources would be avoided or treated in order to mitigate impacts.

There would be beneficial impacts to cultural resources from enhanced protection from extensive high-severity effects from wildfire by removing hazardous fuels on or around the cultural resource to create a defensible buffer. Removing heavy fuels and logs from vulnerable areas would enhance protection of traditionally important plant communities, as well as cultural and natural features of cultural landscapes including the historic character of the viewshed.

The no action alternative would allow 275 acres per year of pile burning over 5 years in the non-wilderness areas of the Exclusion, Conditional, and Wildland Fire Use FMUs, with focus on the Exclusion FMU where the greatest concentration of park structures is located.

Piles to be burned would not be placed in or near sensitive resource areas. Pile burning and/or disposal of debris would be carefully managed and implemented using MIST and oversight by cultural resource advisors (see Appendix D). Additionally, close monitoring of pile burning would be conducted to avoid adverse impacts to known cultural resources. Through adherence to these and other mitigation measures, impacts to cultural resources from pile burning would be short-term and minimal.

IMPACTS FROM BROADCAST BURNS

Under the no action alternative, there would be beneficial impacts to cultural resources from enhanced protection from extensive high-severity fire effects from prescribed broadcast burns that do occur in non-wilderness areas under this alternative. Prior to initiating a prescribed fire, the NPS would develop a prescribed burn plan, which would include advanced coordination with cultural resource staff to identify sensitive cultural locations and protocols for burning near archeological and historic resources, as well as cultural landscape components and resources important to associated tribal groups and the traditional landscape. Cultural resources would be identified and located as part of the prescribed burn plan process. Section 106 compliance would be completed for prescribed burn plans and fire-sensitive cultural resources would be either avoided in the burn unit or prepped prior to the burn in order to mitigate impacts. Preparations might include manually removing fuels on or around the cultural resource, which would create a defensible buffer around the resource. Removing heavy fuels and logs from vulnerable areas would enhance protection for ethnographic resources, including traditionally important plant communities, as well as cultural and natural features of cultural landscapes.

By removing surface fuels, including dead and down vegetation, prescribed fire can reduce the continuity of fuels and provide opportunities for containment of future wildfire before it threatens cultural resources. Therefore, broadcast burns serve to protect cultural resources that would otherwise be adversely affected by wildfire.

Prescribed broadcast burns in non-wilderness would be carefully managed and implemented using MIST and oversight by cultural resource advisors (see Appendix D). Additionally, close monitoring of broadcast burns would be conducted to avoid adverse impacts to known cultural resources. Through adherence to these and other mitigation measures, impacts to cultural resources from broadcast burns would be short-term and minimal under the no action alternative.

Cumulative Impacts

Past and present actions have been subject to evaluation under Section 106 of the NHPA to consider effects to cultural resources from projects. Likewise, reasonably foreseeable future projects at the park would undergo the same process, which is required of all federal actions (see Table 3.1). Undertakings that have the potential to affect resources eligible for or listed in the National Register of Historic Places (NRHP), such as any ground-disturbing activities from wildfire management actions, would fulfill all procedural requirements under Section 106 (36 CFR 800) as part of the environmental review process. Through this process, impacts to cultural resources would either be avoided or, where

impacts are unavoidable, effects mitigated through appropriate treatment, which would be developed in consultation with the State Historic Preservation Office (SHPO) and American Indian tribes with traditional associations to the park.

Unanticipated discoveries during proposed management activities typically results in work ceasing in the area and a qualified NPS staff member visiting the site to assess conditions and recommending a course of action in consultation with the SHPO. Therefore, there would be no cumulative adverse impacts to cultural resources in the park under the no action alternative from planned actions by the NPS and other entities.

Past inventories and studies, and current assessments, have further enhanced knowledge of the park's cultural resources and facilitated better documentation efforts for management strategy development. Future beneficial long-term impacts would occur to cultural resources resulting from continued protection and preservation efforts for archeological and historic resources as well as the planned inventory and documentation for cultural landscapes. Finally, cultural resources would continue to benefit from ongoing consultation efforts with traditionally associated tribal groups and management decisions that encourage tribal access to culturally important sites to promote traditional cultural practices and beliefs.

3.10.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

Under the preferred alternative, direct and indirect impacts to cultural resources from wildfire suppression would be the same as described under the no action alternative. All unplanned natural and human-caused ignitions in the Non- Wilderness FMU would receive a suppression-oriented response to protect frontcountry developments and to reduce the potential for wildfire to spread from or to adjacent lands.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Impacts to cultural resources from the management of wildfire for multiple objectives would be the same as described under the no action alternative.

In the Wilderness FMU, naturally ignited wildfires would be evaluated to determine if the fire should be allowed to function in its natural ecological role, to the extent practicable, to protect, maintain, and enhance resources. Wildfire would be allowed to burn on an average of 1,200 acres of park lands annually, over the life of the revised FMP under this alternative. The use of wildfire for multiple objectives would be considered, as conditions allow. This would create greater structural heterogeneity providing greater opportunities for containment of future wildfire, and result in potentially fewer impacts from wildfire suppression to cultural resources located in these treated areas. The number of treated acres would increase in comparison to the no action alternative, which would effectively create defensible space around sensitive cultural resources across a larger area. Additionally, by allowing fire managers the flexibility to adapt to changes in the environment and update wildfire management policy, protection and preservation of cultural resources may be enhanced because consideration of these resources would be part of the planning process for these management decisions.

Implementation of this alternative also allows for the natural process of wildland fire to be managed across the NPS and USFS boundaries. Many of the park's cultural resources predate its establishment and the delineation of its boundaries. Cross-agency management strategies would enhance protection of cultural resources by reducing the spatial extent of future high-intensity stand replacement fire that could adversely affect archeological, historic, and ethnographic resources, as well as important cultural and natural features of the landscape, on a larger scale than restricting wildland fire use to park boundaries.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments to cultural resources would also be the same as described under the no action alternative, with a maximum of 100 acres per year subject to manual and/or mechanical treatment in the Non- Wilderness FMU. Manual and mechanical treatments would occur in the Wilderness FMU in accordance with the PMRA process when park infrastructure is at immediate risk from wildfire. Additional measures to provide structure protection (including historic buildings and structures) would include covering the resource with fire-resistant wrap or foam.

IMPACTS FROM PILE BURNING

The impacts to cultural resources from pile burning would be the same as described under the no action alternative; however, this alternative would allow a maximum of 20 acres (combined) per year of pile burning, which would occur in the Non-Wilderness FMU.

Under the preferred alternative, no broadcast burning would be permitted within the park without additional environmental review and compliance. Prescribed broadcast burns in wilderness, like the no action alternative, would be dependent on the decisions made in the forthcoming Wilderness Stewardship Plan and would require additional compliance. As a federal undertaking, all prescribed broadcast burning projects would undergo the Section 106 process. As wildfire management actions have the potential to affect resources eligible for, or listed in, the NRHP, the environmental review process would include compliance with all procedural requirements under Section 106 (36 CFR 800). Through this process, impacts to cultural resources would either be avoided or, where impacts are unavoidable, effects mitigated through appropriate treatment, which would be developed in consultation with the SHPO and American Indian tribes with traditional associations to the park.

Cumulative Impacts

Cumulative impacts to cultural resources resulting from implementation of the preferred alternative would be the same as those described under the no action alternative.

3.10.2.3 *Conclusion*

Under both alternatives, cultural resources in the park would be at risk from unplanned ignitions that could result in loss of, or damage to, these resources, either directly or indirectly by wildfire, or from suppression and/or mop-up activities. In the event of a wildland fire, measures would be taken to prevent and/or minimize damage to all cultural resources within the park, and all fire suppression and mop-up operations would be performed using MIST guidelines (see Appendix D).

The main difference between the no action alternative and the preferred alternative is the number of acres subject to wildfire management and other treatments. With an average of 1,200 acres of wildfire allowed to burn per year, the use of wildfire for multiple objectives would be considered, as conditions allow, anywhere within the park under the preferred alternative, and would not be restricted to species-specific habitat. Therefore, more acres would be treated through proactive fire management under the preferred alternative that would afford better protection to cultural resources through fuels reduction to create and enhance natural barriers around cultural resources.

Section 106 consultation would be the primary regulatory mechanism to address impacts to cultural resources in the park in emergency (wildfire, BAER) and non-emergency (planned treatment) situations.

3.11 VISITOR USE AND EXPERIENCE

3.11.1 Affected Environment

Approximately 3 million visitors come to the park each year to enjoy the natural resources and social interactions, and to participate in recreational and educational opportunities. In 2017, visitor numbers reached 3,401,996 people (NPS 2018e); recreational visits were highest from June through September with the greatest number in August, which has exceeded 700,000 visitors that month for the past 5 years. The park receives the greatest number of wilderness campers from July through September. This period coincides with the peak of fire season. Annual recreational visitation has remained above 2.5 million people over the past 33 years (1984–2017). The total number of recreational visitors to the park exceeded 3 million annually for the first time in 1992, and that number of visitors has been maintained during most years since then.

In 1976, the park was designated an International Biosphere Reserve in the Man and the Biosphere Program by UNESCO. This International Biosphere Reserve designation identifies the park as an internationally significant area of ecosystem diversity within one of the world's major biogeographical provinces. In 1981, the park was designated a World Heritage Site by the World Heritage Convention, joining it to a system of natural and cultural properties that are considered

irreplaceable treasures of outstanding universal value. The park serves as a recreational "backyard" for over 10 million residents within a 5-hour drive of the park, in addition to attracting recreating visitors from across the nation and world.

Olympic National Park is open for year-round public use. There are several campgrounds (the largest in the park is a 177- site campground), nature trails, visitor contact stations, guided walks, campfire programs, and ranger services provided within the park to enhance the visitor experience. Primary recreational opportunities in the park include sightseeing (by car and on foot), camping, hiking, backpacking, stock packing, boating, fishing, snow recreational activities (downhill skiing, cross-country skiing, snowshoe excursions, and general snow play), and wildlife viewing. Relatively few visitors use aircraft to receive an overview of the park from the air.

Over 95% (876,447 acres) of Olympic National Park is designated wilderness, encompassing and protecting one of the largest wilderness areas in the contiguous United States and offering visitors a chance to experience the park's amazing diversity in its natural and pristine state. The wilderness provides resource and economic benefits including clean water and air, native plants and wildlife habitat, natural soundscapes, and dark night skies, as well as recreational opportunities. The wilderness offers more than 600 miles of trails, from easy strolls to challenging paths and hundreds of thousands of remote trail-less acres where one can experience solitude and primitive or unconfined recreation. The Pacific Northwest National Scenic Trail traverses approximately 135 miles through the park, passing east-west through wilderness. About 60% of park wilderness trails (approximately 365 miles) are open to stock use (NPS 2008a, 2015b).

A comprehensive visitor survey was conducted at the park in the summer of 2000, which found that the most common visitor activities at the park were sightseeing/scenic driving (88%); walking on nature trails (77%); enjoying wilderness, solitude, quiet (73%); viewing wildlife (72%); and hiking (71%) (Van Ormer et al. 2001). Other activities included camping in developed campgrounds, attending ranger-led programs, visiting cultural sites, stargazing, overnight backpacking, fishing, and bicycling. Several concessions and businesses under permit provide recreational services in and around the park, including river rafting, boat rentals, guided wilderness trips, horseback riding, and pack stock and guided trips (NPS 2008a; Van Ormer et al. 2001). Approximately 69% spent 1 day or more at the park. Of those visitors who spent less than 1 day at the park, 77% spent 1 to 6 hours in the park. Over half of the visitors (62%) said that they spent one or two nights in the park (Van Ormer et al. 2001).

An extensive range of recreational, educational, and interpretive opportunities enables a broad spectrum of visitors to connect with the park from many perspectives. The park draws local, regional, national, and international visitors of many backgrounds and provides options for a variety of interests and abilities ranging from frontcountry sightseeing to multiday wilderness backpacking. Interpretive programs offer opportunities for lifelong learning and stewardship.

Administrative Sites and Facilities

Administrative sites in the park include: the headquarters complex, 16 frontcountry ranger stations (each a complex of buildings), 18 frontcountry campgrounds with more than 2,000 campsites (in non-wilderness and wilderness), 35 picnic sites, 3 visitor centers, 6 concession facilities (4 with overnight lodging), 6 backcountry patrol cabins, several ranger tent platforms, 18 three-sided shelters, and numerous pit-toilets. Other park structures include historic buildings, housing units, utility systems, trailhead facilities, and radio repeaters. Wilderness campsites are scattered throughout the backcountry of the park and require permits for overnight stays (NPS 2008a).

The parkwide road system includes more than 140 miles of paved and unpaved roads, 27 bridges, and 1,500 visitor parking spaces. There are approximately 12 miles of wood-decked puncheon or boardwalk in the park. The park is open 24 hours a day year-round, although some roads, campgrounds, and facilities are open seasonally. The main visitor center in Port Angeles is open daily in the summer with reduced hours from fall to spring. It offers information, an orientation movie, nature trails, a children's discovery room, exhibits, and handicap-accessible exhibits. There are additional visitor centers at Hurricane Ridge and the Hoh Rain Forest (NPS 2008a).

Visitor use management issues facing the park include congestion and crowding at many park facilities, resource damage including garbage and human waste accumulation at front country and wilderness locations, increased pressure on facility maintenance, increased bare-ground formation, and vegetation loss and damage. There is also a lack of public knowledge and understanding of park regulations, Leave No Trace principles, and other ways to be responsible park stewards. The demand for law enforcement and environmental management exceeds current park staff capacity. It has been 18 years since the last parkwide visitor use survey and visitor numbers and demographics have shifted over that time. The 2017

Foundation Document identifies a need to balance increasing visitation with the protection of fundamental resources and values (NPS 2017).

3.11.2 Environmental Consequences

3.11.2.1 *Alternative A: No Action*

IMPACTS FROM WILDFIRE SUPPRESSION

Under a wildfire suppression-only response, if wildfire behavior has the potential to endanger visitor or employee safety, a temporary restriction or closure of a portion of the park may be issued by the superintendent. Based on previous fire activity within the park, road and area closures typically do not exceed 2 to 3 days and most fires occur far away from park roads and therefore road closures are rare (NPS 2003). Other areas in the park would remain open to visitor use and would have similar resources available. Trails may be closed for weeks or months after large fires to reduce the danger of falling snags. This hazard usually lessens after one winter's weather, so impacts would last for less than 1 year. Impacts to visitor use and experience therefore would be localized and adverse in the short-term, lasting for only the duration of the fire and post-fire rehabilitation activities, with visitor use returning to normal as soon as it is safe for visitors to return to the area. In the event of a larger fire, impacts may last for several weeks to months.

Fire management operations generally include fire detection, fire suppression, monitoring, igniting, and holding. Potential activities associated with fire management, specifically the use of aircraft during suppression actions, could generate short-term, temporary noise that would impact visitor use and experience due to disruptions to wildlife and wilderness character within the park during the suppression action. Incident personnel assigned to wildfire would not fly aircraft over wilderness without following the wilderness minimum requirement guidance. As provided for in the PMRA, UAS may be used to gather information regarding fire size and fire behavior, which would minimize noise impacts when compared to larger aircraft. Retardant and water drops are rarely conducted as part of wilderness fire suppression efforts, limiting the potential for fire-related aircraft noise to impact the park soundscape and visitors' experience. If applied, aircraft retardant lines would be noticeable for a relatively short duration, as rainfall associated with the park would typically dilute and wash away the retardant after one season.

Additional suppression tactics like the use of equipment may impair visitor experience due to visual degradation of the natural resource that may last one to two growing seasons post-fire, however, mechanical equipment would normally be limited to the non-wilderness portion of the park, containing impacts to the already developed portions of the park, and MIST would be applied to reduce the intensity of those impacts. Suppression actions within the wilderness portion of the park would require conformance with the Wilderness Act and adherence to a minimum requirements analysis, which would minimize degradation of wilderness character by ensuring that the minimum tools and techniques are selected. Long-term adverse impacts to the wilderness portion of the park from wildfire suppression activities would be minimal.

Beneficial impacts would derive from the protection and preservation of park resources and values during a wildfire and suppression activities. Mitigation measures and MIST would be used to reduce the severity of impacts to visitor use and experience. There may also be opportunities for public education and outreach during the wildfire. Beneficial impacts of managing fire for multiple objectives would not be realized and maintenance of the natural fire regime through the use of wildfire would not occur.

Impacts to visitor use and experience would be adverse in the short term, due to smoke impacts and closures, but would last for only the duration of the fire or until it is safe for visitor use to resume. Since most wildfires occurring in average years in the park are contained before they gain in size, impacts to visitor use and experience would typically last no longer than 2 to 3 days. Exceptions may occur when large fires occur close to trails, and closures may need to be in place until the following spring or later.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the no action alternative, the use of wildfire for multiple objectives would be limited to a maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, with an additional 600 acres limited to once every 5 years

in the Conditional and Wildland Fire Use FMUs (combined). Outside of the species' habitats, a maximum of 500 acres over 5 years would be allowed to burn as wildfire for multiple objectives in the Conditional and Wildland Fire Use FMUs.

Direct adverse impacts from using wildland fire for multiple objectives would include the same impacts as described previously under the no action alternative regarding closures and restricted access but with additional minor displacement of some visitor activities as the wildfire is not immediately suppressed. These impacts would likely be limited to a few hours or days over the course of a year in total. By allowing some fires to burn for multiple objectives, fewer aggressive suppression actions would be employed, reducing adverse impacts of suppression on visitor use and experience.

There would be an incremental increase in smoke in scenic viewsheds and temporary restrictions in access to some areas, and temporarily blackened vegetation. Smoke production would be of limited duration, usually lasting a few hours to a few days. Exceptions may occur when meteorological conditions (such as an inversion) exist and smoke may linger for a longer period of time. The health impacts from smoke are generally considered negligible to the majority of visitors, as most smoke is relatively short in duration in comparison to the average visitor stay at the park. Most visitors would not be in the main smoke column area and exposed to only thin drift smoke. Visitors also tend to be mobile and flexible enough in itinerary to avoid smoke by visiting another area of the park. Mitigation measures and MIST would be used to reduce the severity of impacts to visitor use and experience.

Some visitors may be disappointed to see blackened areas following a wildfire. This would be a short-term, adverse, localized effect that would persist until vegetation regrows. Blackened areas usually green up within a few days to a few months. The experience for many visitors would improve when green vegetation grows back and wildflowers emerge in the spring. The use of wildland fire for multiple objectives and its effects on vegetation may present an opportunity for education and interpretation of natural resource values and processes, which may result in a beneficial impact.

Beneficial impacts would be derived from the protection and preservation of park values during a wildfire and suppression activities. By allowing larger areas to burn under appropriate conditions, beneficial impacts to ecosystem resilience would be magnified and maintenance of the natural fire regime would have long-term benefits for the preservation of park resources, which in turn provide more opportunities for visitor use and experience.

Due to the small scale for managed wildfire under the no action alternative, the impacts to visitor use and experience are expected to be localized and short-term, lasting for only the duration of the wildfire and during rehabilitation activities, due to access restrictions, smoke, and noise and visual impacts and for one to two growing seasons post-fire until viewsheds recover.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Under the no action alternative, a maximum of 200 acres per year would be manually or mechanically treated. Mechanical treatments could result in adverse impacts to visitors in the form of noise from mechanical equipment. These noise impacts would be temporary and localized, lasting for only during the extent of the treatment action. The level of impact would depend on the extent of the treatment, the location of treatment relative to visitor attractions and facilities, and a visitor's sensitivity to noise.

If treatments are directed at creating defensible space around developed sites and other natural and cultural resources, or at the removal of nonnative species, this would adversely impact visitor use of those areas or sites during the extent of the treatment. Good signage and interpretation of the treatment may mitigate impacts and provide an opportunity for education regarding vegetation management and wildfire risk. Treatments may also be planned to coincide with periods of low visitation to limit adverse impacts on visitor use and experience.

Mechanical treatments may necessitate temporary closure of some areas, including trails and roads. This would result in temporary adverse impacts to visitor use and experience while closures are in place. Given the small-scale application of manual and mechanical treatments, impacts to visitor use and experience from access restrictions, closures, or noise disturbance would be localized and short-term, lasting for only the duration of the treatment.

IMPACTS FROM PILE BURNING

Under the no action alternative, 275 acres per year of pile burning would occur over 5 years in the non-wilderness.

Pile burning would necessitate some localized closures of treated areas for the protection of health and safety of visitors. These closures would cause short-term adverse impacts to visitor use and experience that would last the duration of the burn (1–2 days). Pile burning would also create smoke that may impact the experience of some visitors with smoke sensitivities; smoke generation may impair visibility temporarily across some viewsheds. Pile burning would remove excess fuels improving wildlife viewing opportunities, and in the long term (years to decades) improving viewsheds, and reducing the potential of adverse impacts to visitor use and experience.

Impacts to visitor use and experience would be localized around treatment areas, and most adverse impacts from pile burning would be avoided through careful timing of burning to occur during the spring and fall, when visitor numbers are usually low at the park.

IMPACTS FROM BROADCAST BURNS

Under the no action alternative, no more than 125 acres of broadcast burning would occur in the non-wilderness portion of the park over a 5-year period. No more than 65 acres would be subject to broadcast burn in a given year. The small scope of broadcast burning treatments means that adverse and beneficial impacts would be very localized to the treatment areas.

Broadcast burning at the park would potentially result in temporary closures of, or restricted access to, portions of the park during prescribed fire events (1–2 days). Short-term adverse impacts to visitor experience would result from localized public closures and presence of smoke during prescribed fire management activities, which may impact visitors and their principal activities such as hiking, sightseeing, photography, camping, visiting park facilities, and driving park roads. The duration of impacts would correlate to the duration of prescribed fire activities and would be minimized by applying MIST measures (see Appendix D).

There would be short-term, adverse visual impacts within the vicinity of affected areas due to the change in appearance following treatment. The sight of blackened trees could be perceived as a visual impact on visitor experience. An effective public information and interpretation program would help educate visitors about long-term benefits of prescribed fire, also offsetting adverse impacts to visitation. Because fire management actions would be employed in a way to be sensitive to the natural and cultural resources of each park, visitor experience is expected to improve in the long term, as many visitors are attracted by a park's natural and cultural setting.

For fire-adapted vegetation within the park, prescribed fire would benefit native species and in turn improve ecosystem functioning over the long term. This would provide benefits for wildlife, improving wildlife viewing opportunities and creating a more visually desirable mosaic of vegetation, enhancing the overall viewshed. In the long term (years to decades), fire management actions that reduce hazardous fuels would reduce the potential for more damaging wildfires that could potentially create more restrictions and adverse impacts on visitor use and experience.

The small scope of broadcast burning treatments under the no action alternative means that adverse and beneficial impacts would be very localized to the treatment areas.

Cumulative Impacts

The geographic extent for the analysis of cumulative impacts on visitor use and experience is the park viewshed, meaning the expanse of all lands that can be viewed from the park. The temporal scope of cumulative impacts on visitor use and experience is the duration of the impacts which would coincide with the duration of prescribed fire or manual treatment activities, a period of several days when considering impacts to visitation and approximately one to two growing seasons when considering the visual impacts from fire management activities, such as prescribed fire. Section 3.2 outlines the past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts to resources analyzed in this EA. All these actions could impact visitor use and experience at the park.

Wildfire management actions proposed by the Olympic National Forest could cause short-term adverse impacts to visitor use and experience by contributing reduced visibility from smoke, creating health and safety impacts from smoke

emissions, visual impacts of burned and charred forest, and adverse impacts to natural resources and wildlife that might impact visitor interactions with wildlife. Smoke management across the region would need to be carefully coordinated in order to minimize public health and safety within the park and region. Full suppression tactics may be required when fire activity in the region exceeds air quality standards; this would limit the extent of adverse impacts on visitors. Long-term beneficial impacts from actions on the National Forest would include restored native habitat and forest communities, thereby providing beneficial impacts to visitor use and experience within the viewshed of the park. The Pacific Northwest National Scenic Trail Comprehensive Plan would establish management objectives for the section of the trail that passes through the park. These actions could impact visitor use and experience, the intensity of which depending on the plan objectives. It is unlikely that actions would limit access to the trail, and therefore there would be negligible adverse cumulative impacts. Actions identified from the Olympic Hot Springs Road geotechnical investigation would impact visitor use of park roads and may increase area closures or delays on the park road network. Adverse impacts would also include visual impairment within viewsheds for the duration of the construction activity. Road improvements would provide overall beneficial impacts to visitor use and experience by improving public safety and access for recreational activities. Existing overflights in the park combined with aerial fire management activities would cumulatively impact visitor use and experience, especially in the wilderness areas where visitors seek solitude. Whenever possible, fire managers would typically limit the use of aerial suppression tactics in the wilderness, thereby reducing the cumulative impact of aircraft disturbance to visitor experience.

The Wilderness Stewardship Plan would develop actions to protect wilderness character. This would result in overall beneficial impacts to visitor use and experience by improving the wilderness experience for users. Additional actions to improve ecosystem functioning, for example the Elwha River Ecosystem Restoration project, would contribute beneficial impacts to the visitor experience by enhancing ecosystem quality, viewsheds, and opportunities for wildlife viewing and nature interpretation. These actions combined with actions in the park to restore forest health through fire management would cumulatively improve the visitor experience. Improvements to the natural resource would contribute to the visitor experience for many decades. Overall, these actions would contribute short- and long-term impacts, which would be both adverse and beneficial to visitor use and experience.

Impacts to visitor use and experience would occur under the no action alternative in the form of temporary, localized degradation of air quality, noise impacts from suppression activities, short-term closures during planned management actions, and short-term visual impacts within viewsheds as treatment locations recover. Impacts from the no action alternative plus impacts from the past, present, and reasonably foreseeable future actions would result in short- and long-term adverse and beneficial cumulative impacts to visitor use and experience. The incremental impacts of the no action alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within the viewshed of the park.

3.11.2.2 *Alternative B: Preferred Alternative*

IMPACTS FROM WILDFIRE SUPPRESSION

The impacts to visitor use and experience from wildfire, either an event that is targeted for suppression or managed as wildfire for multiple objectives, are as described under the no action alternative.

IMPACTS FROM MANAGING WILDFIRE FOR MULTIPLE OBJECTIVES

Under the preferred alternative, wildfire would be expected to occur on an average of 1,200 acres of the park per year, over the life of the revised FMP. The use of wildfire for multiple objectives would be considered for use anywhere within the park, as conditions allow. Compared to the no action alternative, the preferred alternative would increasingly utilize managed fire for multiple objectives, expanding impacts to visitor use over a larger area, and potentially for longer duration. However, through adherence to mitigation measures and MIST, most adverse impacts to visitor use and experience would be mitigated, and impacts would be short-term, lasting for only the duration of the wildfire. By increasing the scope of managed fire for multiple objectives, structural heterogeneity would be increased across treated acres, resulting in reduced potential for high-intensity wildfire to spread across expansive areas of the park, which would otherwise result in larger-scale impacts to visitor use and experience in the park.

IMPACTS FROM MANUAL AND MECHANICAL TREATMENTS

Impacts from manual and mechanical treatments would be as previously described under the no action alternative. Under the preferred alternative, a maximum of 100 acres per year would be manually or mechanically treated in the Non-Wilderness FMU. Given the small-scale application of manual and mechanical treatments, impacts to visitor use and experience from temporary closures, noise pollution, or visual impacts would be localized and short-term, lasting for only the duration of the treatment and for one to two growing seasons post-treatment for smaller vegetation and longer-term for large trees that may be removed.

IMPACTS FROM PILE BURNING

Impacts from pile burning are as described under the no action alternative. Under the preferred alternative, 20 acres per year of pile burning would occur within the Non-Wilderness FMU annually. The small-scale application of pile burning within the park would contribute negligible localized impacts to visitor use and experience because of closures, smoke, and visibility impacts. Most impacts would last for only the duration of the activity.

No broadcast burning would be allowed within the park without additional environmental review and compliance. Without prescribed fire, visitors would not be subjected to occasional smoke and odor impacts, and there would be no need to close park areas.

Cumulative Impacts

The geographic and temporal scope of the cumulative impacts analysis for visitor use and experience are described under the no action alternative. Similarly, the past, present, and reasonably foreseeable future actions that may impact visitor use and experience are described under the no action alternative. The past, present, and reasonably foreseeable actions would contribute short- and long-term adverse and beneficial cumulative impacts to visitor use and experience.

Cumulative impacts of the preferred alternative would be the same as those for the no action alternative, with fewer impacts from planned fire management activities as the acreage of planned treatments are reduced and broadcast burning would not occur. The preferred alternative would contribute negligible, short-term, adverse impacts to visitor use and experience when added to past, present, and reasonably foreseeable future actions, but would provide long-term beneficial impacts by increasing the opportunity for managing wildfire for multiple objectives. The incremental impacts of the preferred alternative would contribute slightly to, but would not substantially change, the impacts that are already occurring within the viewshed.

3.11.2.3 *Conclusion*

Impacts to visitor use and experience would be similar under both alternatives, except that fewer acres would be treated with manual or mechanical treatment under the preferred alternative, and pile burning would be reduced compared to the no action alternative. No broadcast burning would be used under the preferred alternative (additional compliance would be required), therefore impacts to visitor use and experience associated with broadcast burning would not occur. The management of wildfire for multiple objectives could occur across a larger area in the Wilderness and Non-Wilderness FMUs under the preferred alternative, which would result in increased adverse impacts to visitor use and experience in the short term, but would result in improved forest resilience to wildfire over the life of the FMP which would reduce adverse impacts to visitor use and experience in the long term and improve opportunities for nature watching and scientific interpretation. In some years, however, fewer than 1,200 acres of fire may be managed for resource objectives under the preferred alternative, and therefore opportunities to introduce stand heterogeneity would not be fulfilled, increasing the potential impacts of high-intensity, stand replacement fire on visitor use and experience over larger areas. Impacts to visitor use and experience would also increase under the no action alternative, if acreage limits for wildfire managed for multiple objectives are exceeded; fire may resist containment within habitat acreage limits due to risk to firefighter safety or fires burning in steep inaccessible terrain.

APPENDIX A – ACRONYMS AND ABBREVIATIONS; MAPS

$\mu g/m^3$	micrograms per cubic meter
AQRVs	air quality-related values
BAER	Burned Area Emergency Response
BAR	Burned Area Rehabilitation
CFR	Code of Federal Regulations
CO	carbon monoxide
dB	decibels
dBA	A-weighted decibel
dbh	diameter at breast height
DNR	Washington State Department of Natural Resources
DO-18	Director's Order 18, Wildland Fire Management
DO-41	Director's Order 41, Wilderness Stewardship
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EFH	Essential Fish Habitat
ES	Emergency Stabilization
ESU	evolutionarily significant unit
FMP	Fire Management Plan
FMU	Fire Management Unit
IGBC	Interagency Grizzly Bear Committee
MIST	Minimum Impact Strategies and Tactics
MRA	Minimum Requirements Analysis
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
NSNSD	Natural Sounds and Night Skies Division
O_3	ozone
ORCAA	Olympic Region Clean Air Agency
park	Olympic National Park
Pb	lead
PEPC	Planning, Environment and Public Comment
PM2.5	particulate matter less than 2.5 microns in size
PM10	particulate matter less than 10 microns in size
PMS	Product Management System
PMRA	Programmatic Minimum Requirement Analysis
ppb	parts per billion
PPE	Personal Protective Equipment
ppm	parts per million
RCW	Revised Code of Washington
Red Book	Interagency Standards for Fire and Aviation
RM-18	Reference Manual 18

SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
UAS	unmanned aircraft system
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WFDSS	Wildland Fire Decision Support System

Figure A.1. Map of Olympic National Park.

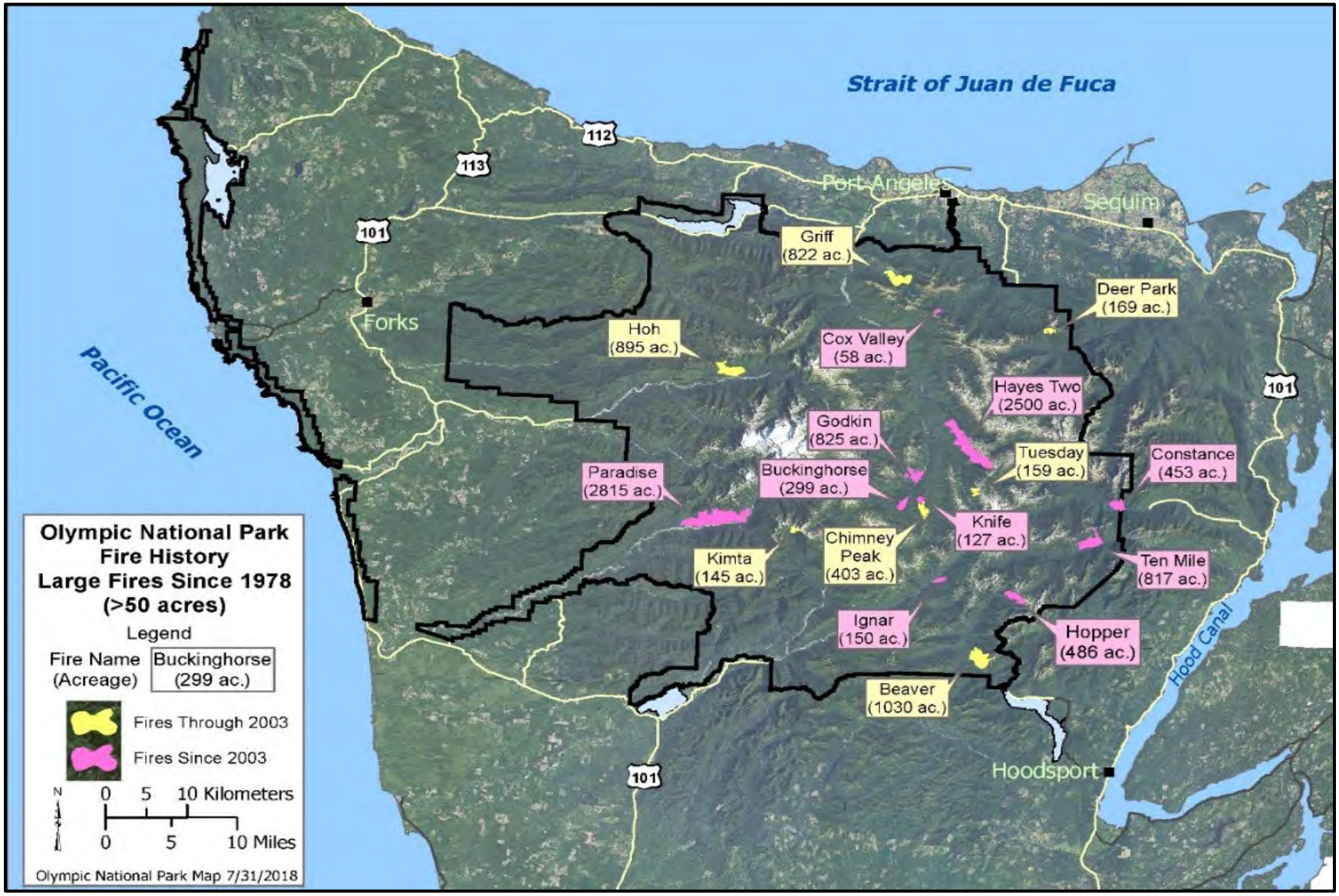


Figure A.2. Large wildfires within the park between 1938 to present.

Figure A.3. Fire Management Units under the no action alternative.

Figure A.4. Fire Management Units under the preferred alternative (Revised FMP).

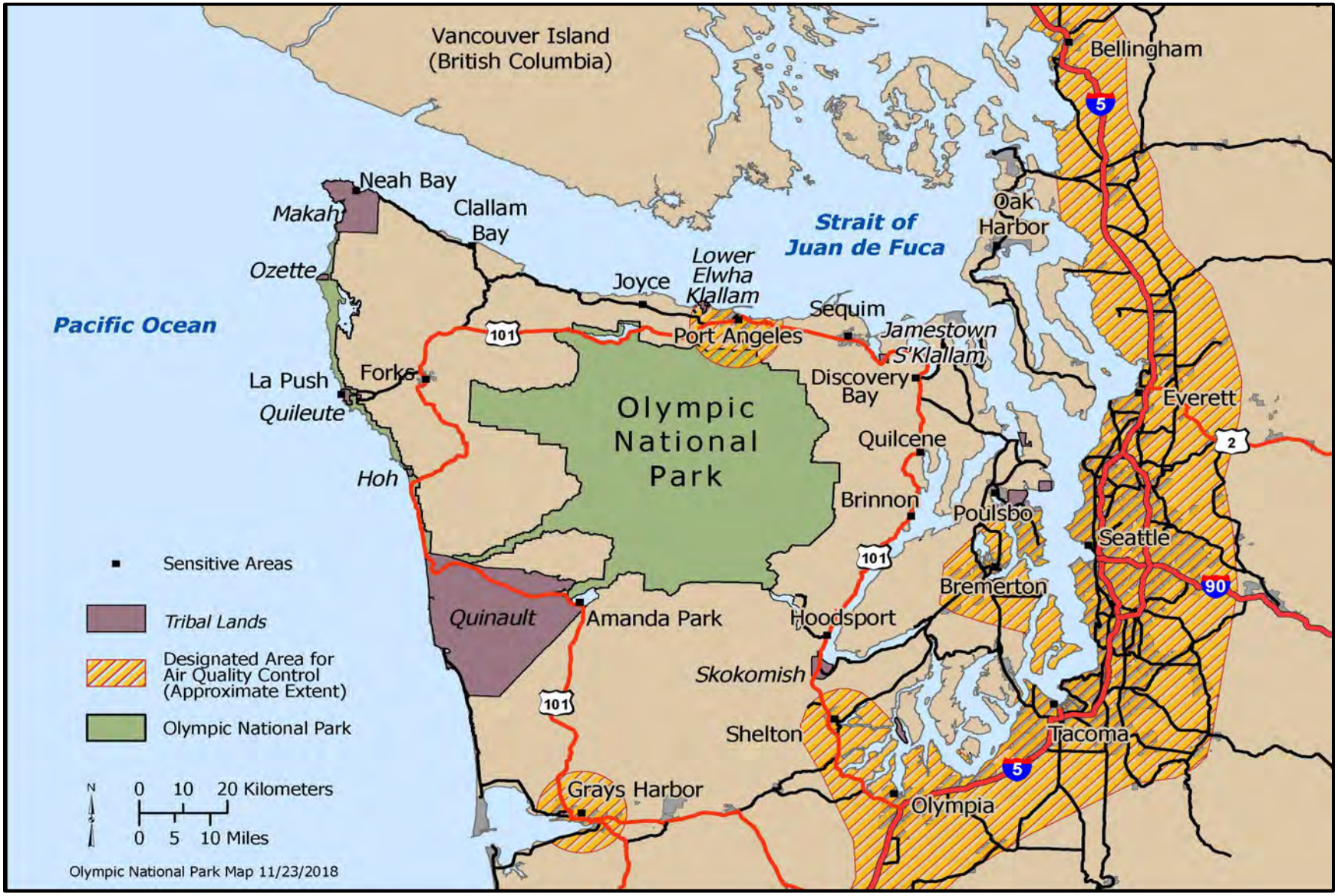


Figure A.5. Smoke management designated areas and smoke sensitive areas. (Source: DNR 1998)

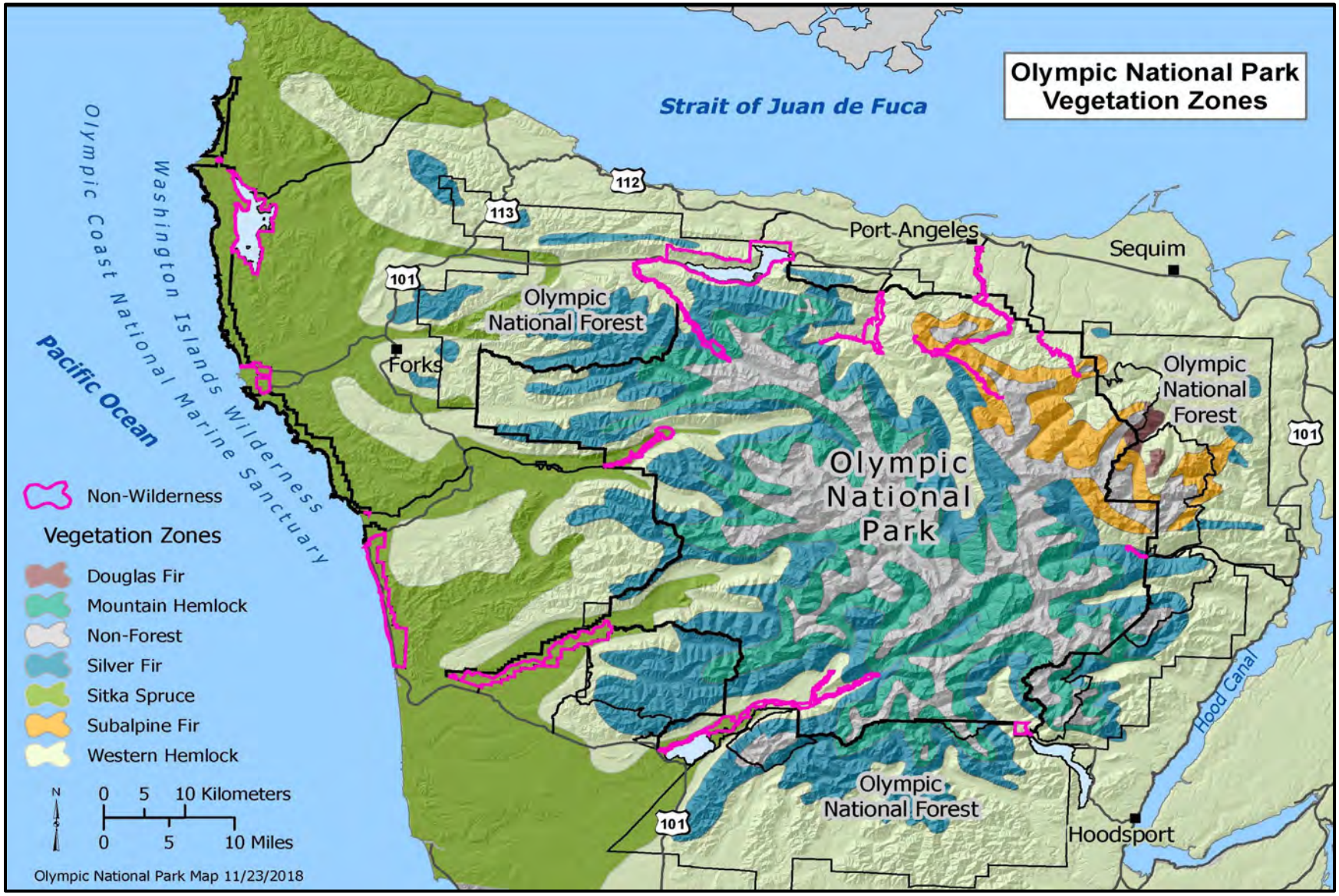


Figure A.6. Vegetation zones within Olympic National Park.

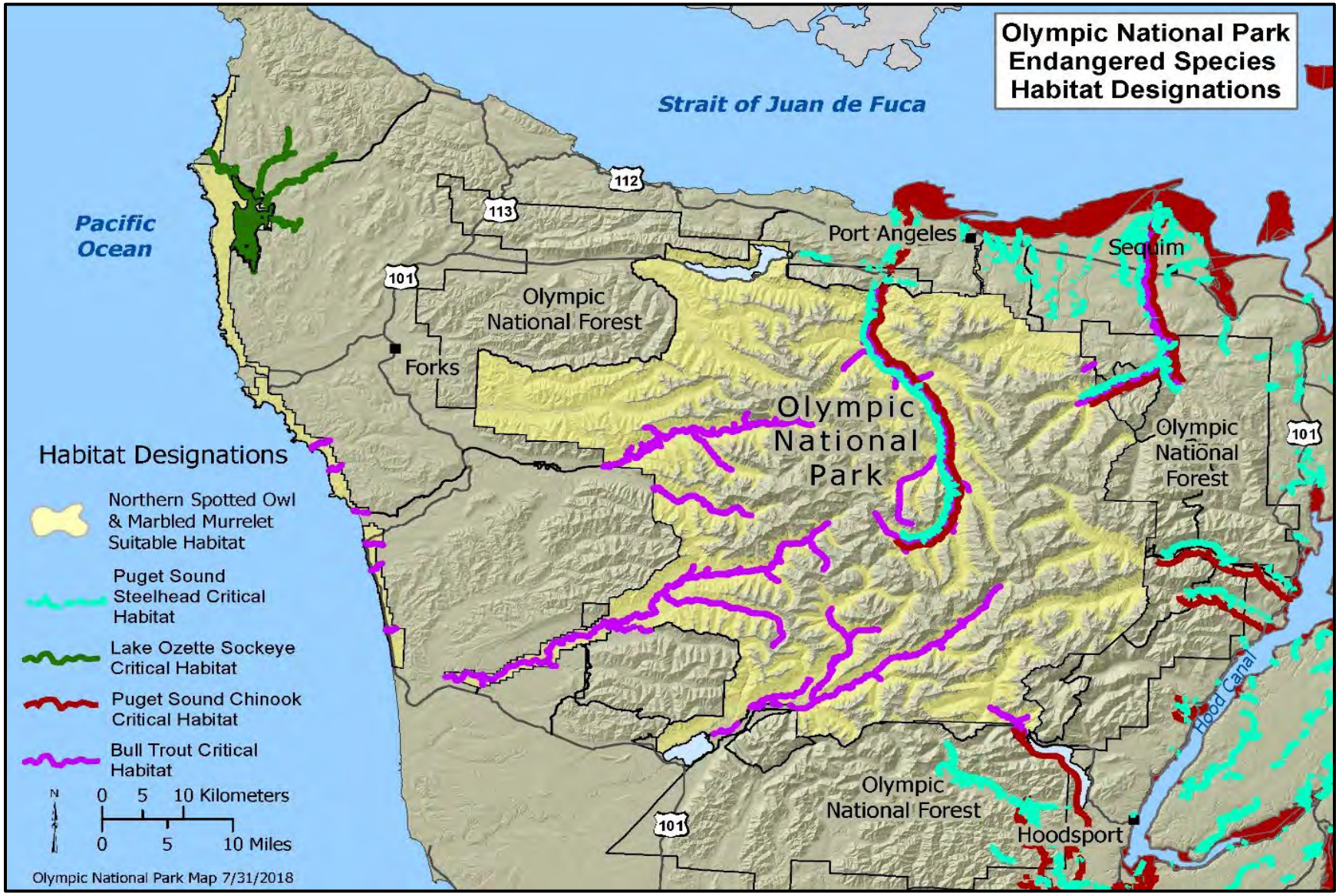


Figure A.7. Critical habitat within Olympic National Park

This page intentionally left blank.

APPENDIX B – PARK FIRE HISTORY

Olympic National Park has a rich and diverse landscape and the fire history reflects that diversity. From the fire-intolerant Sitka spruce forests on the west side of the Olympics to the fire-dependent Douglas-fir forests on the east side, fire is recognized as a significant natural process operating within and shaping the park's ecosystems. Park managers recognize that fire has been an essential part of the ecosystem for thousands of years and that fire is an important natural disturbance that is vital for healthy forest ecosystems.

There has not been a peer reviewed, comprehensive, quantitative analysis of forest disturbance history for Olympic National Park. However, disturbance maps for the peninsula presented by Henderson et al. (1989) and Agee (1994), which are based on studies of adjacent lands in Olympic National Forest and limited field studies in the park, indicate that there is a gradient of fire patterns, also known as fire regimes, across the park. A review of the literature by the USFS (Fryer and Luensmann 2012) produced the fire return table presented here (Table B.1).

The park's fire regime is characterized by relatively long fire return intervals, which are the number of years between two successive fire events for a given area (Table B.1). The fire return interval for the east side of the park ranges from 35 to 100 years, and 200+ years on the west side of the park. The long fire return intervals create an interesting fire history for the park, with episodic large fire (i.e., burning over 50 acres) events occurring between long periods of time with little fire activity. Large fires that occurred several hundred years ago are still apparent on the landscape and helped form the vegetative composition and structure present today. Because fire return intervals in the park are so long, the years of fire suppression have had minimal impact to the park's fire regime. This presents a unique opportunity to restore fire within an ecosystem that has been minimally changed by fire suppression.

Under the classification system described by Schmidt et al. (2002), the fire regimes in the park would be characterized as Class III, with fire return intervals generally ranging from 35- to 100-year frequency, low to mixed severity and Class V with 200+ year frequency, high severity. Large fires typically occur on steep south-facing slopes, and require a combination of circumstances including a source of ignition (such as lightning), an extended period of drought, and east winds (Huff and Agee 1980).

Most fires that burn any significant acreage are high-severity fires that kill the majority of trees on the burned sites and are called "stand replacement fires." These severe fires consume a great deal of fuel, but create even heavier fuel loads following the fires in the form of scorched needles, dead trees, and fine herbaceous fuels (Agee and Huff 1987). Fuel loadings are typically heavier at lower elevations, where fuels would often be characterized by National Fire Danger Rating System fuel model G: dense conifer stands with a heavy accumulation of litter and down woody material. Fuel loadings in the subalpine areas are usually lower overall, though there are often "jackpots" of fuel, which would be characterized by National Fire Danger Rating System fuel model H: short needle conifer. Fuel loadings, especially larger, standing fuels, may be influenced by tree mortality caused by exotic pests and diseases such as white pine blister rust (all five-needle pines) or balsam woolly adelgid (true firs, including subalpine fir). Weather and fuel moisture are often the driving factors in fire behavior. Large fires may burn for weeks but make their major runs during a few days of east wind weather when the temperature is high and the relative humidity is low. In the eastern Olympics, an occasional fire of lower intensity will burn through the understory without killing the overstory (Wetzel and Fonda 2000). A mixed severity fire regime exists where the typical fire, or combination of fires over time, results in a complex mix of patches of different severity, including unburned patches, low severity patches where the fire may have been a low-intensity underburn, moderate severity patches where perhaps one-third to two-thirds of the vegetation is killed, and high severity patches, where almost all the vegetation is killed (Agee 2005).

Table B.1. Fire Return Intervals by Vegetation Zone

Vegetation Zone	Fire Severity*	Fire Regime Characteristics			
		Percent of Fires	Mean Interval	Minimum Interval	Maximum Interval
			(years)	(years)	(years)
Douglas-fir-western hemlock (east side)	Replacement	25%	300	250	500
	Mixed	75%	100	50	150
Douglas-fir-western hemlock (west side)	Replacement	71%	400		
	Mixed	29%	>1,000		
Mountain hemlock	Replacement	93%	750	500	>1,000
	Mixed	7%	>1,000		
Pacific silver fir (low elevation)	Replacement	46%	350	100	800
	Mixed	54%	300	100	400
Pacific silver fir (high elevation)	Replacement	69%	500		
	Mixed	31%	>1,000		
Sitka spruce-western hemlock	Replacement	100%	700	300	>1,000
Subalpine fir	Replacement	81%	185	150	300
	Mixed	19%	800	500	>1,000

Source: Fryer and Luensmann (2012)

Note: Blank cells indicate information is not available in the LANDFIRE Rapid Assessment Vegetation Model.

In the early 2000s, the federal government implemented changes in policy, including the development of the National Fire Plan (2000) and Healthy Forests Restoration Action (2003). Concurrently, the NPS made updates to the park's fire plan, which allowed for an increase in fire occurrence within the park. These changes were also coupled with a trend toward warmer, drier conditions. The result was that large fires occurred in the park 5 of the past 15 years, compared to 5 large fire years between 1938 and 2003. Figure A.2 shows the large fire events that occurred from 1978 to 2003, compared to the large fire events that have occurred within the park after 2003.

The largest fire in park history, to date, the Paradise Fire, occurred in 2015 and burned approximately 2,800 acres. The most acres burned within one year (2016) is estimated at 3,500 acres, which comprised the Hayes Two fire (approximately 2,500 acres), the Godkin fire (approximately 825 acres), the Cox Valley fire (approximately 58 acres), and the Ignar fire (approximately 150 acres). Figure B.1 shows the annual acreage burned by wildfire in the park since 1978.

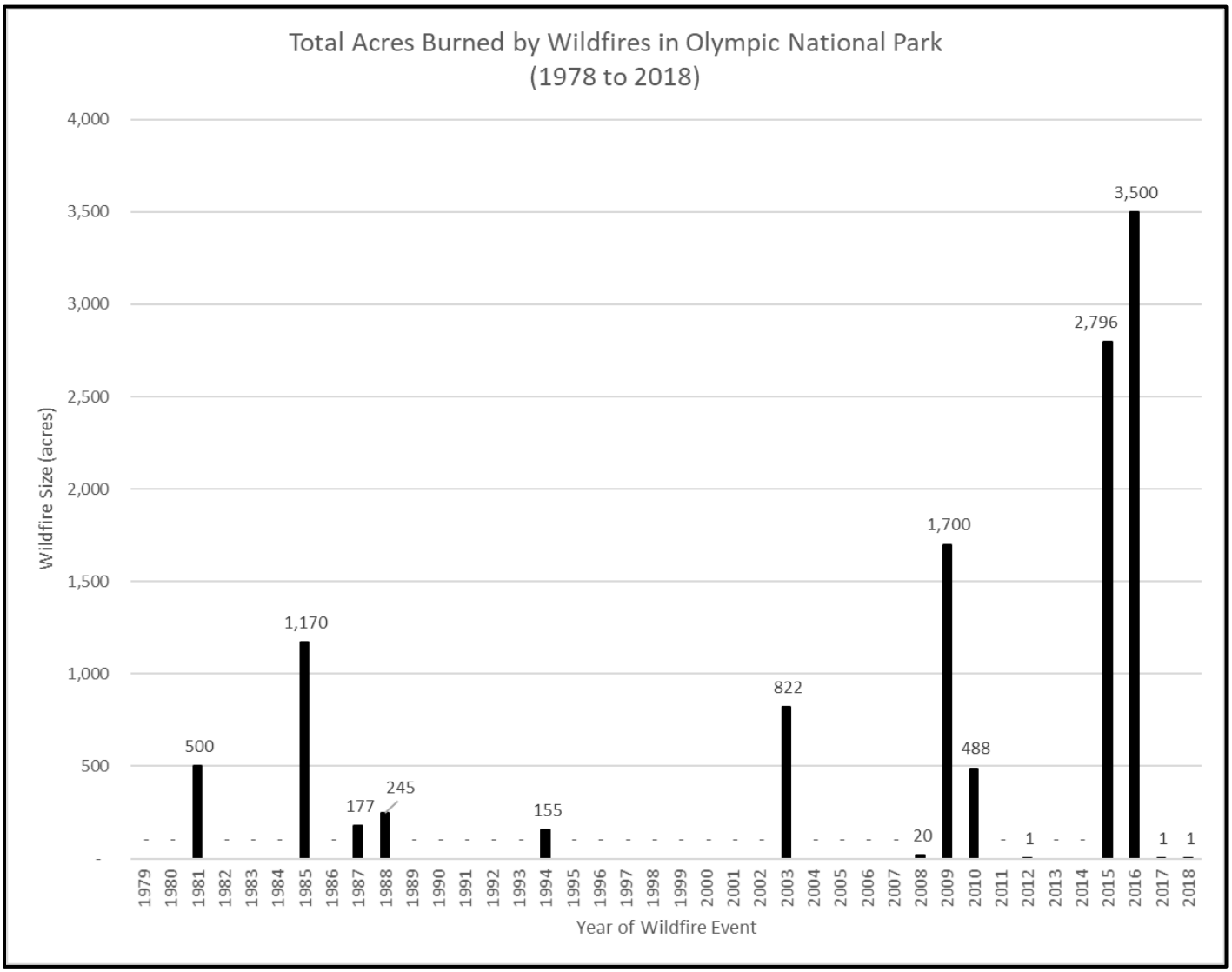


Figure B.1. Annual acres burned by wildfire events in the park from 1978 to 2018

The recent large fire occurrence has provided an opportunity to study not only the elements that drive active fire behavior but also the effects of wildfires that are managed for resource benefit. In general, a combination of fuels, weather, and topography dictate fire behavior. The heavy fuel accumulations of ground and surface fuels in the park allow fires to persist for weeks or even months as they smolder and/or creep with little fire spread. During this time, fuels continue to dry and become more available. These conditions allow the fires to experience critical fire weather patterns that are key to active fire behavior and fire growth. Hot, dry, unstable atmospheric conditions can cause dramatic increases in fire behavior and can quickly transfer a fire from the ground and surface fuels into the aerial fuels (moss, lichen, and tree canopies). These critical fire weather periods are usually short-term events lasting less than 1 week before the weather pattern shifts to a weather pattern typical on the peninsula.

Observations show that an average fire season can have 10 to 15 active burn days, so a fire that burns for 3 months will typically have very few active growth days. This results in wildfires that have a mix of low, moderate, and high severity burn patterns.

The recent fire history indicates that park fires are within the natural range of variability and provide patches and gaps on the landscape that are beneficial as a natural ecological process. It also shows that large fire occurrence in the park is episodic, meaning some years have few if any fires, while other years have multiple fires that can burn for a long period of time over several thousand acres. The park's recent fire history indicates that an average of 1,200 acres per year can be expected to burn, acknowledging that there will be years with little or no fire and other years with fires totaling several thousand acres.

APPENDIX C – RELEVANT PLANS AND POLICIES

NPS *Management Policies* (2006)

The NPS *Management Policies* (2006) provide direction to the NPS and ensures conformance to the Constitution, public laws, treaties, executive orders, regulations, and DOI directives. The park's FMP will conform to the NPS *Management Policies* addressing fire management planning in national parks.

NPS Policy 4.5 directs that FMPs "be designed to guide a fire management program that:

- responds to the park's natural and cultural resource objectives;
- provides for safety considerations for park visitors, employees, and developed facilities;
- addresses potential impacts on public and private neighbors and their property adjacent to the park;
- protects public health and safety; and
- provides guidance on determining in which situations natural regeneration of a burned ecosystem is appropriate and when management actions are needed to restore, stabilize, or rehabilitate an area following wildland fire."

NPS Policy 6.3.9 [Wilderness] Fire Management, in conformance with federal Wildland Fire Management Policy, directs all fire management activities conducted in wilderness to conform to the basic purposes of wilderness. Policy 6.3.9 also states, "guidance on the need to suppress wildland fire
or to use some wildland fires to achieve desired future conditions should appear in the park's planning documents (for example, in the wilderness management plan and fire management plan)" (NPS 2006: 84). The park's revised FMP would integrate this federal policy guidance into park fire management planning and wildfire suppression response.

NPS Policy 6.3.5 [Wilderness] Minimum Requirement requires all management decisions affecting wilderness to be consistent with the minimum requirement concept. This concept is a documented process used to determine if administrative actions, projects, or programs undertaken by NPS and affecting wilderness character, resources, or the visitor experience are necessary, and if so how to minimize impacts (NPS 2006: 81). The minimum requirement concept is applied as a two-step process that determines whether the proposed management action is appropriate or necessary for administration of the area as wilderness and does not cause a significant impact to wilderness resources and character, in accordance with the Wilderness Act; and the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized. Appendix E of this EA includes the PMRA for the proposed fire management activities outlined in Chapter 2.

NPS Director's Order 18 and Reference Manual 18

Tiering from the overarching NPS *Management Policies*, more detailed guidance for fire management in the parks is provided in DO-18 and RM-18: Wildland Fire Management. RM-18 provides background information, standardized definitions, agency requirements, standards, and procedures for wildland fire management in the park. Additional guidance for wildland fire management within wilderness is found in DO-41: Wilderness Stewardship, and RM-41: Wilderness Stewardship.

Olympic National Park General Management Plan

The General Management Plan for Olympic National Park provides management direction for resource protection and visitor use in the park. The General Management Plan was developed as part of an intensive public NEPA planning process which began with public meetings in 2001, and concluded with the signing of a Record of Decision in August 2008. The 2008 General Management Plan identifies the

following desired conditions (goals) and strategies (objectives) for the park's fire management program and it is this guidance that forms the basis of the proposed FMP update for the park.

- Desired Conditions Based on Service-wide Mandates and Policies: Park fire management programs are designed to meet resource management objectives prescribed for the various areas of the park and to ensure that the safety of firefighters and the public are not compromised.
- All wildland fires are effectively managed, considering resource values to be protected and firefighter and public safety, using the full range of strategic and tactical operations as described in an approved FMP. Managers use "minimum requirement" techniques to manage fires within park wilderness areas.

Desired Conditions Specific to Olympic National Park:

- Natural fire regimes are restored and maintained, but will be modified to comply with air quality regulations, and/or to protect listed species, cultural resources, and the safety of life and property.
- The best available technology and scientific information are used to manage fire within the park, to conduct routine monitoring to determine if objectives are met, and to evaluate and improve the fire management program.
- Hazard fuel reduction efforts protect structures, wildland-urban interface areas, and cultural resources where appropriate and necessary.
- Fire is recognized as a natural process that does not acknowledge administrative boundaries; park managers develop a comprehensive cross-boundary FMP with adjacent land managers.
- Minimum requirement methods and tools are used to manage fires in wilderness.

Olympic National Park Wilderness Stewardship Plan

The NPS will be developing a Wilderness Stewardship Plan and Environmental Impact Statement for the wilderness area that comprises the vast majority of the park. The Wilderness Stewardship Plan would identify the core qualities of wilderness character for the park and outline the framework through which wilderness character can be monitored and preserved; provide guidance and direction to meet legal and policy requirements; implement actions identified in the park's 2008 General Management Plan; address how visitors access and use the park's wilderness and the facilities necessary to support those uses; address how natural and cultural resources are managed in wilderness; and address how the NPS manages its administrative operations in wilderness. Based on public and agency comments received during the comment period on preliminary alternatives, the Environmental Impact Statement may consider an alternative which assesses a proposal to use prescribed fire and vegetation treatments to restore prairie habitat.

APPENDIX D – MINIMUM IMPACT STRATEGIES AND TACTICS (MIST)

The intent of this guide is to serve as a checklist for the Incident Commander and Planning Section Chief, Operations Section Chief, Logistics Section Chief, Division/Group Supervisors, Strike Team/Task Force Leaders, Single Resource Bosses, Burn Boss, and firefighters. Accomplishment of MIST originates with instructions that are understandable, stated in measurable terms, and communicated both verbally and in writing. Evaluation of these tactics during and after implementation will further the understanding and achievement of good land stewardship ethics during fire management activities.

The following guidelines are for park superintendents, incident management teams, and firefighters to consider. Some or all of the items may apply, depending upon the situation.

Command and General Staff

FMP-1	Evaluate each and every tactic during planning and strategy sessions to see that they meet superintendent's objectives and minimum impact guidelines.
FMP-2	Include agency resource advisor and/or local representative in above session. Park staff would be notified of all planned and unplanned fire management activities with the potential to impact park operations.
FMP-3	Discuss minimum impact tactics with overhead during overhead briefings, to gain full understanding of tactics.
FMP-4	Ensure minimum impact techniques are implemented during line construction as well as other resource disturbing activities.

Planning Section

FMP-5	Use resource advisor(s) to evaluate that management tactics are commensurate with land/resource objectives and incident objectives. A resource advisor should be involved in the development of WFDSS and during prescribed burn planning. The resource advisor should consult with fisheries biologists, wildlife biologists, cultural resource staff, wilderness staff, and other specialists as needed. The resource advisor should provide input to the Planning Section and Incident Commander and will review shift plans to assess the potential effects of planned actions.
FMP-6	Use an assessment team to get a different perspective of the situation.
FMP-7	Use additional consultation from "publics" or someone outside the agency, especially if the fire has been or is expected to be burning for an extended period of time. Every effort would be made to notify residents and individuals who could be affected by a particular project or wildfire managed for resource benefit. The park would utilize press releases, and/or individual contact as appropriate. Information would be provided regarding measures that individuals can take to minimize their exposure to smoke.
FMP-8	Adjust line production rates to reflect the minimum impact management tactics.
FMP-9	Outside of wilderness, use brush blade for line building--when dozer line is determined necessary.
FMP-10	Leave some trees randomly in fireline.
FMP-11	Ensure that instructions for minimum impact management tactics are listed in the incident action plan.
FMP-12	Detail objectives for extent of mop-up necessary--for instance: "distance within perimeter boundary."
FMP-13	If helicopters are involved, use long line remote hook in lieu of helispots to deliver/retrieve gear.
FMP-14	Anticipate fire behavior and ensure all instructions can be implemented safely.
FMP-15	Consider coyote camps versus fixed campsite in sensitive areas.
FMP-16	In extremely sensitive area, consider use of portable facilities (heat/cook units, latrines).

Operations Section

FMP-17	Emphasize minimum impact management tactics during each operational period briefing.
FMP-18	Explain expectations for instructions listed in incident action plan.
FMP-19	Consider showing minimum impact management presentation to the crews upon arrival at airport/incident.
FMP-20	Consider judicious use of helicopters--consider long lining instead of helispot construction.
FMP-21	Use natural openings so far as practical.
FMP-22	Consider use of helicopter bucket drops and water/foam before calling for air tanker/retardant.
FMP-23	Fire retardant would be used only when an operation cannot be safely completed and/or impacts to values could not be mitigated without the use of retardant. Superintendent approval would be required prior to use. Fire-retardant agents must be on an approved list for use by the USFS and the DOI.
FMP-24	If possible, dipping of helicopter buckets will occur only after chemical injection systems (storage containers) have been removed from the bucket or helicopter.
FMP-25	Keep refueling, fuel storage, and fuel trucks outside designated critical habitat, or utilize spill pads and/or containment units.
FMP-26	Use spill pads under portable pumps and fuel cans/fuel lines connected to pumps.
FMP-27	The park should develop a contingency plan identifying procedure to be initiated should a chemical spill or contamination occur.
FMP-28	Monitor tactics /conditions.
FMP-29	Distribute field guide to appropriate supervisory operations personnel.

Logistics Section

FMP-30	Ensure actions performed around areas other than Incident Base, i.e., dumpsites, camps, staging areas, helibases, etc., result in minimum impact upon the environment.

Division/Group Supervisor and Strike Team/Task Force Leader

FMP-31	Ensure crew superintendents and single resource bosses understand what is expected.
FMP-32	Discuss minimum impact tactics with crew.
FMP-33	Ensure dozer and falling bosses understand what is expected.
FMP-34	If helicopters are involved, use natural openings as much as possible; minimize cutting only to allow safe operations.
FMP-35	Avoid construction of landing areas in high visitor use areas.
FMP-36	Monitor tactics /conditions.

Crew Superintendents

FMP-37	Ensure/Monitor results expected.
FMP-38	Discuss minimum impact management tactics with crew.
FMP-39	Provide feedback on implementation of tactics -- were they successful in halting fire spread, what revisions are necessary?
FMP-40	Look for opportunities to further minimize impact to land and resources during the management action and mop-up phase.

IMPLEMENTATION GUIDELINES

Minimum impact management is an increased emphasis to do the job of managing a wildland fire while maintaining a high standard of caring for the land. Actual fire conditions and your good judgement will dictate the actions you take. Consider what is necessary to halt fire spread and ensure it is contained within the fireline or designated perimeter boundary.

Safety

SAF-1	Safety is of utmost importance. Safety guidelines described in the Wildland Fire Incident Management Field Guide and the Incident Response Pocket Guide (National Wildfire Coordinating Group 2013) would be employed on all fire management actions. Job Hazard Analyses would be prepared or updated prior to each fire season. All personnel involved in fire management activities would meet the current NPS wildland fire qualification standards to include accepted interagency competencies where appropriate.
SAF-2	Constantly review and apply LCES, the 18 Situations That Shout Watch Out and 10 Standard Fire Orders.
SAF-3	Be particularly cautious with: a. Burning snags you allow to burn down. b. Burning or partially burning live and dead trees. c. Unburned fuel between you and the fire.

Fire Lining Phase

FL-1	Select procedures, tools, and equipment that least impact the environment.
FL-2	Avoid the use of heavy equipment in riparian areas.
FL-3	In light fuels, consider: a. Cold trail line. b. Allow fire to burn to natural barrier. c. Consider burn out and use of "gunny" sack or swatter. d. Constantly re-check cold-trailed fireline. e. If constructed fireline is necessary, use minimum width and depth to check fire spread.
FL-4	In medium/heavy fuels, consider: a. Use of natural barriers and cold-trailing. b. Cooling with dirt and water, and cold trailing. c. If constructed fireline is necessary, use minimum width and depth to check fire spread. d. Minimize bucking to establish fireline; preferably build line around logs.
FL-5	Aerial fuels--brush, trees, and snags: a. Adjacent to fireline: limb only enough to prevent additional fire spread. b. Inside fireline: remove or limb only those fuels which if ignited would have potential to spread fire outside the fireline. c. Brush or small trees that are necessary to cut during fireline construction will be cut flush with the ground.
FL-6	Trees, burned trees, and snags: a. MINIMIZE cutting of trees, burned trees, and snags. If possible, do not fell trees within designated critical habitat. b. Live trees will not be cut, unless determined they will cause fire spread across the fireline or seriously endangers workers. If tree cutting occurs, cut stumps flush with the ground. c. Scrape around tree bases near fireline if hot and likely to cause fire spread. d. Identify hazard trees with either an observer, flagging and/or glow-sticks.
FL-7	When using indirect attack: a. Do not fall snags on the intended unburned side of the constructed fireline, unless they are an obvious safety hazard to crews working in the vicinity. b. On the intended burnout side of the line, fall only those snags that would reach the fireline should they burn and fall over. Consider alternative means to falling, i.e., fireline explosives, bucket drops.
FL-8	Avoid increasing fire intensities within critical habitat during burnout or backfire operations.

Mop-up Phase

MOP-1	Consider using "hot-spot" detection devices along perimeter (aerial or hand-held).
MOP-2	Light fuels: a. Cold-trail areas adjacent to unburned fuels. b. Do minimal spading; restrict spading to hot areas near fireline only.
MOP-3	Medium and heavy fuels: a. Cold-trail charred logs near fireline; do minimal scraping or tool scaring. b. Minimize bucking of logs to check for hot spots or extinguish fire: preferably roll the logs. c. Return logs to original position after checking or ground is cool. d. Refrain from making bone-yards: Burned/partially burned fuels that were moved would be arranged in natural position as much as possible. e. Consider allowing larger logs near the fireline to burnout instead of bucking into manageable lengths. Use lever, etc., to move large logs.
MOP-4	Aerial fuels--brush, small trees and limbs: remove or limb only those fuels, which if ignited, have potential to spread fire outside the fireline.
MOP-5	Burning trees and snags: a. First consideration is to allow burning tree/snag to burn themselves out or down (Ensure adequate safety measures are communicated). b. Identify hazard trees with an observer, flagging, and/or glow-sticks. c. If burning trees/snags pose serious threat of spreading firebrands, extinguish fire with water or dirt. FELLING by chainsaw will be last means. d. Consider falling by blasting, if available.

Camp Sites and Personal Conduct

CAMP-1	Use existing campsites if available.
CAMP-2	If existing campsites are not available, select campsites that are unlikely to be observed by visitors/users.
CAMP-3	Camps, staging areas, and base heliports will be located outside designated habitat, if at all possible, and will be identified on a map prior to implementation.
CAMP-4	Select impact-resistant sites such as rocky or sandy soil, or openings within heavy timber. Avoid camping in meadows, along streams or lakeshores.
CAMP-5	Change camp location if ground vegetation in and around the camp shows signs of excessive use.
CAMP-6	Do minimal disturbance to land in preparing bedding and campfire sites. Do not clear vegetation or do trenching to create bedding sites.
CAMP-7	Toilet sites should be located a minimum of 200 feet from water sources. Holes should be dug 6-8 inches deep. Consider the use of vault toilets in large spike camps.
CAMP-8	Select alternate travel routes between camp and fire if trail becomes excessive.
CAMP-9	Evaluate coyote camps versus fixed campsites in sensitive areas.
CAMP-10	Follow campfire restrictions (i.e., Stoves Only regulations and smoke management burn bans)

Restoration of Fire Management Activities

RES-1	Firelines: a. After fire spread is secured, fill in deep and wide firelines, and cut trenches. b. If cultural and natural resource advisors recommend seeding, firelines may be fertilized and seeded with an approved seed mix. c. Waterbar, as necessary, to prevent erosion, or use wood material to act as sediment dams. Waterbars or drain dips should be constructed at a 30 to 45 degree angle to the fireline. A berm height is not to exceed six inches in height. Assure downslope end of waterbar is open and has adequate length to prevent runoff from reentering the line below. d. Ensure stumps from cut trees/large size brush are cut flush with ground. e. Camouflage cut stumps, if possible. f. Any trees or large size brush cut during fireline construction should be scattered to appear natural.
RES-2	Camps (main and spike) and Helibases: a. Restore campsite to natural conditions as much as possible. b. Scatter fireplace rocks, charcoal from fire; cover fire ring with soil; blend area with natural cover. c. Clean up trash, rake up wood chips, and remove any matting placed down to limit impacts. d. Pack out all garbage and unburnables. e. Block any new access routes and post closure signs. f. If cultural and natural resource advisors recommend seeding, impacted areas may be fertilized and seeded with an approved seed mix. Heavily compacted soils may need to be ripped prior to application of seed and fertilizer.
RES-3	Tractor lines/Safety Zones: Tractors are not used in Olympic National Park for fire management. If an emergency circumstance required an exception, the following rehabilitation measures would be recommended: a. Waterbars should be constructed at a 30 to 45 degree angle. Height of waterbars should not exceed 18 inches. Space 50 feet apart on slopes greater than 30 percent and 100 feet apart on slopes between 10 and 30 percent. The downslope side of the waterbar needs to be opened and of adequate length to allow free flow of water off the tractor line. b. Breakup and pull all berms, tractor piles and windrows. Lop and scatter slash on disturbed areas to achieve 50 percent ground cover on disturbed sites.
RES-4	General: a. Remove all signs of human activity (flagging, small pieces of aluminum foil, litter). b. Restore helicopter landing sites. c. Cover, fill in latrine site. d. For any non-system roads: implement erosion control standards and restore the road to a pattern of use prior to its fire usage.

Burned Area Emergency Rehabilitation

BAER-1	A Burned Area Emergency Rehabilitation (BAER) team will be assigned to fires over 100 acres in size, if deemed necessary by the cultural and natural resources management staff.
BAER-2	The BAER Team should include a fisheries biologist.
BAER-3	After a fire is declared out, a biologist should review the management actions and rehabilitation efforts to see if conservation measures were successfully implemented.
BAER-4	Where large fires affect more than about ten percent of a section 7 watershed, it is recommended that a scientific group of experts be convened to prepare a peer reviewed assessment or analysis of the short term and long-term effects from the wildfire, management actions, and rehabilitation. The assessment should also recommend actions (if there are any) that may be appropriate for the burned or unburned areas within the watershed.

RESOURCE SPECIFIC MITIGATION MEASURES

Air Quality Mitigation Measures

AIR-1	All pile burning would comply with regulations contained in the Washington State Department of Natural Resources (DNR) Smoke Management Plan, and Regulation 1 of the Olympic Air Pollution Control Authority. If the burning met the definition of silvicultural burning under the Washington Clean Air Act, the park would have to contact DNR Smoke Management for approval; all other burning would be regulated by the Olympic Air Pollution Control Authority.
AIR-2	Prescribed fires would be timed to minimize smoke impacts on air quality and visibility using favorable conditions of atmospheric stability, mixing height, and transport winds.
AIR-3	No burn piles would be ignited during smoke management burn bans.
AIR-4	Smoke mitigation measures include: limiting the number of acres and amount of fuel burned during prescribed fires; timing prescribed fires to minimize smoke impacts on air quality and visibility using favorable conditions of atmospheric stability, mixing height, and transport winds; specifying an acceptable range of moisture content and wind conditions for each prescribed fire; coordinating with other agencies and landowners to limit the number of prescribed fires occurring simultaneously; and promptly mopping-up prescribed fires.
AIR-5	Timing and methods of ignition on prescribed fires would be constantly assessed and reviewed by fire managers to minimize smoke impacts. Personnel would be trained in emission reduction techniques as outlined in the National Wildfire Coordinating Group's *Smoke Management Guide* (Hardy et al. 2001), and continuous monitoring would be required throughout the burn.
AIR-6	Park fire management staff would communicate closely with smoke regulators about wildfire emissions during all wildfires.

Soils Mitigation Measures

SOIL-1	Monitor burn areas and use erosion control measures (e.g., wattles, log barriers etc.).
SOIL-2	When handline construction is required, construction standards would be issued requiring the handlines to be built with minimum impact.
SOIL-3	Erosion control methods (for example wattles and log barriers) will be used on slopes exceeding 30 percent in areas where handline construction took place during suppression activities.

Vegetation Mitigation Measures

VEG-1	Helibase operations shall minimize contamination of sling loads with exotic seed sources by using a base tarp and mowing when necessary (if applicable to the site).
VEG-2	Park staff will clean fire management equipment prior to its use to prevent the spread of noxious weeds.
VEG-3	Park staff will stage fire management operations away from known noxious weed infestations and will construct firelines away from known patches.
VEG-3	Park staff will survey for noxious weeds in treatment units prior to ignition of prescribed fires.
VEG-4	Park resource specialists would monitor wildfire locations for exotic plant species and manage as necessary post fire to contain any infestations.
VEG-5	To balance concern over hazard fuels with concern for protecting old-growth trees, an interdisciplinary team would evaluate individual large trees.

WILDLIFE AND THREATENED AND ENDANGERED SPECIES MITIGATION MEASURES

Northern Spotted Owl and Marbled Murrelet

T&E-1	Maintain flight patterns and altitude, as best as possible, that avoid murrelet and northern spotted owl habitat.
T&E-2	During breeding season for the marbled murrelet (April 1 to September 23), all helicopter and fixed-wing flights shall be conducted at the highest possible altitude to minimize time spent within 110–265 yards (dependent on type of aircraft; see USFWS thresholds table USFWS 2013, p.103) above the forest canopy of suitable murrelet habitat, except for helicopters on direct approach and departure to/from the landing zone, and in emergency situations.
T&E-3	During breeding season for northern spotted owls (March 1 to July 15), avoid or reduce noise that is above ambient noise activities for each project site located within 65–120 yards of suitable owl habitat; and during nesting season for marbled murrelets (April 1 to September 23), avoid or reduce noise that is above ambient noise activities for each project site located within 110–120 yards of suitable murrelet habitat. See USFWS thresholds tables for distances by equipment type for both spotted owls and marbled murrelets (USFWS 2013, p.103).

ESA-Listed Fish Species, Critical Habitat, and Essential Fish Habitat

T&E-4	When removing water from any drainage and/or when working in or around drainages or natural surface water, sediment disturbance shall be avoided or minimized.
T&E-5	Streams, ponds, and other open water bodies shall be avoided to the extent practicable during suppression activities.
T&E-6	All refueling of equipment will have spill containment pads in position prior to refueling activities.
T&E-7	Equipment must be free of any fluid leaks (fuel, oil, hydraulic fluid, etc.) upon arrival to the work site and will be inspected at the beginning of each shift for leaks. Leaking equipment will be removed for necessary repairs before the commencement of work.
T&E-8	Minimize or avoid stream course disturbance, sedimentation, and actions that will result in increased water temperature.
T&E-9	Maintain a riparian buffer as determined necessary by a resource adviser to meet the site prescription requirements during an incident. Management requirements and/or incident requirements would be included in the WFDSS decision to mitigate impacts to the identified riparian zones.
T&E-10	Fire chemical use within floodplains, wetlands, and other sensitive areas would adhere to the Interagency Policy for Aerial and Ground Delivery of Wildland Fire Chemicals Near Waterways and Other Avoidance Areas, as described in Chapter 12 of the *Interagency Standards for Fire and Fire Aviation Operations* (DOI and USDA 2018) or future revised version. Wherever possible, avoid using chemicals when there is a potential for contamination of waterways (based on proximity, wind direction, wind speed, size and frequency of loads, etc.) Avoid use of retardant or foam within 300 feet of streams or within designated critical habitat. Use of retardant should also be avoided in areas with oligotrophic lakes, bogs, or swamps as effects on aquatic biota may be prolonged. Consult with resource advisors. Do not pump directly from streams if chemical products are going to be injected into the pump or pumping system. If chemicals are needed, use a fold-a-tank from which to pump water.

T&E-11	To the extent possible, limit the number of locations where water would be removed from salmon-bearing streams for helicopter buckets and water pump operations. Olympic National Park biologists could provide a list of these waterways. Firefighter and public safety will always take precedence, and if helicopter drops are needed, they will be utilized.
T&E-12	Intakes for pumps will be screened following the most recent guidance from the Washington Department of Fish and Wildlife.

Wilderness Character Mitigation Measures

WLDN-1	Preservation of wilderness character must be fully considered during all fire management actions beginning with the development of the FMP and continuing through the management of individual wildfires and implementation of fuel treatments and post-fire actions.
WLDN-2	Heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles would not be used in wilderness. The superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances.
WLDN-3	All planned fire management operations that involve Wilderness Act 4(c) prohibited uses would be conducted in accordance with an approved Minimum Requirements Analysis.
WLDN-4	Fire management resources must be adequately briefed on the concepts of wilderness stewardship and be held accountable for preservation of wilderness character. They must be made aware of specific protections and constraints contained in the park's FMP PMRA and any additional separate wildfire-related MRAs.
WLDN-5	Fire personnel will practice *Leave No Trace* principles including proper methods for food storage, human waste disposal, camping at established sites or on durable surfaces, and minimizing travel on sensitive vegetation (e.g., heather-huckleberry). *Leave No Trace* will be listed as a management requirement in WFDSS for incorporation into fire decisions.
WLDN-6	Food and garbage must be secured at all times, whenever not in use or if unattended, to safeguard such items from wildlife access. All food, garbage, and scented items would be stored appropriately following park guidelines. Interagency Grizzly Bear Committee (IGBC)-certified animal resistant food canisters (ARFC) and animal resistant stock pannier bags, or bear wires already in place, would be the first choice. IGBC-certified small storage containers, boxes, and coolers may be considered when larger food storage space is necessary. Large animal-resistant food storage lockers (e.g., Knaack box) would only be transported and used at camps if other options would not be available or practical, usually due to crew size, or if already necessary for secure tool/equipment storage. Any bear-resistant containers purchased for fires would comply with the IGBC certified list: http://igbconline.org/wp-content/uploads/2018/09/180911_Certified_Products_List.pdf.
WLDN-7	A resource advisor will be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness.
WLDN-8	When wildfire ignitions occur within the park, the IDT team assembled at the beginning of the incident would include the park's wilderness coordinator, or designated representative, as well as the resource advisor. The park's wilderness coordinator would also be consulted during WFDSS decision development to assist in identification of the applicable wilderness minimum requirement guidelines and provide wilderness input on the decision-making.

Soundscapes Mitigation Measures

SOUND-1	Consideration should be given to noise intrusion. Practical attempts will be made to minimize impact to soundscapes, such as adequate equipment for the task with least amount of noise production. MIST guidelines and the PMRA requirements would be followed for all motorized equipment use.

Cultural Resources Mitigation Measures

CUL-1	Prior to all fire management activities, cultural resources in planned treatment areas would be identified and avoided, if possible.
CUL-2	The park's cultural resource specialist(s) would provide recommendations on how to mitigate adverse effects on these resources during fire management activities and would coordinate compliance with Section 106 of the National Historic Preservation Act, as appropriate.
CUL-3	The park's cultural resource specialist(s) would be contacted if previously unrecorded cultural resources are discovered during any wildland fire operations. The cultural resources would be recorded, delineated, and protected.
CUL-4	Ground disturbance in and around known cultural sites would be minimized and all efforts would be made to avoid impacts to unknown sites.
CUL-5	If national register-eligible or -listed archeological resources cannot be avoided, an appropriate mitigation strategy would be developed in consultation with the State Historic Preservation Officer and associated tribes.
CUL-6	No handlines exposing mineral soil will be allowed through cultural sites.

Ethnographic Resources Mitigation Measures

ETH-1	Consultations with American Indians linked by ties of kinship, culture, or history to park lands would address the inadvertent discovery of human remains, funerary objects, sacred objects, or objects of cultural patrimony, and all provisions outlined in the Native American Graves Protection and Repatriation Act (25 United States Code [USC] 3001) of 1990 would be followed.

Historic Structures and Landscapes Mitigation Measures

HIS-1	Historic structures that have been included within wilderness would be protected and maintained according to the pertinent laws and policies governing cultural resources using management methods that are consistent with the preservation of wilderness character and values. Laws pertaining to historic preservation remain applicable within wilderness but must generally be administered to preserve the area's wilderness character (16 USC 1133(a)(3)). The responsible decision-maker would include appropriate consideration of the application of the provisions of the Wilderness Act in analyses and decision-making concerning cultural resources.
HIS-2	All project work relating to cultural landscapes would be conducted in accordance with the guidelines and recommendations of the *Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscapes* (NPS 2018a).
HIS-3	Fire retardant use will be prohibited in the vicinity of any historic structure, unless there is imminent threat from wildfire to the historic structure.

Visitor Use and Experience Mitigation Measures

VIS-1	Fire management staff would consider the safety of the public, personnel, and fire crews as the highest priority for all fire management activities.
VIS-2	The park would notify the public of management of wildfires and upcoming prescribed fire operations through press releases and social media. Fire information and prescribed fire notifications and fire information would be posted at public locations, such as trailheads, parking areas, and visitor centers.
VIS-3	Prescribed fires would not be initiated on weekends or holidays without the superintendent's approval.
VIS-4	Fire staff would coordinate closely with rangers to determine the location of visitors. Also, fire staff would use road/trail closures and other restrictions to ensure wildfire operations or prescribed fire do not put visitors at risk.
VIS_5	Visitors would be excluded from the immediate vicinity of the wildfire or prescribed fire when fire management activities are underway.
VIS-6	Weather conditions would be closely monitored during the managed wildfire or prescribed fire to ensure that any changing conditions do not suddenly put visitors at risk.
VIS-7	Media releases would be used to inform the public and park visitors about wildland fire, potential smoke impacts, closures, or other restrictions. Signs would be used throughout the park to inform visitors, and caution signs would be installed where smoke may impact transportation corridors inside and outside the park. If necessary, the superintendent would authorize a temporary closure of some areas to the public and visitors.

APPENDIX E – PROGRAMMATIC MINIMUM REQUIREMENTS ANALYSIS

Olympic National Park

Wilderness Project Proposal Form and Minimum Requirements Worksheet

Wilderness Project Proposal Information	
Project Originator(s):	Todd Rankin
Division:	Resources Management
MRW Preparer:	Ruth Scott/Todd Rankin
Date:	11/2/18, 11/29/18
PEPC #:	73763
What is the <u>issue</u> or <u>problem</u> to be solved?	NPS Director's Order (DO) 18, Wildland Fire Management, requires that parks "with burnable vegetation must have an approved Fire Management Plan (FMP) that will address the need for adequate funding and staffing to support its fire management program". Olympic National Park's (OLYM) 2005 Fire Management Plan needs to be revised to meet current NPS policies. About 95% of the park (876,447 acres) has been designated as the Daniel J. Evans Wilderness. Additional guidance is needed for implementing fire management strategies in the park's wilderness based on the Wilderness Act, wilderness minimum requirements, and new guidance for preservation of wilderness character.
What is the underlying need for the project?	OLYM has a rich and diverse landscape and the fire history reflects that diversity. From the fire-intolerant Sitka spruce forests on the west side of the Olympics to the fire-dependent Douglas-fir forests on the east side, wildland fire is recognized as a significant natural process operating within and shaping the park's ecosystems. Park managers recognize that fire has been an essential part of the ecosystem for thousands of years and that fire is an important natural disturbance that is vital for healthy forest ecosystems. The park's fire regime is characterized by relatively long fire return intervals (35-100 years on east side; 200+ years on west side). This creates an interesting fire history with episodic large fire events. Large fires that occurred several hundred years ago are still apparent on the landscape and helped form the vegetative composition and structure present today. It also means that the era of fire suppression policy within the park during the mid to late 1900s did not overly impact the fire regime. This presents a unique opportunity to restore fire within an ecosystem that has not been overly impacted by fire suppression. NPS, U.S. Department of the Interior, and interagency policies have changed since the park's 2005 FMP was written. Revisions and updates have been made to RM-18 (NPS 2014a) to comply with the 2009 Guidance for Implementation of Federal Wildland Fire Management Policy (DOI and USDA 2009). Sections of Management Policies Chapter 6 and DO-41 that specifically reference wildfire management in wilderness have also been updated since the park's 2005 FMP.

Location (attach map and/or photos):	The Fire Management Plan would address the entire park. This PMRA focuses on the entire Daniel J. Evans wilderness which includes the mountainous and forested park interior as well as the park's wilderness coastal strip.
Is resolution of this issue addressed in an approved NEPA document: Categorical Exclusion (CE); Environmental Assessment, Finding of No Significant Impact (FONSI); or Environmental Impact Statement, Record of Decision (ROD)? If so, please name:	The FONSI for the 2005 OLYM Fire Management Plan Environmental Assessment was signed September 8, 2005. A new FMP is needed however (see underlying need, above).
What would happen if the need were not met? (NO ACTION)	If a new Fire Management Plan is not completed, OLYM would not be in compliance with RM-18 (NPS 2014a) and the 2009 Guidance for Implementation of Federal Wildland Fire Management Policy (DOI and USDA 2009). Additionally, the park would not have the flexibility to manage fire on a landscape scale and in coordination with the U.S. Forest Service (USFS), in accordance with current federal wildland fire management strategy adopted since the publication of the 2005 FMP.

WILDERNESS MINIMUM REQUIREMENT ANALYSIS (MRA)
STEP ONE: Determine if action is necessary or appropriate for administration of the area as wilderness

1	Is the resolution of this issue covered by an existing Wilderness Plan or other NEPA decision document that includes wilderness minimum requirement considerations?	Answer: Yes____ No__X___ If "Yes" provide name of document and approval date:

Yes → Implement action as approved

No → Continue PPF/MRA

2	Has Superintendent determined this is an emergency in accordance with law & policy?	Answer: Yes__X__ No ____ A wildfire is considered an emergency; however a MRA is still required to ensure that emergency responses incorporate wilderness minimum requirements. No PMRA has yet been approved for OLYM's fire management activities, hence, the need for development of this PMRA.

No → Yes, Follow approved emergency SOPs/management plans. If they do not exist or have not gone through MRA, continue MRA.

3	List guidance provided in law and policy for resolution of the issue	See Management Policies Chapter 6, DO-41 and other applicable laws, policies and directives. Add additional policy guidance as appropriate.

WILDERNESS MINIMUM REQUIREMENT

WILDERNESS ACT OF 1964 - PROHIBITION OF CERTAIN USES SECTION 4(C)
Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.

NPS MANAGEMENT POLICIES 2006, § 6.3.5 MINIMUM REQUIREMENT
All management decisions affecting wilderness must be consistent with the minimum requirement concept. This concept is a documented process used to determine if administrative actions, projects, or programs undertaken by the Service or its agents and affecting wilderness character, resources, or the visitor experience are necessary, and if so how to minimize impacts. The minimum requirement concept will be applied as a two-step process that determines whether the proposed management action is appropriate or necessary for administration of the area as wilderness and does not cause a significant impact to wilderness resources and character, in accordance with the Wilderness Act; and the techniques and types of equipment needed to ensure that impacts on wilderness resources and character are minimized.

In accordance with this policy, superintendents will apply the minimum requirement concept in the context of wilderness stewardship planning, as well as to all other administrative practices, proposed special uses, scientific activities, and equipment use in wilderness. The only exception to the minimum requirement policy is for eligible areas that the Service has not proposed for wilderness designation. However, those lands will still be managed to preserve their eligibility.

When determining minimum requirements, the potential disruption of wilderness character and resources will be considered before, and given significantly more weight than, economic efficiency and convenience. If a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character and/or have localized, short-term adverse impacts will be acceptable.

Although park managers have flexibility in identifying the method used to determine minimum requirement, the method used must clearly weigh the benefits and impacts of the proposal, document the decision-making process, and be supported by an appropriate environmental compliance document. Parks must develop a process to determine minimum requirement until the plan is finally approved. Parks will complete a minimum requirement analysis on those administrative practices and equipment uses that have the potential to impact wilderness resources or values. The minimum requirement concept cannot be used to rationalize permanent roads or inappropriate or unlawful uses in wilderness.

Administrative use of motorized equipment or mechanical transport will be authorized only

- if determined by the superintendent to be the minimum requirement needed by management to achieve the purposes of the area, including the preservation of wilderness character and values, in accordance with the Wilderness Act; or
- in emergency situations (for example, search and rescue, homeland security, law enforcement) involving the health or safety of persons actually within the area.

Such management activities will also be conducted in accordance with all applicable regulations, policies, and guidelines and, where practicable, will be scheduled to avoid creating adverse resource impacts or conflicts with visitor use.

While actions taken to address search and rescue, homeland security, and law enforcement issues are subject to the minimum requirement concept, preplanning or programmatic planning should be undertaken whenever possible to facilitate a fast and effective response and reduce paperwork.

For more detailed guidance, see Director's Order #41 and the National Wilderness Steering Committee Guidance Paper #3: "What Constitutes the Minimum Requirements in Wilderness?"

OTHER GUIDANCE

WILDERNESS ACT OF 1964 - SPECIAL PROVISIONS SECTION 4(d)
The following special provisions are hereby made:

(1) Within wilderness areas designated by this Act the use of aircraft or motorboats, where these uses have already become established, may be permitted to continue subject to such restrictions as the Secretary of Agriculture deems desirable. In addition, such measure may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.

NPS MANAGEMENT POLICIES 2006, § 4.5 FIRE MANAGEMENT
Fire management or suppression activities conducted within wilderness, including the categories of designated, recommended, potential, proposed, and eligible areas, will be consistent with the "minimum requirement" concept identified in chapter 6 and Director's Order #41: Wilderness Preservation and Management.

NPS MANAGEMENT POLICIES 2006, § 6.3.4.3 ENVIRONMENTAL COMPLIANCE
Managers contemplating the use of aircraft or other motorized equipment or mechanical transportation within wilderness must consider impacts to the character, esthetics, and traditions of wilderness before considering the costs and efficiency of the equipment.

NPS MANAGEMENT POLICIES 2006, § 6.3.9 FIRE MANAGEMENT
All fire management activities conducted in wilderness areas will conform to the basic purposes of wilderness. Actions taken to suppress wildfires must use the minimum requirements concept unless the on-site decision-maker determines in his professional judgment that conditions dictate otherwise. Preplanning is critical to ensure that emergency response incorporates minimum requirements to the greatest extent possible. Fire suppression activities should be managed in ways that protect natural and cultural resources and minimize the lasting impacts of the suppression actions. Information on developing a fire management program in wilderness is contained in Director's Order #18: Wildland Fire Management.

Guidance on the need to suppress wildland fire or to use some wildland fires to achieve desired future conditions should appear in the park's planning documents (for example, in the wilderness management plan and fire management plan). Information in these documents will guide managers in the selection of fire management tactics that protect natural and cultural resources from fire and from fire suppression actions.

The park's fire management plan will provide guidance for responses to natural and human-caused wildland fires based on fuel conditions, climatic conditions, resources at risk, potential for damage to property or loss of life, both within and adjacent to the wilderness, as well as the availability of fire suppression resources.

If a wildland fire use program is implemented, planning documents will also include the prescriptions and procedures under which the program will be conducted within wilderness.

DIRECTOR'S ORDER #18: WILDLAND FIRE MANAGEMENT, 2008

4.2 Wilderness Policies

NPS policy on fire suppression conducted in wilderness, including the categories of designated, recommended, potential, proposed, and wilderness study areas, is expressed in section 6.3.9 of *Management Policies 2006*. All suppression actions will be consistent with the "minimum requirement" concept in section 6.3.5 of those policies and the Wilderness Act of 1964 (codified at 16 U.S.C. § 1133 (c)). The minimum requirement concept, as expressed in the Wilderness Act, directs: "…*[E]xcept as necessary to meet the minimum requirements for the administration of the area… (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."*
(Wilderness Act Section 4(c), 1964, 16 U.S. C. § 1133 (c))

Actions taken to manage wildland fire in wilderness using the appropriate minimum requirement concept will be conducted to protect life and safety and natural and cultural resources and to minimize the lasting impacts of the management actions and the fires themselves. The potential disruption of wilderness character and resources will be considered before, and given significantly more weight than, economic efficiency and convenience. If a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character and/or have localized, short-term adverse impacts will be acceptable, unless human life is threatened (see 5.1.F, below). Any delegation of authority to incident management teams will convey appropriate emphasis on the protection of wilderness resources.

DIRECTOR'S ORDER #41: WILDERNESS STEWARDSHIP, 2013

6.7 Fire Management

Firefighter and public safety are the first priorities in every fire management activity. However, wilderness character must be fully considered during all fire management actions beginning with the development of the Fire Management Plan (FMP) and continuing through the management of individual wildfires and implementation of fuel treatments and post-fire actions. A FMP is required for each park with burnable vegetation. It defines objectives, management requirements, ecological considerations, and potential strategies and tactics for safely managing fire in order to meet overall land management and wilderness objectives. The FMP considers values that require protection from fire (e.g., structures, cultural resources, and other values) as well as those that may benefit from fire within and outside of wilderness.

In many NPS wilderness areas, fires resulting from natural ignitions are considered a natural process that contributes to ecosystem function and is necessary to maintain wilderness in an unimpaired condition. As a result of many factors including past fire management practices within wilderness and the need to control wildfires on adjacent lands, fire may not be adequately functioning as a natural change agent. In those cases, augmenting natural ignitions with prescribed fire or other fuel treatments within wilderness may be necessary to restore or maintain ecological function if that is a goal identified in the park's Wilderness Stewardship Plan or FMP.

To ensure adequate consideration of wilderness resources, a programmatic MRA must be completed as part of the development of the park's FMP and companion environmental compliance document. The programmatic MRA must address management strategies for wildfires and fuel treatments in wilderness. The programmatic statement will establish the need for potential fire management actions in wilderness and will provide guidance for implementing initial wildfire responses. The analysis should specify the minimum activities (strategies, methods, and tools) that are generally permitted for managing wildfires, implementing fuels treatments, and conducting post-fire activities. For management of long-duration wildfires, an incident specific minimum requirements analysis should be considered to evaluate the methods and tools being applied to manage the event. The analysis should be periodically reviewed throughout the incident to ensure that appropriate strategies, methods, and tools are being used to protect wilderness character.

A MRA must also be developed as part of a Burned Area Emergency Response (BAER) plan for actions in wilderness that are proposed to restore, stabilize, or rehabilitate an area following a wildfire.

Project plans for fuels treatments in wilderness must address the minimum requirement. Project plans should refer to the programmatic MRA developed for the FMP that establishes the necessity for such treatments. If the proposed treatment is confirmed to be within the framework of the programmatic MRA, the project plan is not required to revisit that decision. However, each project plan must contain an analysis of the minimum methods and techniques necessary to accomplish the specific action with the least negative impact to wilderness character.

The application of Minimum Impact Strategies and Techniques (MIST) is required for all fires in wilderness. Qualified wildland fire Resource Advisors should be utilized throughout wildfire incidents, and post-fire activities including emergency stabilization and BAER. Resource advisors must be knowledgeable about wilderness values, objectives, and policies.

A delegation of authority from the park superintendent to an Incident Commander will include appropriate emphasis on the protection of wilderness resources and character, and the minimum requirements concept. Fire management resources must be adequately briefed on the concepts of wilderness stewardship and held accountable for preservation of wilderness character. They must be made aware of specific protections and constraints contained in the park's Wilderness Stewardship Plan and FMP.

Parks lacking an approved FMP must suppress all wildfires in a method that is commensurate with values to be protected and with consideration for the principles of risk management. While parks lacking an approved FMP may not use resource objectives as a primary consideration when selecting a suppression strategy for a wildfire, the impacts of suppression alternatives on wilderness character and other resource values must be considered when response strategies are developed and decisions are approved. Parks lacking an approved FMP may not implement prescribed fire projects. Also see *Management Policies 2006*, Section 6.3.9 and Director's Order #18: Wildland Fire Management.

NPS REFERENCE MANUAL #41, 2013
Wilderness Minimum Requirements for Wildland Fire
Wildland fire activities are subject to the Minimum Requirements Analysis (MRA) process. Most fire management actions can be anticipated and their impact on the wilderness resources and character

should be analyzed and approved in advance through the development of the Fire Management Plan (FMP and associated EA or EIS. The FMP should provide a determination as to whether various actions are necessary in wilderness (MRA Step 1). This would include the necessity for wildfire management and fuels management projects, including prescribed fire. (Figure 1.)

Wildfire Response

The FMP should specify typical methods and tools that may be used during the *initial response* to a wildfire. Different methods and tools that could be used under different initial response situations should be specified.

Example: Initial response to fires in a zone close to the wilderness boundary and that would threaten communities and homes may allow consideration of aggressive methods and tools. In contrast, an initial response deep in the wilderness having minimal risk to human life and safety and high potential for resource benefits may specify more limited and less impacting initial response methods and tools.

In the event that the park is managing a long-duration wildfire (one that will last for more than a few operational periods beyond the initial response) it is strongly recommended that long-term incident planning consider methods and tools that may differ from, and be less intrusive than, those used during the initial response. Subsequent planning cycles should reevaluate methods and tools as conditions and location of the fire activity change.

> *Important note*: When human life and safety are under imminent threat, fire managers may apply any methods or tools necessary.

Prescribed Fire & Fuels Management Projects

NPS policy allows for the use of prescribed fire and fuels projects in wilderness to fulfill wilderness and other approved management objectives. However the use of these practices is not automatic. Each park, through their FMP, should include a determination of the general locations, conditions and frequency of the types of projects that are appropriate and identify the wilderness purposes these projects are intended to fulfill (MRA Step 1). Once the necessity is established, individual project plans are not required to revisit or further justify the necessity unless they fall outside the approved parameters established within the FMP. A methods and tools analysis (MRA Step 2) for specific conditions and locations of fuels projects may be appropriate to develop within the FMP if there are a limited number of situations to consider. Ideally, the analysis could be applied to most, if not all, future projects. If a future project deviates from the analysis parameters, then a separate methods and tools analysis will be completed.

> *Example*: The park intends to develop and maintain a 100’ wide reduced fuel buffer along the wilderness boundary adjacent to an exterior housing development. The FMP has analyzed the project type and locations, and has received a determination that specifies the methods and tools that can be used for those types of projects. Those standards would be applied to all similar future projects. A separate methods and tools analysis would therefore not be required for each future project.

However, in many cases the specific conditions and locations of potential projects are unknown when the FMP is developed. In that case, each Prescribed Fire Plan or Mechanical Fuels Treatment Plan must analyze and gain approval for the methods and tools that will be used to implement the specific project.

NPS MANAGEMENT POLICIES 2006, § 8.4.4 OVERFLIGHTS AND AVIATION USES, ADMINISTRATIVE USE

Aviation is a necessary and acceptable management tool in some parks when used in a manner consistent with the NPS mission. Aviation activities will comply with all applicable policies and regulations issued by the Department of the Interior, the Federal Aviation Administration, and the National Park Service. In its administrative use of aircraft, the Service will

- use, to the maximum extent practicable, the quietest aircraft available for its aviation operations;
- limit official use of flights over parks to those needed to support or carry out emergency operations or essential management activities in cases where there are no practical alternatives or when alternative methods would be unreasonable;

- give full consideration to safety; wilderness management implications; impacts on resources, values, and opportunity for visitor enjoyment; impacts on other administrative activities; and overall cost-effectiveness;
- plan, schedule, and consolidate flights so as to avoid or minimize unacceptable impacts on park resources and values and visitor enjoyment;
- work cooperatively with other agencies using aircraft and airspace over parks to adhere to the above standards.

4 Is resolution of this issue necessary or appropriate to meet wilderness management objectives or the requirements of other laws, policies and directives? Yes No Do not proceed with action	Answer: Yes__ X__ No____ Explain: The vast majority of OLYM is the federally designated Daniel J. Evans Wilderness protected under the 1964 Wilderness Act (876,447 acres or 95% of the park). Wildland fire operations within the wilderness area are to adhere to the requirements of the Wilderness Act, NPS *Management Policies 2006*, DO-18, and DO-41 Wilderness Preservation and Management, and other applicable laws and policies. NPS DO-18 Wildland Fire Management requires that parks "with burnable vegetation must have an approved Fire Management Plan (FMP) that will address the need for adequate funding and staffing to support its fire management program". OLYM's 2005 Fire Management Plan needs to be revised to meet current NPS policies. Additional guidance is needed for implementing fire management strategies in the park's wilderness based on the Wilderness Act and wilderness minimum requirements, and new NPS guidance for preservation of wilderness character.
5 Can the issue be resolved through visitor education? Yes No Carry out visitor education	Answer: Yes____ No__X__ Explain: Visitor and public education is part of an effective fire management program. It is however just one aspect of a complex, multi-faceted program that requires addressing a broad range of actions for its resolution.

6	Can the issue be resolved through actions outside of wilderness? Yes ↓ No Conduct actions outside wilderness	Answer: Yes____ No__X__ Explain: Although some fire management actions would occur outside of wilderness, 95% of OLYM (876,447 acres) is designated wilderness and approximately 378 acres are potential wilderness. The scope and scale of the area managed as wilderness prevents the park from conducting effective fire management only outside of wilderness.

I have reviewed this project proposal and have determined that it meets the overall goals of Olympic National Park and can be included in my divisional work plan. I have designated a project coordinator below to represent my division and present the proposal to the Compliance Council.		
Project Manager:		
Division Chief Signature:		Date:
Contact the Planning & Compliance Office to schedule the issue for discussion by the Olympic National Park Compliance Council.		
I have reviewed this project proposal and have determined that the proposed management action is appropriate or necessary for administration of the park, if in wilderness it is appropriate and necessary for the administration of the area as wilderness in accordance with the Wilderness Act. I recommend that alternatives be developed to ensure that actions taken would not cause a significant impact to wilderness resources or character, and to develop techniques and types of equipment needed to ensure that impacts on park resources and values, and wilderness resources and character are avoided or minimized. Complete Part Two (next page).		
Deputy Superintendent:		Date:

WILDERNESS MINIMUM REQUIREMENT ANALYSIS (MRA)
STEP TWO: Develop alternatives, analyze their impacts and select the action that would effectively resolve the issue while using the techniques and types of equipment that ensure impacts on wilderness resources and character are minimized.

8	Describe in detail alternative ways to resolve the issue (include use of minimum tools as appropriate)	Note: Alternatives described in other compliance documents that address this issue may be referenced. If minimum requirement considerations were not included, develop below for projects affecting wilderness.

Alternative A: Continue to conduct a fire management program based on the 2005 Olympic National Park Fire Management Plan, with three fire management units (Exclusion, Conditional, and Wildland Fire Use)

Fire management goals for the park include: 1) restore and maintain natural fire regimes to the maximum extent practicable so natural ecosystems can operate essentially unimpaired by human interference, and 2) protect natural resources (including flora, fauna, air quality, geologic resources, aquatic resources, and wilderness character) from adverse influences of wildland fires, fire suppression, and prescribed fires. In the interest of restoring at least a portion of the natural role of fire, Alternative A offers a conservative start with careful consideration of human health and safety, ecological processes, wilderness values, threatened and endangered species, air quality, cultural concerns, and neighboring land owners.

Under alternative A, lightning-caused fires in the Exclusion FMU (including 275,894 acres of wilderness) would be suppressed to reduce the potential for wildfire to spread from or to adjacent lands. Within the Conditional and Wildland Fire Use FMUs (including 588,697 acres of wilderness) naturally ignited wildfires would be evaluated through a deliberative risk analysis process using the Wildland Fire Decision Support System (WFDSS) to determine the appropriate management response.

Fire Management Units (FMU)

A FMU is any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or major fire regime groups, etc. that sets it apart from management characteristics of an adjacent unit. Three fire management units have been defined for OLYM based on goals related to protection of life and property, and restoration of natural fire processes. The three units are the Exclusion Unit, the Conditional Unit, and the Wildland Fire Use Unit. The delineation of the units takes into account the values to be protected, local fire history, potential fire behavior, and the presence of natural or man-made barriers to fire spread. Accessibility, smoke dispersal, and location of administrative facilities and private property were additional considerations. Under alternative A, these FMUs would continue.

A fire's location affects the level and extent of fire management actions to be taken dependent on the FMU in which it is located. This strategy would be implemented over the entire park, including the acres of park wilderness that lie within the three FMUs (Exclusion: 275,894 wilderness acres; Conditional: 68,354 wilderness acres; Wildland Fire Use: 520,343 wilderness acres). More than 85% of the Exclusion FMU, almost 99% of the Conditional FMU, and more than 99% of the Wildland Fire Use FMU are within wilderness.

The Exclusion Unit provides a buffer area where fires are suppressed, thus reducing the chance that an uncontrolled wildland fire would compromise human safety and neighboring lands. The boundaries of the exclusion units were chosen to capitalize on natural containment features such as ridgetops and valley bottoms (where there is less slope); and to provide a relatively safe distance between the Wildland Fire Use Unit and developed areas or neighboring properties. Wildfire suppression would be the wildfire management strategy for the Exclusion FMU.

The Conditional Unit is located along the southeast portion of the park between the park's Wildland Fire Use Unit and Olympic National Forest (USFS) lands. Most of this unit adjoins USFS wilderness. In the Conditional Unit, human-caused fires would be suppressed (with possible exceptions noted later under Wildland Fire Use). Lightning-caused fires

that meet standard evaluation criteria would be managed for the benefit of the ecosystem, unless potential exists for the fires to cross out of the park onto USFS lands. Fires that do not meet the criteria, or that threaten to cross from the park onto the forest are suppressed. It is the intent of OLYM to continue to coordinate with federal and state cooperators when managing wildfire that has potential to cross park boundaries.

The Wildland Fire Use Unit consists of the rugged and remote interior of the park, where wildfire can be allowed to burn and be managed for multiple objectives, as conditions allow. In this unit, human-caused fires are suppressed (with a few possible exceptions). Lightning-caused fires in this unit that meet evaluation criteria are managed for the benefit of the ecosystem. Those fires that do not meet the criteria are suppressed.

A full range of management responses would be considered for naturally ignited wildfires in the Conditional and Wildland Fire Use Units. The appropriate management strategy for individual fires would be determined by conducting a risk analysis process and evaluating objectives using WFDSS, including input from interdisciplinary team (IDT) members. Alternative A would be limited to a maximum of 200 acres per year in areas where there is suitable habitat for northern spotted owls or marbled murrelets, with an additional 600 acres once per 5 years in the Conditional and Wildland Fire Use FMUs (combined).

Wildfires managed for resource benefit would be limited to a maximum of 500 acres per year over 5 years outside northern spotted owl and marbled murrelet habitat in the Conditional and Wildland Fire Use FMUs (combined). Naturally ignited fires in the Wildland Fire Use Unit that have the potential to exceed these acreage figures, but meet all other criteria for managing fire as a resource benefit, would be considered candidates only with additional environmental analysis and consultation.

For all FMUs, considerations of wilderness character when developing implementation plans ensure that wilderness resources and wilderness values are considered when plans are executed. This is done in part through development and use of the park's minimum requirements process to help guide the response to wildland fires and the choice of the minimum tools that may be used in the wilderness, and utilizes WFDSS, MIST, and other environmental mitigation measures in all fire management operations.

Wildland Fire Decision Support System (WFDSS)

For each wildfire ignition beyond initial response a deliberative risk analysis process is required to guide the re-evaluation of suppression strategies. WFDSS is a decision process that employs a systematic and reasonable approach to determine the most appropriate management strategy for a particular situation. Reasonable management alternatives are identified, analyzed, and evaluated, and are consistent with the expected probability of success/consequences of failure. Evaluation criteria include firefighter safety, anticipated costs, resource impacts, and environmental, social, and political considerations. This analysis is documented using WFDSS. All applicable guidance in the Programmatic Minimum Requirements Analysis (PMRA) would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident.

Minimum Impact Strategies and Techniques (MIST)

MIST is required by NPS policy for all fire management activities on NPS lands. These guidelines address considerations for agency administrators, incident management teams, and firefighters. They include measures to minimize vegetation, wildlife, and soil disturbance, and protect water quality. MIST guidelines have been modified for use at OLYM and include additional precautions for protecting water quality, riparian zones, and critical habitat.

ALTERNATIVE A – MAIN PROGRAM ELEMENTS

Main Program Elements	Alternative A
Fire Management Units	Three units: Exclusion, Conditional, Wildland Fire Use
Wilderness Minimum Requirements Analysis (MRA)	The PMRA would cover most fire management operations. Methods and tools outside the parameters of the PMRA would require a separate MRA.

Main Program Elements	Alternative A
Wildland Fire Decision Support System (WFDSS)	All applicable guidance in the PMRA would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident.
Wildfire Management	Wildfire suppression would be the wildfire management strategy for the Exclusion FMU. Wildfire for multiple objectives would be allowed as follows: • Maximum of 200 acres per year in northern spotted owl and marbled murrelet habitat, and an additional 600 acres once per 5 years in Conditional and Wildland Fire Use FMUs (combined) • Maximum of 500 acres over 5 years outside northern spotted owl and marbled murrelet habitat in Conditional and Wildland Fire Use FMUs (combined) • Conduct additional consultation with USFWS and environmental analysis if wildfires exceed the acreage limits. The need for fire suppression repair, BAER, or BAR activities would be assessed throughout the fire incident.
Minimum Impact Strategies and Tactics (MIST)	MIST, modified for OLYM, would continue to be used on all fire management activities.
Resource Advisors (READ)	Consider for all fires over 10 acres
Manual and Mechanical Treatment	Maximum of 200 acres per year in wilderness and non-wilderness (combined) In wilderness, manual and mechanical treatments may be used in accordance with the PMRA when wilderness infrastructure is at immediate risk from wildfires.
Prescribed Fire: Pile Burning and Debris Disposal	The potential use of pile burning/debris disposal by fire in wilderness would be addressed in the WSP or separate environmental compliance and MRA.
Prescribed Fire: Broadcast Burns	In non-wilderness: a maximum of 125 acres of broadcast burn over 5 years, with no more than 65 acres in any one year. In wilderness, broadcast burns would be dependent on the decisions made in the forthcoming WSP and require additional compliance.

ALTERNATIVE A - WILDERNESS FIRE MANAGEMENT UNIT (FMU) GUIDELINES FOR FIRE MANAGEMENT METHODS/TOOLS

The tables that follow provide minimum requirement guidance on selecting the methods and tools that would minimize impacts on wilderness character while administering fire management elements/actions. Though a range of alternative methods and tools are outlined that are available for managers' implementation, managers are to select the lowest level that would meet objectives, address safety concerns, and preserve wilderness character. For each list of alternative methods/tools, the first method/tool listed should be evaluated first to determine if it would meet these criteria and thus be the minimum requirement, before the next in the list is considered. The selected guidance would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident.

A wildfire is considered an emergency; however a PMRA/MRA is still required to ensure that emergency responses incorporate wilderness minimum requirements. Any fire management activities not listed in this PMRA require a separate MRA, developed and approved prior to implementation.

A Wilderness Fire Management Activities tracking document would be required for each wildfire to daily record fire management activities, including the use of Wilderness Act 4(c) prohibitions (i.e., use of motor vehicles, motorized equipment or motorboats, landing of aircraft or anything attached to the aircraft, other forms of mechanical transport, structures, and installations). This requirement would be included as a management requirement within WFDSS.

DETECTION AND INITIAL SIZE-UP	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Detection and initial size-up	Most of OLYM's wildfires start from lightning strikes during thunderstorms. The urgency for detecting these lightning ignitions is dependent on burning conditions, seasonal severity, proximity to high visitor use areas, and external factors. In low urgency conditions these fires can be discovered by visitors, park employees, and fire personnel searching from road corridors or hiking to high points. In high urgency conditions aircraft (fixed wing preferred, helicopter if necessary) may be used to search for fires. The frequency and scope of such flights would match the urgency, local preparedness and dispatch levels, and the potential for fire spread in the area where the lightning occurred. To reduce impacts to wilderness character from Unmanned Aircraft Systems (UAS), the decision for their use in the Wilderness FMU would be based on minimum requirements guidance. Those used in fire operations would be used in conformity with general aviation regulations for parks and wilderness (Policy Memorandum 14-05, Unmanned Aircraft – Interim Policy), and the Superintendent's Compendium for the park. Launching, landing, or operating an UAS within park boundaries requires approval in writing from the superintendent. The aircraft would maintain the Federal Aviation Administration requested minimum elevation above ground level (AGL) of 2,000 feet. Additionally, the UAS operator would be located outside the wilderness boundary. <u>Methods/Tools Alternatives</u> 1. Non-wilderness detection only of wilderness fires: search from road corridors; wait for others to report 2. Non-wilderness detection plus hiking to viewpoints within the wilderness and/or to the fire site 3. Deploy UAS if/when technology is effective for specific wildfires' detection/size-up 4. Conduct aircraft reconnaissance flights for detection (preferably >2,000 ft AGL), fixed wing preferred or helicopter if it is the only option

OPERATIONS	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Resource surveys and monitoring (Threatened & Endangered species, exotic plants, other natural resources, cultural resources, etc.)	Common to all strategies 1. A Resource Advisor (READ) would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The READ would be included early and be consulted often throughout the incident. 2. Wildlife surveys to assess presence and habitat of species of concern 3. Vegetation surveys for rare plants and exotic plants in areas proposed for crew use (e.g., helicopter landing zones, spike camps, etc.) 4. Cultural resource surveys related to any ground disturbance 5. Staff conducting surveys would follow the same PMRA guidelines listed for firefighting personnel (e.g., travel to/from, camping, Leave No Trace (LNT) principles, etc.)
Incident staffing	Staffing for wilderness wildfire could vary from zero presence to over 100 people on the fire at one time. Methods/Tools Alternatives 1. Minimal operational personnel; strong fire information and education effort 2. No staff presence in wilderness: monitoring from only non-wilderness corridors 3. Small staff presence in wilderness (up to one 2-person module) to reach the nearest viewpoint where the fire can be monitored 4. Small staff (up to one 5-person squad); presence during day only 5. Small staff (up to one 5-person squad); overnight presence at or near the fire location 6. Fixed wing aircraft or helicopter used for monitoring fire; no staff presence on ground 7. Medium sized organization, up to 20 staff at one time on the fire 8. Large sized organization on fire, 20-100 people at one time 9. Very large organization on fire, over 100 people at one time
Environmental monitoring	Monitoring of environmental conditions during wildfires provides managers with data on local conditions that helps predict fire behavior and smoke dispersal conditions, which in turn reduces the uncertainty for management decisions. Monitoring may be accomplished remotely through overflights or on-site in wilderness with the placement of installations (e.g., weather stations, cameras) as a means to monitor the fire visually without aircraft. Methods/Tools Alternatives 1. Infrared (IR) flights at high elevation and/or remote heat sensing via remote sensing technologies 2. Fixed wing flights (preferably >2,000 AGL) 3. UAS overflights 4. Remote webcam and/or Remote Automated Weather Station (RAWS). Entails use of a tripod/stand and solar panels to charge batteries. Common to all strategies 1. Visibility of wilderness installations would be minimized for the public 2. On-site presence of personnel for monitoring would be minimized 1) Fire personnel travel for installation/take-down but do not remain

	2) Fire personnel on-site to monitor, with spike camp 3. Personnel and equipment transport (i.e., installation, battery replacement/system check, equipment removal) follows Crew Travel and Equipment Transport guidance
Mapping	Fires are routinely mapped to inform managers of their status. This valuable information is used to inform local, regional, and national fire management personnel about the current and predicted fire spread and intensity in the short term. This information is also used to inform the public of the fire location and areas to avoid. Another significant objective is to gain good growth estimates to model fire behavior and spread. It also informs operational personnel of potential hazardous situations and is also used to calibrate fire behavior modeling and forecasting. <u>Methods/Tools Alternatives</u> 1. Visual mapping/estimation from remote location (i.e., nearby ridge, viewpoint, etc.). 2. Hiking around fire 3. Flying above fire: 1) fixed wing, 2) UAS, 3) helicopter 4. IR technology (high altitude aircraft or satellite imagery) <u>Frequency of Mapping</u> Mapping frequency is primarily determined by fire behavior, growth, and forecasted weather as well as external factors. Mapping frequency should be the minimum required to provide information to safely and adequately manage the fire to protect wilderness character.
Fireline construction	Depending on the location and nature of a fire, a range of fire suppression techniques utilizing ground and/or aerial firefighting resources would be used to break the continuity of forest fuels, cool a fire, and slow the advance of a flaming front. Actions may include construction of firelines; cutting of vegetation; application of water, foam, or retardant (used only if human life and safety are under imminent threat); and the application of fire (i.e., back burning or burnout). A fireline may utilize natural barriers, a wet line, or be constructed to contain or control the growth of a wildfire. <u>Methods/Tools Alternatives</u> 1. Use of natural barriers and changes in vegetation 2. Wet line using backpack pumps, use of gravity socks to charge hose lays 3. Wet line using a motorized pump (with sprinklers and/or hose lays) 4. Wet line using helicopter water bucket drops (potential use of portable tanks vs. wilderness water bodies for bucket dip sites) 5. Locate fireline in naturally open areas to avoid or minimize need for cutting 6. Constructed fireline using non-motorized tools (e.g., Pulaski, shovel, hoe, fire hook, D-ring, McCloud) 7. Constructed fireline using motorized tools (chainsaw, cord trimmer, motorized pump) 8. Retardant drops from aircraft (i.e., air tanker), if human life and safety are under imminent threat Note: The use of fireline explosives requires a separate MRA. <u>Common to all strategies</u> 1. Natural barriers and/or changes in vegetation type would be used whenever possible to contain or control all or parts of a wildfire perimeter. Wet line (line of water sprayed on ground) is generally preferable over constructed fireline (that involves soil disturbance and vegetation modification). Water for wet line is drawn from an approved

	stream, river, or lake, or delivered via aircraft in portable water tanks (i.e., blivets). Constructed fireline should avoid areas with rare or vulnerable resources. When considering the location of a fireline both physical and visual recovery time should be considered. It may be preferable to locate a fireline in vegetation that would recover in 5-10 years with few, if any, visible saw cuts instead of a fireline in forest with large-diameter downed logs, where the saw cuts may be visible for many decades. Transitions in vegetation types often cause changes in fire behavior and therefore can be good locations for fireline construction. 2. A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel. 3. Individual snags are ecologically valuable for many decades. Crews should cut only the minimum number of snags to produce an acceptable level of personnel safety and probability of containment.
Back burning/Burnout	Back burning (to set fire downwind of the main fire to control fire behavior by backing it into the main fire) and burnout operations (to set fire inside a control line to consume fuel between the edge of the fire and the control line), may be conducted. <u>Methods/Tools Alternatives</u> 1. Ground-based hand ignition (e.g., drip torch, fusees, very pistols) 2. Aerial ignition device (i.e., plastic sphere dispensers), used in cases where crews cannot access the area safely on foot and the only alternative is to suppress the fire
Communications	
Structure protection	
Mop-up	Mop-up actions prevent the wildfire (or portions thereof) from reigniting and may therefore be thought of as "controlling the wildfire". Actions may include extinguishing or removing burning material near firelines, felling snags, trenching logs to prevent rolling after an area has burned, or reducing residual smoke. There is no urgency to such actions however, and the fire type/response level is irrelevant. Because of the low urgency, motorized tools are unnecessary, with three exceptions: 1. When large amounts of water are required to complete mop-up, and repeated trips to a water source are needed to fill backpack pumps, a motorized pump may be the minimum tool to prevent impacts to riparian vegetation. A motorized pump should not be used when the water source can be accessed on durable surfaces. 2. A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel. 3. When other park fires require urgent responses and staff is limited, motorized tools (i.e., motorized pump, chainsaw) may be used to speed up mop-up to more quickly respond to other higher priority fires.
Closures	Trails and/or whole areas may be closed to the public near where wildfires are burning or at strategic trail junctions. Closures are instituted based on the type and amount of hazards the public would be exposed to as well as expected fire behavior. The conditions that merit a closure can occur with any fire type or response level, but they are more likely where active fire behavior can threaten public safety (i.e., along trail corridors, high visitor use areas, etc.). Fire monitors/trail guards may be used to monitor trail users and provide information on closures, mitigate safety risk to hikers, and/or to escort hikers through areas where conditions allow. Closures may remain in effect post-fire for longer periods, where public safety is a concern.

LOGISTICS	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Crew travel	There are over 600 miles of maintained trails providing access throughout OLYM's wilderness. There are many areas in the wilderness however with steep, rugged terrain where access is difficult or dangerous on foot. In many cases of lightning caused fires, the remote inaccessible terrain precludes options of accessing the fire from the ground, and sometimes even from the air. Traveling by foot to, within, and/or from the fire is often a reasonable option. In low response situations crews can hike to assess values in proximity of the fire (see parameters that follow). Helicopters may be used during high response levels when time-critical actions are necessary to protect life and property. <u>Common to all strategies</u> Access via foot: When hiking to access the fire, crews would follow LNT principles, hiking on trails where possible and on durable surfaces when traveling cross-country, and staying off sensitive vegetation (e.g., heather-huckleberry). Access in rugged areas: In areas that are unsafe to access on foot, helicopter access is permitted for fires that require staff to be on scene for containment or control. This may include rapellers rapelling to the ground while the helicopter hovers at a low AGL, and/or smokejumpers jumping at a minimum altitude of 1,500 feet AGL. Limited natural openings are available in the wilderness for use as helicopter landing zones, mainly on ridgetops or along sand and gravel bars on river bottoms; in these areas no modifications are necessary to provide landing zones when helicopter transport is required. In some locations vegetation may need to be cleared to provide safe landing areas. Managers are to consider alternative locations where vegetation clearing is not necessary or minimal, or a different approach such as firefighting in a different area where such measures would not be necessary. Clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary. Transport to another fire: Crews may be transported by helicopter away from a low urgency wildfire to a high urgency fire. The classification of the fire being responded to would determine the appropriate mode of transportation (on foot or helicopter). <u>Methods/Tools Alternatives</u> 1. Hiking 2. Helicopter 3. Rappellers (from helicopter) 4. Smokejumpers (from fixed wing)
Equipment transport and storage	Transport of firefighting equipment, kitchen/food, camp and personal gear, may be needed to implement tactical actions. This may include transport of fuel, chainsaws, pumps, hoes, sprinklers, portable tanks, backpack pumps, structure wrap, etc. At the lowest level, equipment can be backpacked in with fire personnel.

	Stock is a traditional form of freight transport in the park and when stock and a trained packer are available, should be considered for transporting equipment/gear. Stock use would be limited to trails open to stock (All Purpose and Secondary trails), and not allowed off-trail. When helicopters are necessary for equipment transport, supply runs throughout an incident would be consolidated and flights limited to what is necessary to support firefighting activities and personnel. As described previously (see Crew travel), clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary. Storage boxes would be allowed if necessary to provide secure tool/equipment storage during crew absences, and reduce necessity for repeated equipment in/out transport flights. <u>Methods/Tools Alternatives</u> 1. By foot 2. By stock 3. Combination foot and stock - typically this would mean stock transport on trails with the equipment then backpacked to the camp location through the cross-country terrain 4. By helicopter 5. By parachute (i.e., paracargo)
Camps and camping	Staffing of firefighting personnel overnight in the wilderness may be necessary. Spike camps can vary from those that resemble a typical backpacker's camp to larger, long-term camps. Wherever possible, personnel would camp in established camp areas or campsites. If firefighting locations require camping off-trail or away from established sites, camping would take place on durable surfaces. Firefighting crews would practice LNT principles including proper methods for food storage, human waste disposal, and minimizing travel around camps on vegetation (especially heather-huckleberry). Campfires would not be allowed by fire crews in areas where only stoves are allowed, or when the backcountry is closed to campfires for the public. Based on the specific incident, a local base camp manager or READ would be assigned to spike camps that exceed a 10 person module, depending on the sensitivity of the area's resources, its remoteness, and/or if it's located off-trail. Food and garbage must be secured at all times, whenever not in use or if unattended, to safeguard such items from wildlife access. All food, garbage, and scented items would be stored appropriately following park guidelines. IGBC-certified animal resistant food canisters (ARFC) and animal resistant stock pannier bags; or bear wires already in place, would be the first choice. IGBC-certified small storage containers, boxes, and coolers may be considered when larger food storage space is necessary. Large animal-resistant food storage lockers (e.g., Knaack box) would only be transported and used at camps if other options would not be available or practical, usually due to crew size, or if already necessary for secure tool/equipment storage. Any bear-resistant containers purchased for fires would comply with the IGBC certified list: http://igbconline.org/wp-content/uploads/2018/09/180911_Certified_Products_List.pdf. Human waste management, in camping areas without toilets, would be addressed first through cat hole digging for very small numbers of personnel, then a latrine that is a trench or pit (with cultural resources review) – except in the subalpine, and finally a temporary fly-out vault - especially in the subalpine.

	Methods/Tools Alternatives 1. No camp 2. Backpacking style camp 3. Backpacking style camp + latrine 4. Moderate-sized spike camp: minimal tables/furniture, group cooking gear, latrine 5. Full spike camp: minimal tables/furniture, group cooking gear, latrine, greywater pit, tarps for shade when needed
SAFETY	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Safety zones and escape routes	A variety of strategies are used to increase firefighter safety. It is desirable to have: 1) Safety zones - areas without flammable material and which are large enough to provide refuge in case of a burn-over, 2) Escape routes - a route away from the work area to a safe area that is without significant impediments due to brush or down trees, etc., and 3) Helicopter landing zones sufficiently close to allow medical evacuation in case of serious injury. There are limited natural openings for use as landing zones in the park's wilderness mainly on ridgetops or along sand and gravel bars on river bottoms; in these areas no modifications are necessary to provide the safety areas noted above. In some locations, however, such areas would need to be mechanically cleared. Managers considering clearing safety areas should first evaluate other alternatives including working in a different area where such measures would not be necessary. A separate MRA is required for safety zone clearing. Many variables are involved in determining safety zones and escape routes that would be evaluated in the MRA, including the steepness of the terrain, the experience level of the crew, expected fire behavior, and the availability of various resources. If the decision is made to clear such areas through the MRA, the Incident Commander and Fire Duty Officer should do so in a way that meets safety objectives while minimizing impacts to wilderness character. Policy "No permanent heliports, helipads, or airstrips will be allowed in wilderness unless specifically authorized by statute or legislation. Temporary landing facilities may be used to meet the minimum requirements of emergency situations." (NPS Management Policies 2006 6.3.10.1) "Emergency" is defined in DO-41 as, "a situation that requires immediate action because of imminent danger to the health or safety of people." Methods/Tools Alternatives 1. Use natural vegetation breaks; no clearing. Temporary flagging may mark routes (following the park's Marking and Flagging Office Order #56). 2. Clearing using non-motorized tools 3. Clearing using motorized tools Common to all strategies A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel.

PUBLIC INFORMATION/EDUCATION	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Public interpretive/ Informational tools	Posted public information/education about the wildfire incident would occur outside wilderness (e.g., wilderness information centers, trailheads, visitor centers, etc.). This would include advisements about the presence of wildfires and locations of associated smoke. When trails/areas in the wilderness are closed due to wildfire they can be posted as such on-site, often with a trail guard present. Signs would be removed when closures are lifted.
RESOURCE MONITORING	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Ecological monitoring	Understanding the ecological effects of a wildfire is important for wilderness stewardship. To support such understanding, monitoring plots may be established in burned areas of the wilderness where reasonably accessible. The monitoring is essentially observational, but when markers are determined necessary selection of type and placement would follow OLYM's Office Order #56, Use of Backcountry Marking and Flagging. The type chosen would follow the Office Order in the preferred method list to ensure the minimum requirement is selected. All plot markers would be removed when monitoring is complete. The use of markers for fire ecological monitoring other than wood or buried (e.g., small metal bars or magnets), or any markers for long-term monitoring (>2 years), would require a separate MRA. Any air quality monitoring would occur outside of wilderness.

FIRE SUPPRESSION REHABILITATION	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Suppression rehabilitation	The major goal of wildfire suppression rehabilitation is to repair or mitigate environmental resource damage caused by the fire suppression activities and rehabilitate the impacts to as natural a condition as possible. Suppression rehabilitation targets damage to resources, lands, and facilities resulting from wildfire suppression actions in contrast to damages resulting from the wildfire itself. Repair of damages that are a direct result of wildfire suppression activity would be planned for and implemented as soon as possible, prior to demobilization. Wildfire suppression impacts to be rehabilitated may include firelines, pump sites, staging areas, new access trails, bivy camps, spike camps, latrines, safety zones, and helispots; removing equipment, flagging; erosion control (water bar placement); flush-cutting stumps and camouflaging cut ends; and replacing relocated materials (out of streambeds, etc.). The guidelines entitled "Rehabilitation Following Wilderness Fire Suppression Activities," found in the wilderness.net fire management toolbox would be followed and included in the incident mapsheets (i.e., maps/guidance developed for wildfire planning and implementation). These would help inform management actions during the fire operations phase and the wrap-up of the fire <u>Methods/Tools Alternatives</u> 1. Rehab using non-motorized tools 2. Rehab using motorized tools (for flush-cutting stumps, if hand tools present safety issues or quantity of stumps is high)

Post-fire rehabilitation	Post-wildfire programs/activities (i.e., emergency stabilization, burned area rehabilitation, restoration) require a separate MRA. Emergency stabilization involves immediate post wildfire actions needed to minimize the threat to life and health and prevent unacceptable degradation to natural and cultural resources. Burned area rehabilitation (BAR) focuses on repair/replacement of minor facilities and damage to natural and cultural resources sustained by the unplanned fire event. A burned area emergency response team (BAER) may be called in during or after the suppression effort to develop a plan that would include a project-specific MRA, to rehabilitate park resources impacted by either the fire or the suppression activities. Rehabilitation treatments are developed based on impacts observed or anticipated. These may include treatments to address soil disturbance, erosion and compaction, sediments or excessive debris entering waterways, damage to roads and trails, spread of nonnative invasive plant species, damage to cultural resource sites, and hazardous trees near public use areas. For post-fire rehabilitation a tiered categorical exclusion (CE) under category G.1 "Actions Related to Hazardous Fuels Reduction and Post-fire Rehabilitation" would be conducted, along with the separate MRA.

USE OF 4(C) PROHIBITED USES

Alternative A: Continue to conduct a fire management program based on the 2005 Olympic National Park Fire Management Plan, with three fire management units (Exclusion, Conditional, and Wildland Fire Use)

	Wilderness Act of 1964, Section 4(c), **Prohibition Of Certain Uses:** • temporary road • use of motor vehicles, motorized equipment or motorboats • landing of aircraft • other forms of mechanical transport • structure or installation	List the Wilderness Act 4(c) prohibited uses proposed in this alternative and what they are proposed to be used for.

FIRE MANAGEMENT ELEMENT/ ACTION	PROPOSED 4(C) AND AIRCRAFT USE	AIRCRAFT/ MECHANICAL TRANSPORT	INSTALLATION	MOTORIZED EQUIPMENT
DETECTION AND INITIAL SIZE-UP	• Aircraft reconnaissance flights (preferably >2,000 ft AGL), fixed wing preferred or helicopter if only option	X		
OPERATIONS				
Resource surveys and monitoring	• Flagging rare plants/exotic plants in crew operational areas		X	
Environmental monitoring	• Fixed wing flights (preferably >2,000 AGL) • UAS overflights • Remote webcam and/or RAWS includes use of a tripod/stand and solar panels to charge batteries	X	X	

FIRE MANAGEMENT ELEMENT/ ACTION	PROPOSED 4(C) AND AIRCRAFT USE	AIRCRAFT/ MECHANICAL TRANSPORT	INSTALLATION	MOTORIZED EQUIPMENT
Mapping	• Flying above fire: 1) fixed wing, 2) UAS, 3) helicopter	X		
Fireline construction	• Wet line using backpack pumps, use of gravity socks to charge hose lays • Wet line using a motorized pump (with sprinklers and/or hose lays) • Wet line using helicopter water bucket drops (potential use of portable tanks vs. wilderness water bodies for bucket dip sites) • Constructed fireline using motorized tools (chainsaw, cord trimmer, motorized pump) • Retardant drops from aircraft (air tanker)	X	X	X
Back burning/burnout	• Aerial ignition device deployed from aircraft	X		
Communications	• Flagging to communicate information to crew • Radio, park repeater • Radio, temporary fire repeater		X	
Structure protection	• Wrapping infrastructure • Sprinklers using gravity-fed hose lays and/or gravity socks • Sprinklers using motorized pumps		X	X
Mop-up	• Motorized pump • Chainsaw			X
LOGISTICS				
Crew travel	• Helicopter	X		
Equipment transport and storage	• Helicopter • Secure storage box	X	X	
Camps and camping	• Full spike camp: tents, minimal tables/furniture, fly-out vault, tarps, animal-resistant food storage		X	
SAFETY				
Safety zones and escape routes	• Temporary flagging • Chainsaw for clearing		X	X
PUBLIC INFORMATION/EDUCATION				
Public interpretive/ informational tools	• On-site closure signs		X	

FIRE MANAGEMENT ELEMENT/ ACTION	PROPOSED 4(C) AND AIRCRAFT USE	AIRCRAFT/ MECHANICAL TRANSPORT	INSTALLATION	MOTORIZED EQUIPMENT
RESOURCE MONITORING				
Ecological monitoring	• Use of wood or buried markers (e.g., small metal bars or magnets) • Other types of markers or any markers for long-term monitoring (>2 years) would require a separate MRA		X	
Suppression rehabilitation	• Flagging • Chainsaw		X	X

Alternative B: Conduct a fire management program based on an updated Olympic National Park Fire Management Plan, with two fire management units (Wilderness and Non-Wilderness)

The overall fire management objective under this alternative is to preserve wilderness character by allowing natural-caused wildfires to proceed within the Daniel J. Evans Wilderness without human manipulation to the fullest extent possible, and therefore preserve the untrammeled, natural, undeveloped, opportunities for solitude or primitive and unconfined recreation, and other features of value qualities of wilderness character.

Alternative B (the Preferred Alternative) would revise and update the park's FMP to reflect current federal regulation and guidance, and the best available science and practices in regard to fire management. It would provide a range of strategies and tactics that could be used to respond to changes in the environment and the specific needs of individual firefighting efforts. Alternative B would also allow for a more flexible use of wildfire for multiple objectives, which includes increasing the number of acres allowed to burn annually.

Wildfire would be expected to affect an average of 1,200 acres of wildfire per year based on current conditions and recent fire history. Wildfire for monitoring only and for multiple objectives would be allowed under appropriate safety and resource conditions.

This section (#8) of the PMRA provides proposed guidelines for determining the methods and tools that would be used for implementing management actions on natural and human-caused wildfire ignitions within the park's wilderness under an updated FMP. Alternative B would implement the following proposed fire management program:

Fire Management Units (FMU) - Objectives and Actions

A FMU is any land management area definable by objectives, topographic features, access, values-to-be-protected, political boundaries, fuel types, or major fire regime groups, etc. that sets it apart from management characteristics of an adjacent unit. The park would be allocated into two FMUs, Wilderness and Non-Wilderness, for the purposes of the fire management program. The FMUs affect the level and extent of fire management actions to be taken in each. The Wilderness FMU would allow for a full range of wildfire management strategies (Monitor, to Multiple Objectives, to Full Suppression), while the Non-Wilderness FMU would allow for only a suppression-oriented strategy (unless risk to firefighter safety is too great or fires are burning in steep, inaccessible terrain). The FMP provides specific guidance for each FMU that allows for full implementation of federal wildland fire management policies.

The Wilderness FMU comprises 95% of the park: 876,447 designated wilderness acres. In addition to NPS law and policy, the Wilderness Act and wilderness-related policies also apply to fire management within this FMU. Objectives for the Wilderness FMU focus on maintaining the natural fire regime and conditions, and include standards and limitations necessary to protect values including wilderness character, and natural, cultural, and infrastructure resources. Authorized actions include applying the full range of strategies (monitoring to aggressive full suppression) to all or portions of wildfires as appropriate to provide for firefighter and public safety while preserving wilderness character and maximizing opportunities for fire to fulfill its ecological role in the park's ecosystems.

For each wildfire ignition that persists beyond initial response, a deliberative risk analysis process would be conducted and documented using WFDSS. When actions and activities listed in this PMRA apply to a wildfire within the Wilderness FMU (based on the specific conditions of that wildfire) the guidance in the PMRA would be incorporated into the WFDSS decision as management requirements or incident requirements for that wildfire incident.

Wildfire Strategies

Fire management objectives and actions vary depending on a number of factors: location within the park (Wilderness or Non-Wilderness FMUs), location within the wilderness itself, environmental conditions at the time of the action, current-year acres already burned/treated, and with foremost consideration of firefighter and public safety. One of three strategies, Monitor, Multiple Objectives, and Full Suppression, would be employed to meet fire management objectives. The strategy that best balances potential risks and benefits to firefighter and public safety, wilderness character, and other land management objectives would be selected.

Monitor Strategy: These wildfires are monitored but are not managed to control spread or intensity. In some cases rare or valuable resources, such as some cultural resources, nest trees, or rare plant species not adapted to fire, may be protected through minor control measures.

Multiple Objectives Strategy: These wildfires are allowed to continue to burn, but are managed to prevent spread in certain directions or to reduce intensity. A wildfire being managed for multiple objectives may have a suppression objective on one part of the fire while another part of the fire is managed for resource and/or wilderness objectives. The strategy with these fires is to have the least management impact in order to return to a monitor strategy.

Full Suppression Strategy: The management strategy for these wildfires is to confine them to a general geographic area wherever possible using natural barriers, roads (outside of wilderness), trails, and vegetation type changes that could slow or stop the spread of a fire. In some cases more advantageous locations (including natural barriers) for wildfire confinement can be used even though it increases the amount of space and time the wildfire is allowed to burn. In some cases the goal is to reduce the spread and intensity of the wildfire immediately and minimize the number of acres burned. This may happen due to the proximity of the fire to high values at risk, difficulty in accessing the fire, vegetation type, and seasonal severity. This strategy is the most aggressive approach to managing a wildfire. Suppression may include mop-up operations on certain sections of the fire to prevent spread, when seasonal severity, other wildfires in the park or on adjacent public lands, sociopolitical issues or air quality make managing the fire less favorable. Unwanted human-caused ignitions would be assigned a suppression strategy based on the situation and firefighter safety, with fire management elements and actions in wilderness following the guidance in this PMRA as well.

Once a wildfire has been detected and initial size-up conducted, one of the three wildfire strategies would be assigned based on WFDSS management decision criteria. Suppressing wildfires is a significant impact to wilderness character and should be only a last resort because the situation is too complex, risks too high, or externalities overshadow the benefits to wilderness character.

Management decision criteria for wildfire strategies within the wilderness address both wilderness and non-wilderness values. Criteria to be evaluated address specific values: wilderness character, natural resources including T&E habitat, cultural resources, structures, and infrastructure. Non-wilderness values can, and often do, guide selection of the wildfire strategy. Potential for spread to non-wilderness areas and air quality effects in non-wilderness areas are considered as well as operational concerns, such as the availability of fire personnel and resources at the local, regional, and national levels. These are referred to as “external factors” in the analysis.

Wildfire management conditions are likely to change over time and space based on the management decision criteria outlined above, and on issues involving social, political, wilderness, safety, cost, etc. Such factors may result in the need to shift to one of the two other strategies during the same incident. Managers should consider both potential impacts to wilderness character, and non-wilderness values and concerns when weighing strategy selection decisions. Though factors can result in the need for the fire to change from one strategy to another, the intention of fire management in wilderness is to move back to the least impacting management strategy as quickly as possible.

Management Response Levels

Within each of the three wildfire strategies (i.e., Monitor, Multiple Objectives, Full Suppression), each fire would be assigned, at any one time, to one of three management responses (or urgency) levels: low, moderate, or high. These are defined by the amount and type of management that is appropriate for that fire given the current situation (i.e., fire danger ratings, staffing levels, preparedness levels) and a relative risk assessment. These vary from a low response level involving minimal staff with few operational actions to large, complex suppression management actions. Similar to strategies, response levels are likely to change over time and space based on the management decision criteria. Managers should seek the lowest response level that would meet objectives, address safety concerns, and preserve wilderness character. See the “Fire Management Strategies and Response Urgency” figure that follows, for a visual depiction of the relationship between the wildfire strategies and the management response levels.

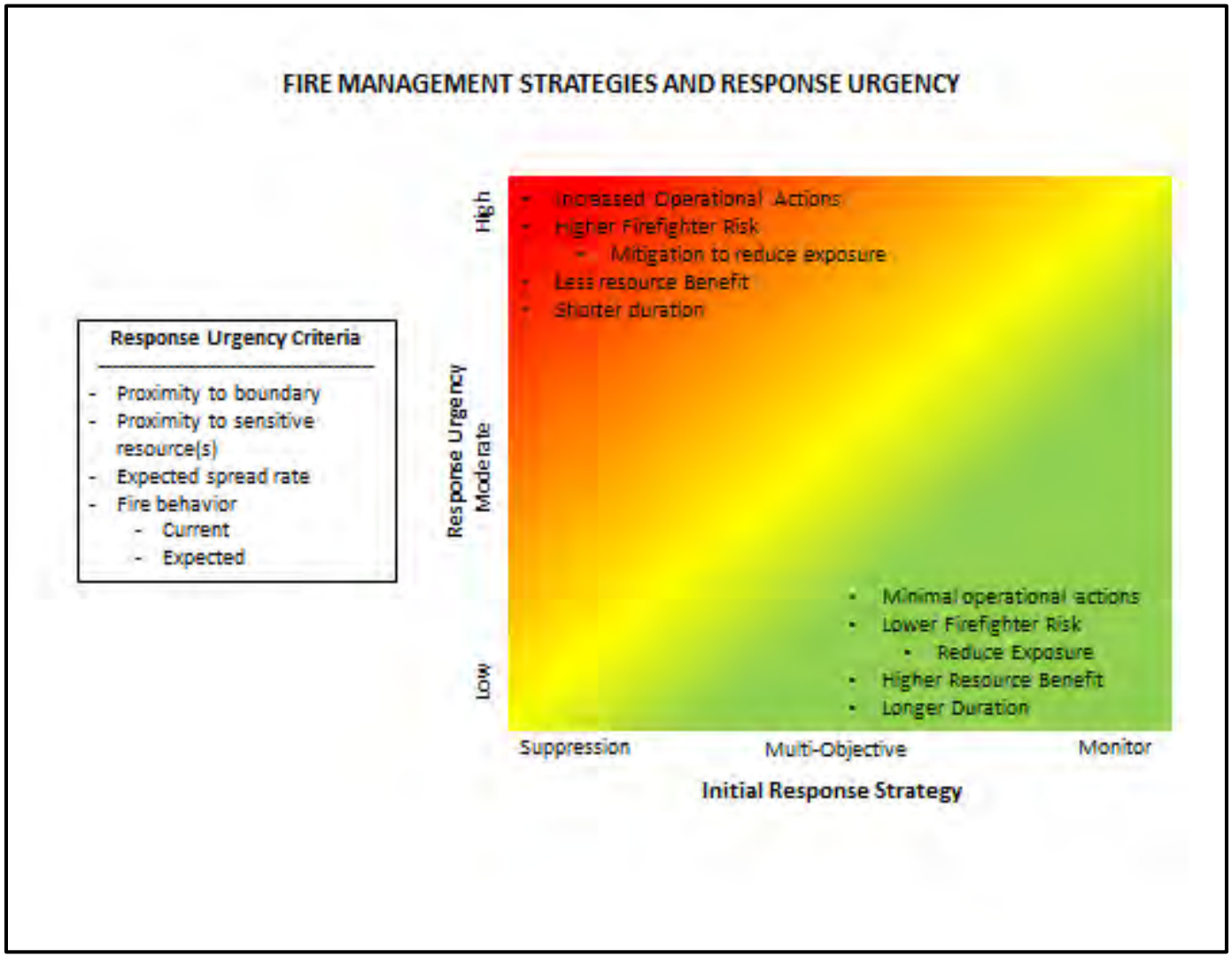
Wildland Fire Decision Support System (WFDSS)

For each wildfire ignition beyond initial response a deliberative risk analysis process is required to guide the re-evaluation of suppression strategies. WFDSS is a decision process that employs a systematic and reasonable approach to determine

the most appropriate management strategy for a particular situation. Reasonable management alternatives are identified, analyzed and evaluated, and are consistent with the expected probability of success/consequences of failure. Evaluation criteria include firefighter safety, anticipated costs, resource impacts, and environmental, social, and political considerations. This analysis is documented using WFDSS. All applicable guidance in the PMRA would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident.

MIST (Minimum Impact Strategies and Techniques)

MIST is required by NPS policy for all fire management activities on NPS lands. These guidelines address considerations for agency administrators, incident management teams and firefighters. They include measures to minimize impacts on vegetation, wildlife, and soil disturbance, and protect water quality. MIST guidelines have been modified for use at OLYM and include additional precautions for protecting water quality, riparian zones, and critical habitat.


FIRE MANAGEMENT STRATEGIES AND RESPONSE URGENCY
Response Urgency Criteria
- Proximity to boundary
- Proximity to sensitive resource(s)
- Expected spread rate
- Fire behavior
  - Current
  - Expected
Response Urgency
High
Moderate
Low
Increased Operational Actions
Higher Firefighter Risk
Mitigation to reduce exposure
Less resource Benefit
Shorter duration
Minimal operational actions
Lower Firefighter Risk
Reduce Exposure
Higher Resource Benefit
Longer Duration
Suppression
Multi-Objective
Monitor
Initial Response Strategy

ALTERNATIVE B – MAIN PROGRAM ELEMENTS

Main Program Elements	Alternative B
Fire Management Units	**Two units: Wilderness, Non-Wilderness**
Wilderness Minimum Requirements Analysis (MRA)	A wildfire is considered an emergency; however a PMRA/MRA is still required to ensure that emergency responses incorporate wilderness minimum requirements. Guidelines would be established in the PMRA for most fire management operations within the Wilderness FMU. Once the PMRA is approved by the superintendent, these activities may proceed in wilderness, following PMRA direction, without further MRA approval. Any fire management activities not listed in the PMRA require a separate MRA, approved by the superintendent prior to implementation. Programs or activities requiring a separate MRA include proposed pre-wildfire fuels treatment, post-wildfire programs/activities (i.e., emergency stabilization, rehabilitation, restoration; BAER, BAR), and prescribed fire. Though unlikely, if debris pile burning is proposed within the wilderness, a separate MRA is also required. Methods and tools outside the parameters of this PMRA require a separate MRA, including fireline explosives, remote satellite internet communications (including satellite dish, and Wi-Fi), generators (including those for powering communications), safety zone clearing, and the use of markers for fire ecological monitoring other than wood or buried (e.g., small metal bars and magnets), or any markers for long-term monitoring (>2 years). Though to be considered under only extreme and rare circumstances in wilderness, a separate MRA would be required for the use of heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles. The majority of proposed fire management activities within wilderness for long-duration wildfires (i.e., those that will last for more than a few operational periods beyond the initial response) would likely fit within the scope of this PMRA. However, any long-duration fire activities not approved within the PMRA would require an incident-specific MRA to evaluate those strategies, methods and/or tools. This would most often be triggered at the time MAPs (management action points) are identified and methods/tools, that require a separate MRA, are proposed for when the wildfire reaches the MAPs.
Wildland Fire Decision Support Process (WFDSS)	All applicable guidance in the PMRA would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident.
Wildfire Management	Wildfire in both FMUs would be expected as follows: • An average of 1,200 acres of wildfire per year based on current conditions and recent fire history • Wildfire for Multiple Objectives would be allowed under appropriate safety and resource conditions. The need for fire suppression repair, BAER, or BAR activities would be assessed throughout the fire incident. An ID team would be assembled to prepare for formal analysis and report, within the required days of fire containment.
Minimum Impact Strategies and Tactics (MIST)	MIST, modified for OLYM, would continue to be used on all fire management activities.

Main Program Elements	Alternative B
Resource Advisors (READ)	A READ would be assigned to wildfires based on the values at risk per WFDSS and Resource Advisor Guide. A READ would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness.
Manual and Mechanical Treatment	Maximum of 100 acres per year in the Non-Wilderness FMU. In the Wilderness FMU, treatments may be used in accordance with the PMRA when wilderness infrastructure is at immediate risk from wildfires, until final decisions are made in the WSP.
Prescribed Fire: Pile Burning and Debris Disposal	The potential use of pile burning/debris disposal by fire in the Wilderness FMU would be addressed in the WSP or separate environmental compliance and MRA.
Prescribed Fire: Broadcast Burns	Broadcast burns would not be allowed in either FMU under the revised FMP without additional environmental review and compliance. Broadcast burns in wilderness would be dependent on the decisions made in the WSP and require additional compliance.

Mitigations

- Wilderness character would be fully considered during all fire management actions beginning with the development of the FMP and continuing through the management of individual wildfires and implementation of fuel treatments and post-fire actions.
- All planned fire management operations in wilderness would be conducted in accordance with the programmatic minimum requirements analysis and any separate MRAs related to the fire management program.
- Fire management personnel would be adequately briefed on the concepts of wilderness stewardship and be held accountable for the preservation of wilderness character. They would be made aware of specific protections and constraints contained in the park's FMP PMRA and any additional separate wildfire-related MRAs.
- A READ would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The READ's duties during the incident would include comparing proposed management strategies and techniques with the limits established for each element/action of the assigned wilderness wildfire strategies (i.e., the wilderness minimum requirement guidelines for methods and tools in the PMRA).
- When wildfire ignitions occur within the wilderness, the IDT team assembled at the beginning of the incident would include the park's wilderness coordinator as well as the READ. The park's wilderness coordinator would also be consulted during WFDSS decision development to assist in identification of the applicable wilderness minimum requirement guidelines and provide wilderness input on the decision-making for any fires within the wilderness. A management requirement in WFDSS for the fire incident would be that the wilderness coordinator would be consulted as early as possible to help inform the "strategic wildfire decision analysis" (the WFDSS decision development).
- MIST, revised for OLYM, would be employed for all fire management actions to minimize impacts on resources. MIST would be included as a management requirement in WFDSS for incorporation into fire decisions.
- Fire personnel would practice LNT principles including proper methods for food storage (see following bullet), human waste disposal, and minimizing travel on sensitive vegetation (e.g., heather-huckleberry). Wherever possible, personnel would camp in established camp areas or campsites. If firefighting locations require camping off-trail or away from established sites, camping would take place on durable surfaces. Campfires would not be allowed by fire crews in areas where only stoves are allowed, or when the backcountry is closed to campfires for the public. LNT would be listed as a management requirement in WFDSS for incorporation into fire management decisions.
- Food and garbage must be secured at all times, whenever not in use or if unattended, to safeguard such items from wildlife access. All food, garbage, and scented items would be stored appropriately following park guidelines. IGBC-certified animal resistant food canisters (ARFC) and animal resistant stock pannier bags; or bear wires already in place, would be the first choice. IGBC-certified small storage containers, boxes, and coolers may be considered when larger food storage space is necessary. Large animal-resistant food storage lockers (e.g., Knaack box) would only be transported and used at camps if other options would not be available or practical, usually due to crew size, or if

already necessary for secure tool/equipment storage. Any bear-resistant containers purchased for fires would comply with the IGBC certified list: http://igbconline.org/wp-content/uploads/2018/09/180911_Certified_Products_List.pdf.

- The smallest, quietest helicopters would be used to accomplish tasks efficiently and safely.
- Heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles would not be used in wilderness. The exception to this is that the superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances.
- Following an incident, an evaluation would take place to determine if actions undertaken during the fire management response met with direction established in the Fire Management Plan PMRA for preserving wilderness character. This would include an evaluation of any use of Wilderness Act 4(c) prohibitions to determine how improvements could be made for preserving wilderness character on future incidents.

ALTERNATIVE B - WILDERNESS FIRE MANAGEMENT UNIT (FMU) GUIDELINES FOR FIRE MANAGEMENT METHODS/TOOLS

The primary management mandate of the Wilderness Act for the federal agencies administering wilderness is to preserve the wilderness character of the area. While also administering the "area for any other purposes for which it may have been established," the agencies are directed to do so in ways that "preserve its wilderness character". The tables that follow provide minimum requirement guidance on selecting the methods and tools that would minimize impacts on wilderness character while administering fire management elements/actions. Though a range of alternative methods and tools are outlined that are available for managers' implementation, managers are to select the lowest level that would meet objectives, address safety concerns, and preserve wilderness character. For each list of alternative methods/tools, the first method/tool listed should be evaluated first to determine if it would meet these criteria and thus be the minimum requirement, before the next in the list is considered. This guidance would be included in WFDSS.

SEPARATE MRA REQUIREMENTS

A wildfire is considered an emergency; however a PMRA/MRA is still required to ensure that emergency responses incorporate wilderness minimum requirements. Guidelines would be established in the PMRA for most fire management operations within the Wilderness FMU. Once the PMRA is approved by the Superintendent, these activities may proceed in wilderness, following PMRA direction, without further MRA approval.

Any fire management activities not listed in the PMRA require a separate MRA, approved by the superintendent prior to implementation. Programs or activities requiring a separate MRA include proposed pre-wildfire fuels treatment, post-wildfire programs/activities (i.e., emergency stabilization, rehabilitation, restoration; BAER, BAR) and prescribed fire. Though unlikely, if debris pile burning is proposed within the wilderness a separate MRA is also required. Methods and tools outside the parameters of this PMRA require a separate MRA, including fireline explosives, remote satellite internet communications (including satellite dish and Wi-Fi), generators (including those for powering communications), safety zone clearing, and the use of markers for fire ecological monitoring other than wood or buried (e.g., small metal bars and magnets), or any markers for long-term monitoring (>2 years). Though to be considered under only extreme and rare circumstances in wilderness, a separate MRA would be required for the use of heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles.

The majority of proposed fire management activities within wilderness for long-duration wildfires (i.e., those that will last for more than a few operational periods beyond the initial response) would likely fit within the scope of this PMRA. However, any long-duration fire activities not approved within the PMRA would require an incident-specific MRA to evaluate those strategies, methods and/or tools. This would most often be triggered at the time MAPs (management action points) are identified and methods/tools, that require a separate MRA, are proposed for when the wildfire reaches the MAPs.

FIRE MANAGEMENT ACTIVITIES TRACKING

A Wilderness Fire Management Activities tracking document would be required for each wildfire to record daily fire management activities, including the Wilderness Act 4(c) prohibitions (i.e., use of motor vehicles, motorized equipment or motorboats, landing of aircraft or anything attached to the aircraft, other forms of mechanical transport, structures, installations). This requirement would be included as a management requirement within WFDSS. Examples of specific activities/tools that would be tracked on the form include use of the following: helicopter (and type), chainsaw, pump, remote camera, wheeled litter, water drop, retardant use, remote camera, and UAS.

DETECTION AND INITIAL SIZE-UP	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Detection and initial size-up	Most of OLYM's wildfires start from lightning strikes during thunderstorms. The urgency for detecting these lightning ignitions is dependent on burning conditions, seasonal severity, proximity to high visitor use areas, and external factors (see list above under Wildfire Strategies). In low urgency conditions these fires can be discovered by visitors, park employees, and fire personnel searching from road corridors or hiking to high points. In high urgency conditions aircraft (UAS, fixed wing preferred; helicopter if necessary) may be used to search for fires. The frequency and scope of such flights would match the urgency, local preparedness and dispatch levels, and the potential for fire spread in the area where the lightning occurred. To reduce impacts to wilderness character from Unmanned Aircraft Systems (UAS), the decision for their use in the Wilderness FMU would be based on minimum requirements guidance. Those used in fire operations would be used in conformity with general aviation regulations for parks and wilderness (Policy Memorandum 14-05, Unmanned Aircraft – Interim Policy), and the Superintendent's Compendium for the park. Launching, landing, or operating an UAS within park boundaries requires approval in writing from the superintendent. The aircraft would maintain the Federal Aviation Administration requested minimum elevation 2,000 feet AGL. Additionally, the UAS operator would be located outside the wilderness boundary. <u>Methods/Tools Alternatives</u> 1. Non-wilderness detection only of wilderness fires: search from road corridors; wait for others to report 2. Non-wilderness detection plus hiking to viewpoints within the wilderness and/or to the fire site 3. Deploy UAS if/when technology is effective for specific wildfires' detection/size-up 4. Conduct aircraft reconnaissance flights for detection (preferably >2,000 ft AGL), fixed wing preferred or helicopter if it is the only option

OPERATIONS	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Resource surveys and monitoring (Threatened & Endangered species, exotic plants, other natural resources, cultural resources, etc.)	Common to all strategies 1. A READ would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The READ would be included early and be consulted often throughout the incident. 2. Wildlife surveys to assess presence and habitat of species of concern 3. Vegetation surveys for rare plants and exotic plants in areas proposed for crew use (e.g., helicopter landing zones, spike camps, etc.) 4. Cultural resource surveys related to any ground disturbance 5. Staff conducting surveys would follow same PMRA guidelines listed for firefighting personnel (e.g., travel to/from, camping, LNT principles, etc.)
Incident staffing	Staffing for wilderness wildfire could vary from zero presence to over 100 people on the fire at one time. Methods/Tools Alternatives 1. Minimal operational personnel; strong fire information and education effort 2. No staff presence in wilderness: monitoring from only non-wilderness corridors 3. Small staff presence in wilderness (up to one 2-person module) to reach the nearest viewpoint where the fire can be monitored 4. Small staff (up to one 5-person squad); presence during the day only 5. Small staff (up to one 5-person squad); overnight presence at or near the fire location 6. Fixed wing aircraft or helicopter used for monitoring fire; no staff presence on ground 7. Medium sized organization, up to 20 staff at one time on the fire 8. Large sized organization on fire, 20-100 people at one time 9. Very large organization on fire, over 100 people at one time Monitor Strategy The primary strategy for these wildfires is monitoring. This calls for minimal staff presence, from remote monitoring at a low response level to a small, low impact camp at a high response level. In some cases minimal management action is needed to protect vulnerable resources such as nest trees, rare plant species not adapted to fire, or cultural resources. At the highest response level, typically for a larger fire, a low impact camp may be needed. Multiple Objectives Strategy These wildfires would likely be monitored on a more frequent basis and would typically require a full-time staff presence. Some management actions are employed to steer the fire or limit its growth in certain directions. A larger staff may be desirable when an environmental change or an increase in fire behavior calls for an action to limit spread and intensity. At a higher response level, camps may become more noticeable. After actions have been implemented to limit fire spread or intensity, the strategy should return to a monitoring strategy. Full Suppression Strategy There is a significant range of effects within these types of fires, from a small, low impact camp and crew to large camps and multiple crews within an area.

Environmental monitoring	Monitoring of environmental conditions during wildfires provides managers with data on local conditions which helps predict fire behavior and smoke dispersal conditions, which in turn reduces uncertainty for management decisions. Monitoring may be accomplished remotely through overflights or on-site in wilderness with the placement of installations (e.g., weather stations, cameras) as a means to monitor the fire visually without aircraft. Methods/Tools Alternatives 1. IR flights at high elevation and/or remote heat sensing via remote sensing technologies 2. Fixed wing flights (preferably >2,000 AGL) 3. UAS overflights 4. Remote webcam and/or RAWS. Entails use of a tripod/stand and solar panels to charge batteries. Common to all strategies 1. Visibility of wilderness installations would be minimized for the public 2. On-site presence of personnel for monitoring would be minimized 1) Fire personnel travel for installation/take-down but do not remain 2) Fire personnel on-site to monitor, with spike camp 3. Personnel and equipment transport (i.e., installation, battery replacement/system check, equipment removal) follows Crew Travel and Equipment Transport guidance Monitor and Multiple Objectives Strategies During low response levels no weather stations are justified; the potential for spread on these fires is low; management actions are very unlikely. During moderate and high level response, weather stations may be justified if they allow managers a greater certainty to let the wildfire burn unhindered rather than taking a suppression action. Managers should consider the proximity and utility of non-wilderness weather installations before placing such stations in wilderness. Portable weather stations are permissible when monitoring wildfires when there are multiple fires in the park, and lack of information on fire weather might lead to choosing a suppression strategy. Full Suppression Strategy At all response levels weather stations may be justified if they allow managers a greater certainty to let the wildfires burn unhindered or to minimize management actions. Managers should consider the proximity and utility of non-wilderness weather installations before placing such stations in wilderness. Camouflaging the RAWS should be considered.
Mapping	Fires are routinely mapped to inform managers of their status. This valuable information is used to inform local, regional, and national fire management personnel about the current and predicted fire spread and intensity in the short term. This information is also used to inform the public of the fire location and areas to avoid. Another significant objective is to gain good growth estimates to model fire behavior and spread. It also informs operational personnel of potential hazardous situations and is used to calibrate fire behavior modeling and forecasting. Methods/Tools Alternatives 1. Visual mapping/estimation from remote location (i.e., nearby ridge, viewpoint, etc.). 2. Hiking around fire 3. Flying above fire: 1) fixed wing, 2) UAS, 3) helicopter 4. IR technology (high altitude aircraft or satellite imagery) Monitor Strategy For wildfires under this strategy the objective would be to map by walking, or in rugged terrain, by estimation from another location. At the two higher response levels, mapping should be on foot or a remote estimation unless: 1)

	terrain is too rugged to safely allow access on foot to the fire or a remote viewing location, 2) fire behavior does not allow safe access on foot to the fire or a remote viewing location, or 3) multiple fires and high external factors (e.g., planning level >3, air quality, and human health) require frequent, immediate information. Multiple Objectives Strategy During low to moderate response levels, aircraft mapping is not appropriate unless: 1) terrain is too rugged to safely allow access on foot to the fire or a remote viewing location, 2) fire behavior does not allow safe access on foot to the fire or a remoteviewing location, 3) multiple fires and high external factors (e.g., planning level >3, air quality, and human health) require frequent, immediate information, or 4) a helicopter is already flying to another, nearby fire. At the high response level there would be an additional consideration: 5) the fire is unstaffed and is more than 5 miles and/or 4000' from the trailhead. Full Suppression Strategy Management of these wildfires usually needs frequent, up-to-date information. As such, the decision to walk or fly the fire to map it would be based primarily on fire behavior, terrain, and urgency. If fire can be mapped on foot then that should be considered whenever possible. Otherwise, use of a helicopter is justified. Frequency of Mapping Mapping frequency is primarily determined by fire behavior, growth, and forecasted weather as well as external factors. Mapping frequency should be the minimum required to provide information to safely and adequately manage the fire to protect wilderness character.

Fireline construction	Depending on the location and nature of a fire, a range of fire suppression techniques utilizing ground and/or aerial firefighting resources would be used to break the continuity of forest fuels, cool a fire, and slow the advance of a flaming front. Actions may include construction of firelines; cutting of vegetation; application of water, foam, or retardant (used only if human life and safety are under imminent threat); and the application of fire (i.e., back burning or burnout). A fireline may utilize natural barriers, a wet line, or be constructed to contain or control the growth of a wildfire. Methods/Tools Alternatives 1. Use of natural barriers and changes in vegetation 2. Wet line using backpack pumps, use of gravity socks to charge hose lays 3. Wet line using a motorized pump (with sprinklers and/or hose lays) 4. Wet line using helicopter water bucket drops (potential use of portable tanks vs. wilderness water bodies for bucket dip sites) 5. Locate fireline in naturally open areas to avoid or minimize need for cutting 6. Constructed fireline using non-motorized tools (e.g., Pulaski, shovel, hoe, fire hook, D-ring, McCloud) 7. Constructed fireline using motorized tools (chainsaw, cord trimmer, motorized pump) 8. Retardant drops from aircraft (i.e., air tanker), if human life and safety are under imminent threat Note: The use of fireline explosives requires a separate MRA. Common to all strategies 1. Natural barriers and/or changes in vegetation type would be used whenever possible to contain or control all or parts of a wildfire perimeter. Wet line (line of water sprayed on ground) is generally preferable over constructed fireline (that involves soil disturbance and vegetation modification). Water for wet line is drawn from approved

	stream, river, lake sources, or delivered via aircraft in portable water tanks (i.e., blivets). Constructed fireline should avoid areas with rare or vulnerable resources. When considering the location of a fireline both physical and visual recovery time should be considered. It may be preferable to locate a fireline in vegetation that would recover in 5-10 years with few, if any, visible saw cuts instead of a fireline in forest with large-diameter downed logs, where the saw cuts may be visible for many decades. Transitions in vegetation types often cause changes in fire behavior and therefore can be good locations for fireline construction. 2. A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel. 3. Individual snags are ecologically valuable for many decades. Crews should cut only the minimum number of snags to produce an acceptable level of personnel safety and probability of containment. Monitor Strategy During a low response level no firelines are necessary. Only natural barriers or favorable environmental conditions are necessary to slow or stop the growth of the fire. At the moderate response level fireline is used only to protect rare resources such as nest trees, rare plant species not adapted to fire, or cultural resources. Wet line is preferable to constructed fireline when and where possible. Motorized pumps and saws are not justified at this level. During moderate and high response levels, fireline may be constructed to protect rare resources. Motorized saw use is not justified, but motorized pumps may be used to establish a wet line if it prevents a constructed fireline. Multiple Objectives Strategy At the lowest response level only non-motorized tools should be used to construct line, although a motorized pump may be used to create a wet line, thereby avoiding constructed fireline. During moderate and high response levels management actions to modify fire behavior may require significant lengths of constructed fireline, and some urgency (from external factors) may require a quick completion of this line. For those reasons, chainsaws may be used for fireline construction. Full Suppression Strategy During a low response level these wildfires are mostly managed through containment using natural barriers, so little fireline should be needed. Non-motorized tools are the minimum required for this task, although a motorized pump may be used if doing so precludes the need for line construction (e.g., soil disturbance and vegetation modification). Moderate and high response levels are more urgent by nature and motorized tools and aircraft for water drops (helicopter buckets and air tanker) may be justified. Retardant drops (air tanker) may be used under moderate and high response levels, but only if human life and safety are under imminent threat.
Back burning/Burnout	Back burning (to set fire downwind of the main fire to control fire behavior by backing it into the main fire) and burnout operations (to set fire inside a control line to consume fuel between the edge of the fire and the control line), may be conducted. Methods/Tools Alternatives 1. Ground-based hand ignition (e.g., drip torch, fusees, very pistols) 2. Aerial ignition device (i.e., plastic sphere dispensers), used in cases where crews cannot access the area safely on foot and the only alternative is to suppress the fire Monitor Strategy No back burning is appropriate for these fires except in rare circumstances where limited (e.g., ring firing) burning may be required to protect rare or particularly valuable resources.

	Multiple Objectives Strategy At a low response level no back burning is appropriate for these wildfires except in rare circumstances where limited burning may be required to protect rare or particularly valuable resources. At a moderate and high response level some back burning and burnout operations may also be justified to ensure the effectiveness of a fireline and/or provide for firefighter safety. At the high response level back burns and burnout operations should be used only when the resulting impacts to wilderness character from not burning (as when a constructed fireline or natural barrier fails and a new one must be constructed beyond it) are substantial, or there is no other way to ensure the safety of staff. Full Suppression Strategy At the lowest response level some back burning/burnout may be justified to ensure the effectiveness of a fireline and/or provide for staff safety. At moderate and high response levels back burns and burnout operations should be used only when the resulting impacts to wilderness character from not back burning (as when a constructed fireline or natural barrier fails and a new one must be constructed beyond it) are substantial, or there is no other way to ensure the safety of personnel or the protection of property.
Communications	Temporary radio repeaters are sometimes installed when radio contact with existing park repeaters is inadequate. This would continue to be necessary for the safety of fire personnel until satellite or other technology becomes more ubiquitous and reliable. Flagging may be used to communicate information to wildfire staff by marking escape routes, and travel routes to firelines (see more information that follows). Methods/Tools Alternatives 1. Radio, park repeater 2. Radio, temporary fire repeater - with solar panels to charge batteries 3. Cell phone 4. Satellite phone 5. Computer/tablet – with solar panels to charge batteries 6. Radio, temporary fire repeater - with helicopter flights to change batteries if solar panels not adequate Common to all strategies Temporary radio repeaters may be placed in wilderness where needed to increase employee safety. When staffing levels are low and satellite communications provide adequate communication for safe operations, satellite technology should be used instead of temporary repeaters. A separate MRA is needed for the use of remote satellite communication installations (e.g., satellite dish, Wi-Fi) and is also needed for the placement of generators in the wilderness including those for powering communications. Flagging may be placed when needed to communicate to fire personnel, both with and without written information on the flagging. This includes flagging to mark safety zones and escape routes. Flagging use is to follow the park's Marking and Flagging Office Order #56. Biodegradable flagging is to be used and all removed when the fire management incident is complete.

Structure protection	Wilderness infrastructure (e.g., ranger stations, cabins, shelters, toilets, bridges, signs) is sometimes at risk from wildfires and may be identified for point protection. The type of infrastructure, the ease of its protection, safety risk, and wilderness impacts would be considered in decisions for point protection. Point protection can usually be undertaken with low level actions such as covering the infrastructure with fire resistant wrap, temporarily moving smaller infrastructure (i.e., signs), setting up sprinkler systems, or with use of surfactants (i.e., foam). In a few cases, limited vegetation clearing (i.e., fuels treatment) may be required to provide a reasonable level of protection. During a fire event, fuels treatment may be used, in accordance with the PMRA, when wilderness infrastructure identified for point protection is at immediate risk from wildfire and lower level actions would not be sufficient to protect the structure, until final decisions are made in the WSP (see more information that follows). Fuels treatment includes modifying or removing non-fire-resistant vegetation from around structures. The distance to be treated around each structure would vary from 0 to **3**0 feet depending on the fire hazard severity, based on: accessibility to a water supply, use of fire-resistant materials, size and value of the structure, historic significance, proximity to aquatic resources or critical habitat, characteristics of local fuels, visitor use of the area, and proximity to neighboring properties. Fuels treatment would be accomplished at the minimum level necessary for structure protection. 0-15 feet from structure: Clear brush away from roof, doors, gutters, and remove dead woody material on ground and in standing vegetation. This may include removing or pruning trees that impinge on higher value infrastructure. Low-growing, fire resistant plants resist catching fire and provide little fuel so do not need removal. Fuels treatment would be conducted at the minimum level necessary for structure protection. 15-30 feet from structure: To create a fire-resistant defensible space for higher value structures, intensive management may be needed. This may include removal of dead and down fuels, and brush and tree reproduction up to 16" dbh. Well-spaced trees and shrubs may be retained, but dead limbs or limbs overhanging the structure may be removed. Ladder fuels may be removed to a height of 8-10 feet. Fuels treatment would be conducted at the minimum level necessary for structure protection. Many wilderness structures are valued as historic resources and are listed or eligible for listing in the NRHP. Some cabins and all bridges serve an administrative function. During the development of the WFDSS decision an infrastructure inventory would be conducted for the fire planning area and an appropriate level of protection actions would be determined/developed and included within incident objectives and stated within the course of action. Future decisions on the protection of structures in wilderness during wildfire incidents would be established in the WSP. Until the WSP is complete, structures in wilderness threatened by wildfire would be protected based on the above, unless compliance for removal has been completed and approved (e.g., damaged privy structure). <u>Methods/Tools Alternatives</u> 1. Wrapping 2. Temporarily moving infrastructure (i.e., signs) 3. Sprinklers using gravity-fed hose lays and/or gravity socks 4. Sprinklers using motorized pumps 5. Firefighting foam surfactant and other similar approved products 6. Vegetation clearing – 15 ft and 30 ft using hand tools (following PMRA guidelines)

	7. Vegetation clearing – 15 ft and 30 ft using motorized tools (following PMRA guidelines)
Mop-up	Mop-up actions prevent the wildfire (or portions thereof) from reigniting and may therefore be thought of as "controlling the wildfire". Actions may include extinguishing or removing burning material near firelines, felling snags, trenching logs to prevent rolling after an area has burned, or reducing residual smoke. There is no urgency to such actions however, and the fire type/response level is irrelevant. **Because of the low urgency, motorized tools are unnecessary, with three exceptions:** 1. When large amounts of water are required to complete mop-up, and repeated trips to a water source are needed to fill backpack pumps, a motorized pump may be the minimum tool to prevent impacts to riparian vegetation. A motorized pump should not be used when the water source can be accessed on durable surfaces. 2. A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel. 3. When other park fires require urgent responses and staff is limited, motorized tools (i.e., motorized pump, chainsaw) may be used to speed up mop-up to more quickly respond to other higher priority fires.
Closures	Trails and/or whole areas may be closed to the public near where wildfires are burning or at strategic trail junctions. Closures are instituted based on the type and amount of hazards the public would be exposed to as well as expected fire behavior. The conditions that merit a closure can occur with any fire type or response level, but they are more likely where active fire behavior can threaten public safety (i.e., along trail corridors, high visitor use areas, etc.). Fire monitors/trail guards may be used to monitor trail users and provide information on closures, mitigate safety risk to hikers and/or to escort hikers through areas where conditions allow. Closures may remain in effect post-fire for longer periods, where public safety is a concern.

LOGISTICS	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Crew travel	There are over 600 miles of maintained trails providing access throughout OLYM's wilderness. There are many areas in the wilderness however with steep, rugged terrain where access is difficult or dangerous on foot. In many cases of lightning caused fires, the remote inaccessible terrain precludes options of accessing the fire from the ground, and sometimes even from the air. Traveling by foot to, within, and/or from the fire is often a reasonable option. In low response situations crews can hike to assess values in proximity of the fire (see parameters that follow). Helicopters may be used during high response levels when time-critical actions are necessary to protect life and property. <u>Common to all strategies</u> Access via foot: When hiking to access the fire, crews would follow LNT principles, hiking on trails where possible and on durable surfaces when traveling cross-country, and staying off sensitive vegetation (e.g., heather-huckleberry). Access in rugged areas: In areas that are unsafe to access on foot, helicopter access is permitted for fires that require staff to be on scene for containment or control. This may include rapellers rapelling to the ground while the helicopter hovers at a low AGL, and/or smokejumpers jumping at a minimum altitude of 1,500 feet AGL. Limited natural openings are available in the wilderness for use as helicopter landing zones, mainly on ridgetops or along sand and gravel bars on river bottoms; in these areas no modifications are necessary to provide landing zones when helicopter transport is required. In some locations vegetation may need to be cleared to provide safe landing areas. Managers are to consider alternative locations where vegetation clearing is not necessary or minimal, or a different approach such as firefighting in a different area where such measures would not be necessary. Clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary. Transport to another fire: Crews may be transported by helicopter away from a low urgency wildfire to a high urgency fire. The classification of the fire being responded to would determine the appropriate mode of transportation (on foot or helicopter). <u>Methods/Tools Alternatives</u> 1. Hiking 2. Helicopter 3. Rappellers (from helicopter) 4. Smokejumpers (from fixed wing) <u>Monitor strategy</u> Because there is no urgency for a management response to these wildfires, all crew traveling to such fires would hike. There are two exceptions to this restriction. First, at the highest response level, if a fire is in terrain that prevents monitoring from the ground, a helicopter may be used for monitoring. Second, if there are multiple wildfires with monitoring responses that are too remote to hike to in one day or can't be monitored from a vantage point accessible by foot travel, then a helicopter can be used for monitoring or crew transport. The majority of high elevation lightning starts go out on their own; and often multiple lightning starts result in only one or two fires with potential to grow larger than a fraction of an acre. It is therefore important to select a monitoring strategy for many of these wildfires until potential can be adequately assessed. If conditions require monitoring or staff presence to protect rare

	resources on multiple fires and more staff is unavailable, a helicopter may be used until such staff is available. Such use should be geographically limited if possible by using a mix of foot access and helicopter transport; efforts should be made to keep as much of the wilderness as helicopter-free as possible. Multiple Objectives Strategy During a low response level these fires do not have any urgent actions that would require helicopter crew transport. During moderate to high response levels some management actions may require crew transport by helicopter, particularly in response to rapidly changing conditions. Helicopters would not likely be used, however, when the hike to the fire can be made from the trailhead in one day. The urgency for such management actions should not be so great that the increased staff would be needed in less than a day. In the case of a rapid, dramatic, and unanticipated change in fire behavior or air quality, the wildfire would most likely change to full suppression status where helicopter transportation is more appropriate. Full Suppression Strategy During low level response, helicopters are not needed for crew transport. Wildfires assigned a full suppression strategy often have a low urgency, allowing hiking access to the wildfire location if terrain permits. At higher response levels time can be critical, and a helicopter can be used whenever the total transport time using a helicopter is significantly shorter than hiking access. Regional and National Planning levels or other sociopolitical factors can force fire managers to change from a monitor or multiple objectives strategy to a full suppression strategy even though the wildfire has a low probability of spreading. In this case a helicopter to transport firefighting personnel may reduce impacts when the hike to the fire cannot be made from the trailhead in less than one day. A helicopter is allowed when more than one wildfire must be suppressed at one time. A delayed reaction time to multiple lightning caused wildfires, caused by hiking rather than flying, might allow enough fire growth that the resulting suppression tactics would result in considerably higher impacts to wilderness character.

Equipment transport and storage	Transport of firefighting equipment, kitchen/food, camp, and personal gear, may be needed to implement tactical actions. This may include transport of fuel, chainsaws, pumps, hoes, sprinklers, portable tanks, backpack pumps, structure wrap, etc. At the lowest level, equipment can be backpacked in with fire personnel. Stock is a traditional form of freight transport in the park and when stock and a trained packer are available, should be considered for transporting equipment/gear. Stock use would be limited to trails open to stock (All Purpose and Secondary trails), and not allowed off-trail. When helicopters are necessary for equipment transport, supply runs throughout an incident would be consolidated and flights limited to what is necessary to support firefighting activities and personnel. As described previously (see Crew travel), clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary. Storage boxes would be allowed if necessary to provide secure tool/equipment storage during crew absences, and reduce necessity for repeated equipment in/out transport flights. <u>Methods/Tools Alternatives</u> 1. By foot 2. By stock 3. Combination foot and stock - typically this would mean stock transport on trails with the equipment then backpacked to the camp location through the cross-country terrain 4. By helicopter 5. By parachute (i.e., paracargo) <u>Monitor Strategy</u> During low response levels there is little to no staff and minimal equipment needs. If firefighters become committed to a fire, equipment can be backpacked in with the crew. During a moderate or high response level stock may be used to pack in fire equipment and food. If a fire needs to be staffed for a long period of time and is more than a day's hike from the trailhead, then stock may be used to transport equipment and food, once to establish the camp and once to demobilize the camp. <u>Multiple Objectives Strategy</u> During low and moderate response levels aircraft use is not usually appropriate. Stock, if available, should be used to transport gear to a camp near an established trail. When it is desirable to have a camp off-trail, gear may be backpacked from the stock packing drop-off point on the trail to the camp location (depending on distance and weight of gear). During a high response level a helicopter may be used when the amount of stock available cannot transport the needed equipment. Sudden changes in conditions that call for an urgent increase in the number of personnel and gear also justify helicopter use. <u>Full Suppression Strategy</u> At a low response level the urgency does not justify helicopter use. In most cases these wildfires have a low potential to spread and in many cases would be contained/controlled using natural barriers that require little in the way of active management. Foot (backpacking) or stock (if available) would be used to supply equipment to the fire. When stock is needed, it should be used to transport gear to a camp on an established trail. When it is desirable to have a camp off-trail, gear dropped off by stock at the nearest trail would be backpacked from the trail to the camp location. Moderate and high response levels present an urgent situation in which external factors or a risk to natural conditions (such as the risk of an unnaturally large, stand replacing fire) requires immediate action. In these cases helicopter use is justified to supply equipment to a fire. Helicopters should only be used for the minimum number of flights required to support the containment/control needed actions

Camps and camping	Staffing of firefighting personnel overnight in the wilderness may be necessary. Spike camps can vary from those that resemble a typical backpacker's camp to larger, long-term camps. Wherever possible, personnel would camp in established camp areas or campsites. If firefighting locations require camping off-trail or away from established sites, camping would take place on durable surfaces. Firefighting crews would practice LNT principles including proper methods for food storage, human waste disposal, and minimizing travel around camps on vegetation (especially heather-huckleberry). Campfires would not be allowed by fire crews in areas where only stoves are allowed or when the backcountry is closed to campfires for the public. Based on the specific incident, a local base camp manager or READ would be assigned to spike camps that exceed a 10 person module, depending on the sensitivity of the area's resources, its remoteness, and/or if it's located off-trail. Food and garbage must be secured at all times, whenever not in use or if unattended, to safeguard such items from wildlife access. All food, garbage, and scented items would be stored appropriately following park guidelines. IGBC-certified animal resistant food canisters (ARFC) and animal resistant stock pannier bags; or bear wires already in place, would be the first choice. IGBC-certified small storage containers, boxes, and coolers may be considered when larger food storage space is necessary. Large animal-resistant food storage lockers (e.g., Knaack box) would only be transported and used at camps if other options would not be available or practical, usually due to crew size, or if already necessary for secure tool/equipment storage. Any bear-resistant containers purchased for fires would comply with the IGBC certified list: http://igbconline.org/wp-content/uploads/2018/09/180911_Certified_Products_List.pdf. Human waste management, in camping areas without toilets, would be addressed first through cat hole digging for very small numbers of personnel, then a latrine that is a trench or pit (with cultural resources review) – except in the subalpine, and finally a temporary fly-out vault - especially in the subalpine. <u>Methods/Tools Alternatives</u> 1. No camp 2. Backpacking style camp 3. Backpacking style camp + latrine 4. Moderate-sized spike camp: minimal tables/furniture, group cooking gear, latrine 5. Full spike camp: minimal tables/furniture, group cooking gear, latrine, greywater pit, tarps for shade when needed <u>Monitor Strategy</u> These wildfires have little to no staffing, and there is no need for anything but a typical backpacking style camp. In cases where these fires are staffed for a long time period it may be justified to dig a latrine. A READ should be used to monitor this. <u>Multiple Objectives Strategy</u> During a low response level a backpacking style camp or backpacking style camp with latrine should be all that is required. During moderate and high response levels a moderately sized spike camp may be justified when the size of the crew and the actions require such. <u>Full Suppression Strategy</u> During a low response level a moderately sized spike camp is often sufficient to provide for the needs of the crew. At the moderate response level a moderately sized spike camp may work in some locations, but a full spike camp could be justified as crew numbers increase. At the highest level, a full spike camp is justified, but care must be taken to minimize impacts. A well-placed, carefully run camp may still have only minor physical impacts but would still have a significant visual impact.

SAFETY	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Safety zones and escape routes	A variety of strategies are used to increase firefighter safety. It is desirable to have: 1) Safety zones - areas without flammable material and which are large enough to provide refuge in case of a burn-over, 2) Escape routes - a route away from the work area to a safe area that is without significant impediments due to brush or down trees, etc., and 3) Helicopter landing zones sufficiently close to allow medical evacuation in case of serious injury. There are limited natural openings for use as landing zones in the park's wilderness, mainly on ridgetops or along sand and gravel bars on river bottoms; in these areas no modifications are necessary to provide the safety areas noted above. In some locations, however, such areas would need to be mechanically cleared. Managers considering clearing safety areas should first evaluate other alternatives including working in a different area where such measures would not be necessary. A separate MRA is required for safety zone clearing. Many variables are involved in determining safety zones and escape routes that would be evaluated in the MRA, including the steepness of the terrain, the experience level of the crew, expected fire behavior, and the availability of various resources. If the decision is made to clear such areas through the MRA, the Incident Commander and Fire Duty Officer should do so in a way that meets safety objectives while minimizing impacts to wilderness character. <u>Policy</u> "No permanent heliports, helipads, or airstrips would be allowed in wilderness unless specifically authorized by statute or legislation. Temporary landing facilities may be used to meet the minimum requirements of emergency situations." (NPS Management Policies 2006 6.3.10.1) "Emergency" is defined in DO-41 as, "a situation that requires immediate action because of imminent danger to the health or safety of people." <u>Methods/Tools Alternatives</u> 1. Use natural vegetation breaks; no clearing. Temporary flagging may mark routes (following the park's Marking and Flagging Office Order #56). 2. Clearing using non-motorized tools 3. Clearing using motorized tools <u>Common to all strategies</u> A chainsaw may be used to cut any standing tree when the use of a crosscut saw would increase the risk to personnel. <u>Monitor Strategy</u> Fire personnel on these wildfires are seldom performing actions that put them in a dangerous situation that would justify clearing safety zones or escape routes. Because the risk these wildfires pose to resources and life/property is so low, putting firefighters in a situation where they would need a safety zone is not prudent. <u>Multiple Objectives Strategy</u> During low response levels there would likely be enough flexibility in management choices and a lack of urgency that clearing safety zones can be avoided or greatly minimized. Those safety-related clearings that are determined necessary and approved can be created with non-motorized tools. During moderate and high response levels the urgency of management actions should drive the decision of whether to use motorized or non-motorized tools. Protection of other resources and/or

	external factors may reduce the management action options available, increasing the likelihood that clearing of safety zones are necessary. Full Suppression Strategy When wildfires are being contained with natural barriers these same barriers should provide safety zones and escape routes that preclude the need for clearing. At a high response level a decision to clear, and the methods to clear, should be based on the variables noted above, taking wilderness values into consideration through the MRA process and in consultation with a READ and clearly articulated in the WFDSS decision document.
PUBLIC INFORMATION/EDUCATION	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Public interpretive/ Informational tools	Posted public information/education about the wildfire incident would occur outside wilderness (e.g., wilderness information centers, trailheads, visitor centers, etc.). This would include advisements about the presence of wildfires and locations of associated smoke. When trails/areas in the wilderness are closed due to wildfire they can be posted as such on-site, often with a trail guard present. Signs would be removed when closures are lifted
RESOURCE MONITORING	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Ecological monitoring	Understanding the ecological effects of a wildfire is important for wilderness stewardship. To support such understanding, monitoring plots may be established in burned areas of the wilderness where reasonably accessible. The monitoring is essentially observational, but when markers are determined necessary, the selection of type and placement would follow OLYM Office Order #56, Use of Backcountry Marking and Flagging. The type chosen would follow the Office Order in the preferred method list to ensure the minimum requirement is selected. All plot markers would be removed when monitoring is complete. For fire ecological monitoring, the use of markers that are other than wood or buried (e.g., small metal bars or magnets), or any markers for long-term monitoring (>2 years), would require a separate MRA. Any air quality monitoring would occur outside of wilderness.
FIRE SUPPRESSION REHABILITATION	
FIRE MANAGEMENT ELEMENTS/ACTIONS	**GUIDELINES FOR METHODS/TOOLS**
Suppression rehabilitation	Suppression Rehabilitation The major goal of wildfire suppression rehabilitation is to repair or mitigate environmental resource damage caused by the fire suppression activities and rehabilitate the impacts to as natural a condition as possible. Suppression rehabilitation targets damage to resources, lands, and facilities resulting from wildfire suppression actions in contrast to damages resulting from the wildfire itself. Repair of damages that are a direct result of wildfire suppression activity would be planned for and implemented as soon as possible, prior to demobilization. Wildfire suppression impacts to be rehabilitated may include firelines, pump sites, staging areas, new access trails, bivy camps, spike camps, latrines, safety zones, and helispots; removing equipment, flagging; erosion control (water bar placement); flush-cutting stumps and camouflaging cut ends; and replacing relocated materials (out of streambeds, etc.). The guidelines entitled “Rehabilitation Following Wilderness Fire Suppression Activities,” found in the wilderness.net fire management toolbox would be followed and included in the incident mapsheets (i.e., maps/guidance

	developed for wildfire planning and implementation). These would help inform management actions during the fire operations phase and the wrap-up of the fire Methods/Tools Alternatives 1. Rehab using non-motorized tools 2. Rehab using motorized tools (for flush-cutting stumps, if hand tools present safety issues or quantity of stumps is high)
Post-fire rehabilitation	Post-Fire Actions Post-wildfire programs/activities (i.e., emergency stabilization, burned area rehabilitation, restoration) require a separate MRA. Emergency stabilization involves immediate post wildfire actions needed to minimize the threat to life and health and prevent unacceptable degradation to natural and cultural resources. Burned area rehabilitation (BAR) focuses on repair/replacement of minor facilities and damage to natural and cultural resources sustained by the unplanned fire event. A burned area emergency response team (BAER) may be called in during or after the suppression effort to develop a plan, which would include a project-specific MRA, to rehabilitate park resources impacted by either the fire or the suppression activities. Rehabilitation treatments are developed based on impacts observed or anticipated. These may include treatments to address soil disturbance, erosion and compaction, sediments or excessive debris entering waterways, damage to roads and trails, spread of nonnative invasive plant species, damage to cultural resource sites, and hazardous trees near public use areas. For post-fire rehabilitation a tiered CE under category G.1 "Actions Related to Hazardous Fuels Reduction and Post-fire Rehabilitation" would be conducted, along with the separate MRA.

USE OF 4(C) PROHIBITED USES

Alternative B: Conduct a fire management program based on an updated Olympic National Park Fire Management Plan, with two fire management units (Wilderness and Non-Wilderness)

Wilderness Act of 1964, Section 4(c), Prohibition Of Certain Uses: • temporary road • use of motor vehicles, motorized equipment or motorboats • landing of aircraft • other forms of mechanical transport • structure or installation	List the Wilderness Act 4(c) prohibited uses proposed in this alternative and what they are proposed to be used for.

FIRE MANAGEMENT ELEMENT/ ACTION	PROPOSED 4(C) AND AIRCRAFT USE	AIRCRAFT/ MECHANICAL TRANSPORT	INSTALLATION	MOTORIZED EQUIPMENT
DETECTION AND INITIAL SIZE-UP	• Aircraft reconnaissance flights (preferably >2,000 ft AGL), UAS, fixed wing preferred; or helicopter if only option	X		
	OPERATIONS			
Resource surveys and monitoring	• Flagging rare plants/exotic plants in crew operational areas		X	
Environmental Monitoring	• Fixed wing flights (preferably >2,000 AGL) • UAS overflights • Remote webcam and/or RAWS includes use of a tripod/stand and solar panels to charge batteries	X	X	
Mapping	• Flying above fire: 1) fixed wing, 2) UAS, 3) helicopter	X		
Fireline construction	• Wet line using backpack pumps, use of gravity socks to charge hose lays • Wet line using a motorized pump (with sprinklers and/or hose lays) • Wet line using helicopter water bucket drops (potential use of portable tanks vs. wilderness water bodies for bucket dip sites) • Constructed fireline using motorized tools (chainsaw, cord trimmer, motorized pump) • Retardant drops from aircraft (air tanker)	X	X	X
Back burning/burnout	• Aerial ignition device deployed from aircraft	X		
Communications	• Flagging to communicate information to crew • Radio, park repeater • Radio, temporary fire repeater		X	
Structure protection	• Wrapping infrastructure		X	X

FIRE MANAGEMENT ELEMENT/ ACTION	PROPOSED 4(C) AND AIRCRAFT USE	AIRCRAFT/ MECHANICAL TRANSPORT	INSTALLATION	MOTORIZED EQUIPMENT
	• Sprinklers using gravity-fed hose lays and/or gravity socks • Sprinklers using motorized pumps			
Mop-up	• Motorized pump • Chainsaw			X
LOGISTICS				
Crew travel	• Helicopter	X		
Equipment transport and storage	• Helicopter • Secure storage box	X	X	
Camps and camping	• Full spike camp: tents, minimal tables/furniture, fly-out vault, tarps, animal-resistant food storage		X	
SAFETY				
Safety zones and escape routes	• Temporary flagging • Chainsaw for clearing		X	X
PUBLIC INFORMATION/EDUCATION				
Public interpretive/ informational tools	• On-site closure signs		X	
RESOURCE MONITORING				
Ecological Monitoring	• Use of wood or buried markers (e.g., small metal bars or magnets) • Other types of markers or any markers for long-term monitoring (>2 years) would require a separate MRA		X	
Suppression Rehabilitation	• Flagging • Chainsaw		X	X

9	Evaluate the impacts of each alternative	Potential impacts to evaluate under <u>each</u> alternative: • Wilderness character effects • Effects on natural resources • Cultural resources considerations • Social/recreational/experiential effects • Societal/political effects • Health/safety concerns • Economic/timing/sustainability considerations

Alternative A: No Action. Continue to conduct a fire management program based on the 2005 Olympic National Park Fire Management Plan, with three fire management units (Exclusion, Conditional, and Wildland Fire Use)

Wilderness character effects (untrammeled, natural, undeveloped, solitude or a primitive & unconfined type of recreation, and other features of value)

Positive effects:

- **Untrammeled**

Lightning-caused wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response, and thus the type and level of trammeling. When the selected response does not include fire suppression, natural processes would continue untrammeled in the wildfire event areas and human manipulation of the biophysical environment would not occur.

Trammeling from fire suppression (using firelines, portable pumps, hose lays and aerial water drops) would not be implemented nor would suppression-related trammeling actions including removing ground vegetation and duff during fireline construction, limbing trees, cutting other vegetation, relocating fuels outside of the fireline, and burnout operations. Though wildfire management for multiple objectives would likely include some suppression actions at management points, in other areas of the fire natural processes would be allowed to continue without human manipulation. This strategy would be most often implemented in two of the three FMUs (Wildland Fire Use: 520,343 wilderness acres; Conditional: 68,354 wilderness acres), and would be implemented in the Exclusion FMU (275,894 wilderness acres) when risk to firefighter safety or fires burning in steep inaccessible terrain precludes suppression.

During suppression efforts, use of aerial water drops would rarely be conducted and use of retardant that would also alter fire behavior would not be used unless human life and safety are under imminent threat. Clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary.

Manual/mechanical vegetation treatments (i.e., plant removal, a type of trammel) would not occur until wilderness infrastructure, specifically identified for point protection, is at immediate risk from wildfires. Such defensible space treatments would be limited in extent.

- **Natural**

Many lightning-caused ignitions would be allowed to burn in the Wildland Fire Use and Conditional FMUs, providing an array of positive natural effects that include changes in plant community composition and forest structure, as well as creating new habitats (e.g., snags). Full suppression of wildfires would typically keep them small and reduce the duration of suppression activities in the wilderness that impact the natural quality of wilderness character. Human-caused fire ignitions would be suppressed in all FMUs where possible, reducing human effects on wilderness ecological systems from non-natural fire ignitions. All suppression tactics would follow PMRA direction including minimum requirement guidance, MIST guidelines, and resource advisers would participate in fire planning to reduce impacts on resources.

Though the introduction of nutrient-rich fire retardant chemicals can impact aquatic habitats and organisms, use of retardant would not be used unless human life and safety are under imminent threat. Impacts from vegetation clearing for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary.

Impacts from the manual/mechanical vegetation treatments (i.e., plant removal) would be limited to defensible space around wilderness structures and would occur only when park infrastructure identified for point protection is at immediate risk from wildfire.

Fire managers would limit the use of aerial suppression resources over the wilderness, reducing noise impacts on wilderness character whenever possible. Helicopter noise impacting the natural soundscape and causing wildlife disruption would be reduced when crews hike rather than fly to access wildfire areas and use stock or foot to transport equipment, and crew food and gear. The selection of fixed wings, helicopters, and/or UAS for monitoring would include adherence to minimum tool requirements. With superintendent approval and if determined to be the minimum tool, UAS may be used to gather information regarding fire size and fire behavior as noise impacts would be less than from larger aircraft.

Firefighting crews would practice LNT principles including proper methods for food storage, human waste disposal, camping at established sites or on durable surfaces; following campfire restrictions (i.e., Stoves Only regulations and smoke management burn bans); and minimizing travel on sensitive vegetation whenever possible, especially heather-huckleberry in the subalpine. When "monitoring only" is used as a wildfire strategy, personnel-related impacts would be few or not occur at all, based on little or no staff presence in the wilderness.

Suppression rehabilitation actions would mitigate resource impacts caused by suppression activities (e.g., erosion control on firelines, moving back soil/other natural materials to the fireline, flush-cutting stumps, removing woody material thrown into water courses during firefighting).

Additional positive effects on the natural quality of wilderness character are listed in the FMP EA, Chapter 3, Environmental Consequences.

- **Undeveloped**

Some structures in the fire's path may burn down, reducing human development in the wilderness in the long-term, or short-term if the decision is made to rebuild the structure. Final decisions for wilderness structure disposition would be made in the park's WSP.

Adherence to the approved PMRA guidance for the Wilderness Act 4(c) prohibitions (motor vehicles, motorized equipment, helicopter landings, other mechanical transport, and installations) would limit any such use to the minimum requirement. For example, the use of generators for powering communication would not be permitted when other effective communication tools with less impact on wilderness character are available, thus reducing or eliminating impacts on the undeveloped quality.

Alternatives to the Wilderness Act 4(c) prohibitions would always be the first choice considered, reducing impacts on the undeveloped quality of wilderness character. For example, gravity socks to operate sprinkler systems would be utilized where possible rather than motorized pumps, or foot or stock used to transport firefighting equipment or crew gear rather than a helicopter. If a prohibited use is found necessary to achieve the approved objective, the tool or method causing the least impact on wilderness character would be selected.

- **Solitude or Primitive and Unconfined Recreation**

Wildfire monitoring would likely be implemented with no on-site staff presence or just a few individuals, with chances then low for visitors to encounter fire staff in the wilderness, enhancing visitors' solitude during a wildfire. Trail or area closures would redirect visitors away from locations with high fire-related human activity, reducing visitors' encounters with fire personnel. For suppression activities, guidelines for the type, number and use of installations, motorized equipment and helicopter use would be established under the PMRA and included in WFDSS to minimize impacts on visitors' solitude or primitive experience. Opportunities for primitive recreation would be improved when visitors have the opportunity to view a natural landscape that has burned in a lightning-caused fire.

- **Other Features of Value**

American Indian resources associated with Olympic Peninsula tribes represent the other features of value quality of wilderness character within the park's wilderness. American Indian resources include archeological resources, ethnographic resources, and traditional cultural properties (there are currently no listed traditional cultural properties in the park). Plants and animals, landscapes, and spiritual aspects that are fundamental to the culture of the surrounding tribes are vital elements of the park's wilderness character.

The effects of wildfire on archeological and ethnographic resources are variable, but can directly damage or destroy important traditional resources (see alternative A, negative effects on the other features of value quality of wilderness character). In the Exclusion FMU (including 275,894 acres of wilderness) wildfires would be suppressed where possible, to reduce the potential for wildfire to spread from or to adjacent lands. Within the Conditional and Wildland Fire Use FMUs (including 588,697 acres of wilderness) naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response, including suppression. Under alternative A, more acres of lightning-caused fires would be suppressed than under alternative B, reducing wildfire impacts on the other features of value quality of wilderness character.

Full suppression of wildfires would attempt to minimize fire spread to the smallest possible size, which would provide immediate protection to archeological resources located outside the fire perimeter. There can be however, negative impacts on archeological and ethnographic resources from the suppression activities themselves. Thus when the wildfire strategy is focused on monitoring instead of suppression, the potential for impacts to archeological and ethnographic resources from suppression activities would be limited or eliminated (see alternative A, negative effects on the other features of value quality of wilderness character for suppression-related impacts).

Some lightning-caused ignitions would be allowed to burn in the Wildland Fire Use and Conditional FMUs, providing an array of positive natural effects that include changes in plant community composition and forest structure that may enhance some ethnographic resources.

Consultation and coordination with tribal groups would continue under existing management to share knowledge about important ethnographic resources and to solicit tribal perspectives on their management and protection in the event of wildfire.

Negative effects:

- **Untrammeled**

Under alternative A, all lightning-caused wildfires in the park's Exclusion FMU would be suppressed where possible. Suppression in any of the 275,894 park's wilderness acres that lie in the Exclusion FMU would be a direct human manipulation of the biophysical environment, trammeling the wilderness. Lightning-caused wildfires in the Wildland Fire Use and Conditional FMUs (588,697 acres within park wilderness) would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response which may include suppression as well.

Trammeling impacts would be caused by suppression activities such as fireline construction, relocation of fuels outside of the fireline, suppressing fire with the use of portable pumps and hose lays as well as aerial water drops, limbing trees, and cutting vegetation. Burn-outs may be selected as an action to alter fire behavior, thus also trammeling natural ecosystem processes. Manual/mechanical fuel treatments (i.e., plant removal) would occur around some wilderness structures when park infrastructure is at immediate risk from wildfires. Some clearing of vegetation for helispots may need to occur if no natural openings are available and helicopter landings are necessary. All such manipulation of vegetation would be an impact to the untrammeled quality of wilderness character.

Rehabilitation actions are taken after a fire has been suppressed to repair resource damage caused by the fire suppression activities (e.g., erosion control on firelines, moving back soil/other natural materials, flush-cutting stumps, removing woody material thrown into water courses during firefighting). Though resulting in positive effects on the natural quality, these actions involve manipulation of the biophysical environment and thus impact the untrammeled quality of wilderness character.

- **Natural**

Natural changes in plant community composition and forest structure that result from wildfire would be impacted by the suppression of lightning-caused wildfire. Any unplanned human-caused fires (e.g., from escaped campfires, cigarettes, etc.) would result in non-natural changes to the landscape, the plant community and to soils.

Suppression tactics from fireline construction and other firefighting activities (e.g., suppressing spot fires) would result in impacts to vegetation and soils, and possibly water flow patterns, and water quality, and would potentially disturb wildlife impacting the natural quality of wilderness character. The introduction of nutrient-rich fire retardant chemicals can impact vegetation and wildlife including aquatic habitats and organisms. Vegetation clearing may be necessary to develop helispots in the wilderness (only if no natural openings were available and helicopter landings were the minimum requirement necessary). This would result in impacts to vegetation and potentially to soils. Impacts from manual/mechanical vegetation treatments (i.e., plant removal) would occur around wilderness structures, though would be limited to defensible space and would occur only when park infrastructure identified for point protection is at immediate risk from wildfire.

Other fire crew activities such as cross-country hiking to/from and within the fire planning area and camping could result in impacts on vegetation including long-term impacts on the more fragile heather-huckleberry plant community, impacts on wildlife from the presence of people in habitat (e.g., noise disturbance, dispersal of wildlife to other areas, habituation, human food acquisition) and impacts on water quality from human waste disposal or improper dishwashing, etc. Fire camps (i.e., on-site spike camps) often concentrate higher levels of use with much larger group sizes than the public is allowed, damaging area resources. And, if necessary, camps might be located in areas without previously established sites creating long-lasting impacts on natural resources. The presence or the unintended introduction of non-native plants could result in expansion or new establishment of these species, especially where soil disturbance occurs.

Any use of motorized equipment (e.g., chainsaws, motorized pumps) and aircraft (helicopters, fixed wings, UASs) would result in noise impacts to the natural soundscape and could potentially affect wildlife. Water draws for bucket drops could impact fish and other aquatic species. Allowing wildfires to burn could result in loss of old growth habitat that is critical to Threatened & Endangered species such as the northern spotted owl and the marbled murrelet. Though lightning-caused ignitions and their associated smoke are natural, smoke still affects air quality. Smoke transported into the wilderness from pile burning, debris disposal or broadcast burns outside of the wilderness adversely impacts air quality as well, and thus the natural quality of wilderness character. Additional negative effects on the natural quality of wilderness character are listed in the FMP EA, Chapter 3, Environmental Consequences.

- **Undeveloped**

The undeveloped quality of wilderness character would be negatively affected by the placement of installations (e.g., temporary radio repeaters, weather stations, remote cameras, temporary signs, flagging and other markers, sprinklers, portable tanks, food/tool/equipment storage containers), the use of motorized equipment (e.g., chainsaws and motorized pumps); and transport via helicopters (i.e., for equipment, crew food and gear, crew travel, fire mapping). The use of generators for powering communication would impact this quality of wilderness character, though would be permitted only when other effective tools with less impact on wilderness character are not available.

Manual/mechanical fuel treatments (i.e., plant removal) would occur around some wilderness structures when park infrastructure is at immediate risk from wildfires, reducing the probability of the structures burning down, retaining human development in the wilderness. Final decisions for wilderness structure disposition would be made in the park's WSP.

- **Solitude or Primitive and Unconfined Recreation**

Wildfire suppression involves personnel traveling to/from and being on-site within the wilderness thus increasing the chance of encounters with visitors and reducing opportunities for visitors' solitude. Trail or area closures due to wildfire would affect visitor opportunities for unconfined recreation. Fire management use of installations, motorized equipment, and helicopters would impact visitors' solitude and sense of remoteness from the sights and sounds of human activity if exposed to them. There would be a continuum from multiple objectives to suppression strategies of increasing use of these tools and thus increasing impacts on this quality of wilderness character. The presence of spike

camps and associated facilities (e.g., food storage devices, toilets) impact the primitive experience for visitors coming upon them. New campsites and social trails may develop as a result of concentrated firefighter use at spike camps, also affecting visitors' primitive experience. Visual impacts of manual and mechanical vegetation removal treatments, and of constructed firelines, though rehabbed post-fire, may still be seen far into the future as a result of removal of vegetation and log saw cuts, again impacting visitors' primitive experience. This negative impact may especially be true in the off-trail areas where visitors often expect no noticeable trace of human activity.

- **Other Features of Value**

The effects of wildfire on archeological and ethnographic resources can directly damage or destroy important traditional resources. The effects on prehistoric archeological resources are of particular concern regarding impacts from wildfire to sites containing dense, surface-visible lithic scatters. Greater fire severity can result in deeper soil heating from longer residence time and smoldering of surface litter, and also higher severity in terms of effects to surface and subsurface archeological resources (Ryan et al. 2012). Combustion, smoke, and ash, and heat-transfer mechanisms are factors that directly affect archeological resources during wildfire events. Indirect impacts to archeological resources include post-fire erosion and flooding, carbon contamination in subsurface deposits, and ground disturbance from fire-killed trees that fall (Ryan et al. 2012). Historic-era archeological materials are often fire-sensitive as well. Extensive stand replacement wildfire, typical of the fire regime of much of the park's wilderness, could result in the alteration and/or removal of important archeological sites.

The effects of wildfire on ethnographic resources and the traditional landscape may vary widely. Wildfires can directly damage or destroy important traditional resources, including plant communities, archeological sites, prehistoric and historically used trails, springs, and sacred places. The loss of important plant resources impacts gathering areas and traditional activities important to cultural heritage. Additionally, the loss of access to ethnographic resources due to large-scale, high-intensity wildfire, hinders the ability of these groups to continue to maintain ancestral ties to the land through cultural traditions and affects the relationship between these resources and the associated group's body of practices and beliefs. Wildland fire could, depending on its severity of effects, also diminish the visual integrity of ethnographic resources valued by tribal groups, especially the damage to sacred and ceremonial areas.

In the Exclusion FMU (including 275,894 acres of wilderness) wildfires would be suppressed where possible to reduce the potential for wildfire to spread from or to adjacent lands. Within the Conditional and Wildland Fire Use FMUs, including 588,697 acres of wilderness, naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response. Full suppression of wildfires would attempt to minimize fire spread to the smallest possible size, which can lead to more aggressive suppression activities. Tactical actions for multiple objective management strategies include monitoring only and point protection of sensitive resources, but also managing part of the wildfire for suppression while monitoring other parts of the wildfire. Wildfire suppression techniques, such as the construction of firelines, cutting of vegetation for fire breaks and helispots, and burnout operations may cause direct impacts to surface and subsurface cultural materials due to soil disturbance and compaction. There is the potential to impact unknown cultural resources resulting from clearing of vegetation and ground cover. Additionally, mop-up activities, including extinguishing or removing burning material near firelines, felling snags, trenching logs, and treating spot fires and hot spots beyond the fireline, also have the potential for adverse impacts to cultural resources where they occur within wildfire burn areas.

Damage to plant communities, gathering areas, and sacred and ceremonial sites as a result of wildfire suppression may also occur, which could disturb, destroy, or alter ethnographic resources important to American Indian groups associated with the park. As ethnographic resources include archeological components, loss, damage, and other impacts to these resources from wildfire suppression activities would result in impacts to ethnographic resources as well.

For archeological resources, while construction of firelines and removal of fuel around the resource would help minimize impacts from wildfire, these protection methods may not prevent spot fires from igniting outside the wildfire perimeter, which may still damage these resources even at a distance from the main fire. Direct impacts from wildfire suppression activities may also result from the application of water and foam, as well as fire retardant if they have the potential to damage archeological and ethnographic resources when applied in a wildfire situation. Impacts to sensitive ethnographic resources could also occur during mechanical and manual treatments.

Additional negative effects on the Other Features of Value quality of wilderness character are listed in the FMP EA, 3.10, Environmental Consequences (Archeological Resources and Ethnographic Resources).

Alternative B: Conduct a fire management program based on an updated Olympic National Park Fire Management Plan, with two fire management units (Wilderness and Non-Wilderness)

Wilderness character effects (untrammeled, natural, undeveloped, solitude or a primitive & unconfined type of recreation, and other features of value)

Positive effects:

- **Untrammeled**

The Wilderness FMU covers 876,447 acres or 95% of the park. The intent of this alternative is to allow lightning-caused wildfires within the Wilderness FMU to be managed under the monitor strategy to the fullest extent possible, allowing natural processes to proceed without human control/ manipulation within the Daniel J. Evans Wilderness. Lightning-caused wildfires would be evaluated through a deliberative risk analysis and systematic decision-making process using WFDSS to determine the appropriate management response. PMRA guidelines would be followed and applicable PMRA strategies incorporated into WFDSS for each fire. When the selected response does not include fire suppression, natural processes would continue untrammeled in the wildfire event areas and human manipulation of the biophysical environment would not occur. The untrammeled quality of wilderness character would thus be enhanced over much of the wilderness under this alternative.

Though wildfire management under the multiple objectives strategy would likely include some suppression activities (e.g., fireline construction) at management action points, in other areas of the fire natural processes would still be allowed to continue without human manipulation. Use of retardant that would also alter fire behavior would not be used unless human life and safety are under imminent threat.

Trammeling from fire suppression (using firelines, portable pumps, hose lays, and aerial water drops) would not be implemented nor would suppression-related trammeling actions including removing ground vegetation and duff during fireline construction, limbing trees, cutting other vegetation, relocating fuels outside of the fireline, and burnout operations. Though wildfire management for multiple objectives would likely include some suppression actions at management points, in other areas of the fire natural processes would be allowed to continue without human manipulation.

During suppression efforts, use of aerial water drops would rarely be conducted and use of retardant that would also alter fire behavior would not be used unless human life and safety are under imminent threat. Clearing vegetation from sites for helispots within the wilderness would occur only if no natural openings were available and helicopter landings were the minimum requirement necessary.

Manual/mechanical vegetation treatments (i.e., plant removal, a type of trammel) would not occur until wilderness infrastructure, specifically identified for point protection, is at immediate risk from wildfires. Such defensible space treatments would be limited in extent.

- **Natural**

Most lightning-caused ignitions would be allowed to burn in the Wilderness FMU, the 876,447 acres of the park designated as the Daniel J. Evans Wilderness. This would provide an array of positive natural effects that include changes in plant community composition and forest structure, as well as creating new habitats (e.g., snags). Full suppression of wildfires would typically keep them small and reduce the duration of suppression activities in the wilderness that impact the natural quality of wilderness character. Human-caused fire ignitions would be suppressed in all FMUs where possible, reducing human effects on wilderness ecological systems from non-natural fire ignitions. All suppression tactics would follow PMRA direction including minimum requirement guidance, MIST guidelines, and resource advisers would participate in fire planning to reduce impacts on resources.

Though the introduction of nutrient-rich fire retardant chemicals can impact aquatic habitats and organisms, use of retardant would not be used unless human life and safety are under imminent threat. Impacts from vegetation clearing for helispots within the wilderness would only occur if no natural openings were available and helicopter landings were the minimum requirement necessary.

Impacts to vegetation from manual/mechanical treatments (i.e., plant removal) would be limited to defensible space around wilderness structures and would occur only when park infrastructure identified for point protection is at immediate risk from wildfire.

Fire managers would limit the use of aerial suppression resources over the wilderness, reducing noise impacts on wilderness character whenever possible. Helicopter noise impacting the natural soundscape and causing wildlife disruption would be reduced when crews hike rather than fly to access wildfire areas and use stock or foot to transport equipment, crew food, and gear. The selection of fixed wings, helicopters and/or UAS for monitoring would include adherence to minimum tool requirements. With superintendent approval and if determined to be the minimum tool, UAS may be used to gather information regarding fire size and fire behavior as noise impacts would be less than from larger aircraft.

Firefighting crews would practice LNT principles including proper methods for food storage, human waste disposal, camping at established sites or on durable surfaces; following campfire restrictions (i.e., Stoves Only regulations and smoke management burn bans); and minimizing travel on sensitive vegetation whenever possible, especially heather-huckleberry in the subalpine. When "monitoring only" is used as a wildfire strategy, personnel-related impacts would be few or not occur at all, based on little or no staff presence in the wilderness.

Suppression rehabilitation actions would mitigate resource impacts caused by suppression activities (e.g., erosion control on firelines, moving back soil/other natural materials to the fireline, flush-cutting stumps, removing woody material thrown into water courses during firefighting).

- **Undeveloped**

Some structures in the fire's path may burn down reducing human development in the wilderness in the long-term, or short-term if the decision is made to rebuild the structure. Final decisions for wilderness structure disposition would be made in the park's WSP.

Under alternative B, it is far more likely that wildfire "monitoring only" or multiple objectives fire management strategies would be selected over "suppression only" strategies, when compared to alternative A. This would result in far less necessity for use of Wilderness Act 4(c) prohibitions, reducing impacts on the undeveloped quality of wilderness character.

Adherence to the approved PMRA guidance for the Wilderness Act 4(c) prohibitions (motor vehicles, motorized equipment, helicopter landings, other mechanical transport, and installations) would limit any such use to the minimum requirement. For example, the use of generators for powering communication would not be permitted when other effective communication tools with less impact on wilderness character are available, thus reducing or eliminating impacts on the undeveloped quality.

lternatives to the Wilderness Act 4(c) prohibitions would always be the first choice considered, reducing impacts on the undeveloped quality of wilderness character. For example, gravity socks to operate sprinkler systems would be utilized where possible rather than motorized pumps, or foot or stock used to transport firefighting equipment or crew gear rather than a helicopter. If a prohibited use is found necessary to achieve the approved objective, the tool or method causing the least impact on wilderness character would be selected.

- **Solitude or Primitive and Unconfined Recreation**

Implementation of the wildfire monitoring strategy would likely be done with no staff presence or just a few individuals, with chances then low for visitors to encounter fire staff in the wilderness, enhancing visitors' solitude during a wildfire. Trail or area closures would redirect visitors away from locations with high fire-related human activity, reducing visitors' encounters with fire staff. The type, number and use of installations, motorized equipment,

and helicopter use would be under strict PMRA guidelines included in WFDSS to minimize impacts on visitors' primitive experience. There would be less use of installations and helicopters, and little to no use of motorized equipment under a monitoring strategy.

Opportunities for primitive recreation would be improved when visitors have the opportunity to experience a natural landscape that has burned in a lightning-caused fire.

- **Other Features of Value**

The effects of wildfire on archeological and ethnographic resources are variable, but can directly damage or destroy important traditional resources (see alternative A, negative effects on the other features of value quality of wilderness character). Within the Wilderness FMU, naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response, including suppression. Though wildfires would be suppressed over less acreage within the wilderness under alternative B compared to alternative A, some suppression would occur. Suppression would reduce wildfire impacts on the other features of value quality of wilderness character. Fire spread would be minimized to the smallest possible size, which would provide immediate protection to archeological resources located outside the fire perimeter.

Given there are negative impacts on archeological and ethnographic resources from the suppression activities themselves, under alternative B's focus on monitoring and multiple objectives rather than suppression, the potential for impacts to archeological and ethnographic resources from suppression activities would be limited or eliminated (see alternative A, negative effects on other features of value quality of wilderness character for suppression-related impacts).

Most lightning-caused ignitions would be allowed to burn in the Wilderness FMU, providing an array of positive natural effects that include changes in plant community composition and forest structure that may enhance some ethnographic resources.

Consultation and coordination with tribal groups would continue under existing management to share knowledge about important ethnographic resources and to solicit tribal perspectives on their management and protection in the event of wildfire.

- **Negative effects:**
- **Untrammeled**

Wildfire management ranging from monitoring only, to a multiple objective strategy, to full suppression under alternative B in the Wilderness FMU would involve varying degrees of human manipulation of the natural ecological process of fire. Lightning-caused wildfires in the Wilderness FMU would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response which may include suppression. Suppression of naturally ignited fire is a trammeling action taken on a natural process to intentionally affect "the earth and its community of life."

Trammeling impacts would be caused by suppression activities such as fireline construction, relocation of fuels outside of the fireline, suppressing fire with the use of portable pumps and hose lays as well as aerial water drops, limbing trees, and cutting vegetation. Burn-outs may be selected as an action to alter fire behavior, thus also trammeling natural ecosystem processes. Manual/mechanical fuel treatments (i.e., plant removal) would occur around some wilderness structures when park infrastructure is at immediate risk from wildfires. Some clearing of vegetation for helispots may need to occur if no natural openings are available and helicopter landings are necessary. All such manipulation of vegetation would be an impact to the untrammeled quality of wilderness character.

Rehabilitation actions are taken after a fire has been suppressed to repair resource damage caused by the fire suppression activities (e.g., erosion control on firelines, moving back soil/other natural materials, flush-cutting stumps, removing woody material thrown into water courses during firefighting). Though resulting in positive effects on the natural quality, these actions involve manipulation of the biophysical environment and thus impact the untrammeled quality of wilderness character.

- **Natural**

Natural changes in plant community composition and forest structure that result from wildfire would be impacted by the suppression of lightning-caused wildfire. Though less under alternative B than alternative A, suppression of naturally ignited wildfires would result in impacts on the natural quality of wilderness character and any unplanned human-caused fires (e.g., from escaped campfires, cigarettes, etc.) would result in non-natural changes to the landscape, the plant community, and to soils.

Suppression tactics from fireline construction and other firefighting activities (e.g., suppressing spot fires) would result in impacts to vegetation and soils, and possibly water flow patterns, water quality, and would potentially disturb wildlife impacting the natural quality of wilderness character. The introduction of nutrient-rich fire retardant chemicals can impact vegetation and wildlife including aquatic habitats and organisms. Vegetation clearing may be necessary to develop helispots in the wilderness (only if no natural openings were available and helicopter landings were the minimum requirement necessary). This would result in impacts to vegetation and potentially to soils. Impacts to vegetation from manual/mechanical treatments (i.e., plant removal) would occur around wilderness structures, though would be limited to defensible space and would only occur when park infrastructure identified for point protection is at immediate risk from wildfire.

Other fire crew activities such as cross-country hiking to/from and within the fire planning area and camping could result in impacts on vegetation including long-term impacts on the more fragile heather-huckleberry plant community, impacts on wildlife from the presence of people in habitat (e.g., noise disturbance, dispersal of wildlife to other areas, habituation, human food acquisition) and impacts on water quality from human waste disposal or improper dishwashing, etc. Fire camps (i.e., on-site spike camps) often concentrate higher levels of use with much larger group sizes than the public is allowed, damaging area resources. And, if necessary, camps might be located in areas without previously established sites creating long-lasting impacts on natural resources. The presence or the unintended introduction of non-native plants could result in expansion or new establishment of these species, especially where soil disturbance occurs.

Given that there would be less suppression activities under alternative B compared to alternative A in the park's wilderness, there would be less impact on the natural soundscape. However, any use of motorized equipment (e.g., chainsaws, motorized pumps) and aircraft (helicopters, fixed wings, UASs) would result in noise impacts to the natural soundscape and could potentially affect wildlife. Water draws for bucket drops could impact fish and other aquatic species. Allowing wildfires to burn could result in loss of old growth habitat that is critical to Threatened & Endangered species such as the northern spotted owl and the marbled murrelet. Though lightning-caused ignitions and their associated smoke are natural, smoke still affects air quality. Smoke transported into the wilderness from pile burning, debris disposal or broadcast burns outside of the wilderness adversely impacts air quality as well, and thus the natural quality of wilderness character. Additional negative effects on the natural quality of wilderness character are listed in the FMP EA, Chapter 3, Environmental Consequences.

- **Undeveloped**

Though alternative B would have less suppression activities than alternative A in the park's wilderness, the undeveloped quality of wilderness character would be negatively affected by any placement of installations (e.g., temporary radio repeaters, weather stations, remote cameras, temporary signs, flagging and other markers, sprinklers, portable tanks, food/tool/equipment storage containers), the use of motorized equipment (e.g., chainsaws and motorized pumps); and transport via helicopters (i.e., for equipment, crew food and gear, crew travel, fire mapping). The use of generators for powering communication would impact this wilderness character quality, though would be permitted only when other effective tools with less impact on wilderness character are not available. These Wilderness Act 4(c) prohibitions would increase as one progresses along the continuum of strategies from monitoring only, to multiple objectives to full suppression, though the emphasis would be on monitoring only, as per decisions made through WFDSS, the deliberative risk analysis process.

Manual/mechanical fuel treatments (i.e., plant removal) would occur around some wilderness structures when park infrastructure is at immediate risk from wildfires, reducing the probability of the structures burning down, retaining human development in the wilderness. Final decisions for wilderness structure disposition would be made in the park's WSP).

- **Solitude or Primitive and Unconfined Recreation**

Though there would be less suppression activities in the wilderness under alternative B than alternative A, there would be some. Wildfire suppression involves personnel traveling to/from and being on-site within the wilderness thus increasing the chance of encounters with visitors and reducing visitors' opportunities for solitude. Trail or area closures due to wildfire would affect visitor opportunities for unconfined recreation. Fire management use of installations, motorized equipment, and helicopters would impact visitors' solitude and sense of remoteness from the sights and sounds of human activity if exposed to them. There would be a continuum from monitor only, to multiple objectives, to full suppression strategies of increasing use of these tools and thus increasing impacts on this wilderness character quality. The presence of spike camps and associated facilities (e.g., food storage devices, toilets) impact the primitive experience for visitors coming upon them. New campsites and social trails may develop as a result of concentrated firefighter use at spike camps, also affecting visitors' primitive experience. Visual impacts of manual and mechanical vegetation removal treatments, and of constructed firelines, though rehabbed post-fire, may still be seen far into the future as a result of removal of vegetation and log saw cuts, again impacting visitors' primitive experience. This negative impact may especially be true in the off-trail areas where visitors often expect no noticeable trace of human activity.

- **Other Features of Value**

The effects of wildfire on archeological and ethnographic resources are variable, but can directly damage or destroy important traditional resources (see alternative A, negative effects on the other features of value quality of wilderness character).

Within the Wilderness FMU naturally ignited wildfires would be evaluated through a deliberative risk analysis process using WFDSS to determine the appropriate management response, including suppression.

Wildfires would be suppressed over less acreage within the wilderness under alternative B compared to alternative A, resulting in greater impacts from wildfire on the other features of value quality of wilderness character over more acreage. Fire spread would not be minimized to the smallest possible size if monitor only or multiple objectives strategies were selected, which would reduce protection of archeological resources within a larger fire perimeter.

Given there are negative impacts on archeological and ethnographic resources from the suppression activities themselves, under alternative B there would still be potential for impacts to archeological and ethnographic resources when a strategy that includes suppression is selected. Wildfire suppression techniques, such as the construction of firelines, cutting of vegetation for fire breaks and helispots, and burnout operations may cause direct impacts to surface and subsurface cultural materials due to soil disturbance and compaction. There is the potential to impact unknown cultural resources resulting from clearing of vegetation and ground cover. Additionally, mop-up activities, including extinguishing or removing burning material near firelines, felling snags, trenching logs, and treating spot fires and hot spots beyond the fireline, also have the potential for adverse impacts to cultural resources where they occur within wildfire burn areas.

Damage to plant communities, gathering areas, and sacred and ceremonial sites as a result of wildfire suppression may also occur, which could disturb, destroy, or alter ethnographic resources important to American Indian groups associated with the park. As ethnographic resources include archeological components, loss, damage, and other impacts to these resources from wildfire suppression activities would result in impacts to ethnographic resources as well.

For archeological resources, while construction of firelines and removal of fuel around the resource would help minimize impacts from wildfire, these protection methods may not prevent spot fires from igniting outside the wildfire perimeter, which may still damage these resources even at a distance from the main fire. Direct impacts from wildfire suppression activities may also result from the application of water and foam, as well as fire retardant if they have the potential to damage archeological and ethnographic resources when applied in a wildfire situation. Impacts to sensitive ethnographic resources could also occur during mechanical and manual treatments.

Additional negative effects on the other features of value quality of wilderness character are listed in the FMP EA, 3.10, Environmental Consequences (Archeological Resources and Ethnographic Resources).

10	**After approval by the Deputy Superintendent to proceed, update the PPF/MRA with input provided by the Compliance Council and/or the Interdisciplinary Planning Team (IDP) and provide an electronic copy to the Planning and Compliance Office to initiate park internal review and comment.** **Comments due by:**_____

Wilderness Specialist Comments:

The PMRA for the Fire Management Plan/EA was developed by the park's wilderness specialist.

Reviewed by: Ruth Scott Date: 11-2-18

After the established review period, contact the Planning and Compliance Office to schedule a discussion of your issue at a park Compliance Council meeting to recommend a preferred alternative and complete the review process.

11	Select the alternative that would most effectively resolve the issue while having the <u>least</u> overall adverse impact on park resources & values and wilderness resources, character and the visitor experience	*Note:* When selecting the preferred alternative for actions in wilderness, the potential disruption of wilderness character and resources will be considered before, and given significantly more weight than, economic efficiency and convenience. If a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character and/or have localized, short-term adverse impacts will be acceptable.

Preferred alternative: B
Conduct a fire management program based on an updated Olympic National Park Fire Management Plan, with two fire management units (Wilderness and Non-Wilderness)

Describe the rationale for selecting this alternative *as the most effective in resolving the issue while having the least overall adverse impact on wilderness character. Include how impacts to wilderness character would be minimized, and mitigated if possible.*

Olympic National Park's 2005 Fire Management Plan needs to be revised to meet current NPS policies. Additional guidance is needed for implementing fire management strategies in the park's wilderness, based on the Wilderness Act, wilderness minimum requirements, and new guidance for preservation of wilderness character. Alternative B proposes to conduct a fire management program based on an updated Fire Management Plan.

The overall fire management goal under alternative B for the wilderness is to preserve wilderness character by allowing natural-caused wildfires to burn without human manipulation, to the fullest extent possible. Under alternative B there would be two fire management units (Wilderness and Non-Wilderness). The Wilderness FMU comprises 95% of the park: 876,447 designated wilderness acres. Objectives for the Wilderness FMU focus on maintaining the natural fire regime and conditions, and include standards and limitations necessary to protect values including wilderness character, and natural, cultural, and infrastructure resources.

Alternatives A and B would employ many of the same types of wildland fire and fuels management actions, but differ as to where in the park the actions could be employed, how the actions would be carried out, and under what circumstances. Under alternative B there would be three wildfire management strategies: Monitor, Multiple Objectives, Full Suppression. The Wilderness FMU would allow for applying the full range of wildfire strategies to all or portions of wildfires as appropriate to provide for firefighter and public safety while preserving wilderness character and maximizing opportunities for fire to fulfill its ecological role in the park's ecosystems. Each fire would be assigned, at any one time, to one of three management responses (or urgency) levels: low, moderate, or high. Strategies and management response can change throughout a wildfire event. Alternative B would allow for more selections of the monitor-only strategy, and more flexible use of wildfire for multiple objectives than alternative A, allowing the natural process of wildfire to continue over more wilderness acreage. Alternative B would consider and determine, for each wildfire

strategy and each management response within the Wilderness FMU, what minimum tools/methods to employ to implement fire management in a manner that best preserves wilderness character while meeting fire management goals and objectives.

For each wildfire ignition that persists beyond initial response, a deliberative risk analysis process would be conducted and documented using the Wildland Fire Decision Support System (WFDSS). When actions and activities listed in the PMRA apply to a wildfire within the Wilderness FMU (based on the specific conditions of that wildfire) the guidance in the PMRA would be incorporated into the WFDSS decision as incident objectives or management requirements for that wildfire incident. This would ensure that wilderness guidance is followed and wilderness character is taken into consideration in all applicable decisions, and that any potential adverse impacts to wilderness character are minimized and/or mitigated.

List the Wilderness Act 4(c) prohibited uses *proposed in the preferred alternative and explain how these uses are the minimum requirement necessary for administering the area for the purpose of preserving wilderness character:*

4(c) PROHIBITIONS – POTENTIAL TOOLS/METHODS FOR USE
(See Section 7 for minimum requirement selection details)

INSTALLATIONS	MOTORIZED EQUIPMENT	AIRCRAFT/ MECHANICAL TRANSPORT
• gravity socks • hose lays • portable tanks • sprinklers • structure wrap • temporary radio repeater • remote cameras • weather stations • solar panels • tarps/tents • camp tables/chairs • animal resistant food storage • secure storage box • toilet vault • flagging • temporary signs • plot markers	• chainsaws • cord trimmer • generators • motorized pumps	• fixed wing • helicopters • UAS

Describe the mitigation measures that would be implemented to help preserve wilderness character:

Mitigations

- Wilderness character would be fully considered during all fire management actions beginning with the development of the FMP and continuing through the management of individual wildfires and implementation of fuel treatments and post-fire actions.
- All planned fire management operations in wilderness would be conducted in accordance with the programmatic minimum requirements analysis and any separate MRAs related to the fire management program.
- Fire management personnel would be adequately briefed on the concepts of wilderness stewardship and be held accountable for the preservation of wilderness character. They would be made aware of specific protections and constraints contained in the park's FMP PMRA and any additional separate wildfire-related MRAs.
- A READ would be consulted and/or assigned to each wildfire in wilderness or likely to burn into wilderness. The READ's duties during the incident would include comparing proposed management strategies and techniques with the limits established for each element/action of the assigned

wilderness wildfire strategies (i.e., the wilderness minimum requirement guidelines for methods and tools in the PMRA).

- When wildfire ignitions occur within the wilderness, the IDT team assembled at the beginning of the incident would include the park's wilderness coordinator as well as the READ. The park's wilderness coordinator would also be consulted during WFDSS decision development to assist in identification of the applicable wilderness minimum requirement guidelines and provide wilderness input on the decision-making for any fires within the wilderness. A management requirement in WFDSS for the fire incident would be that the wilderness coordinator would be consulted as early as possible to help inform the "strategic wildfire decision analysis" (the WFDSS decision development).
- MIST, revised for OLYM, would be employed for all fire management actions to minimize impacts on resources. MIST would be included as a management requirement in WFDSS for incorporation into fire decisions.
- Fire personnel would practice LNT principles including proper methods for food storage (see following bullet), human waste disposal, and minimizing travel on sensitive vegetation (e.g., heather-huckleberry). Wherever possible, personnel would camp in established camp areas or campsites. If firefighting locations require camping off-trail or away from established sites, camping would take place on durable surfaces. Campfires would not be allowed by fire crews in areas where only stoves are allowed, or when the backcountry is closed to campfires for the public. LNT would be listed as a management requirement in WFDSS for incorporation into fire management decisions.
- Food and garbage must be secured at all times, whenever not in use or if unattended, to safeguard such items from wildlife access. All food, garbage, and scented items would be stored appropriately following park guidelines. IGBC-certified animal resistant food canisters (ARFC) and animal resistant stock pannier bags; or bear wires already in place, would be the first choice. IGBC-certified small storage containers, boxes, and coolers may be considered when larger food storage space is necessary. Large animal-resistant food storage lockers (e.g., Knaack box) would only be transported and used at camps if other options would not be available or practical, usually due to crew size, or if already necessary for secure tool/equipment storage. Any bear-resistant containers purchased for fires would comply with the IGBC certified list: http://igbconline.org/wp-content/uploads/2018/09/180911_Certified_Products_List.pdf.
- The smallest, quietest helicopters would be used to accomplish tasks efficiently and safely.
- Heavy earth-moving equipment such as graders, bulldozers, or other tracked vehicles would not be used in wilderness. The exception to this is that the superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances.
- Following an incident, an evaluation would take place to determine if actions undertaken during the fire management response met with direction established in the Fire Management Plan PMRA for preserving wilderness character. This would include an evaluation of any use of Wilderness Act 4(c) prohibitions to determine how improvements could be made for preserving wilderness character on future incidents

Describe the safety risks *and the preventive/mitigation safety measures that would be implemented:*

The first goal of the park's FMP and wildland fire program is to ensure that firefighter and public safety is the first priority in every fire management activity.

Objectives and actions include:

- Provide required annual safety training to all red-carded personnel per the Interagency Standards for Fire and Aviation (Red Book) and NPS standards.
- Incorporate safety considerations into all decision processes (e.g., Wildland Fire Decision Support System [WFDSS], Fuel Treatment Plans, etc.). Follow safety and qualification standards per the Red Book.
- Provide adequate Personal Protective Equipment (PPE) to all operations staff.
- Provide operational briefings that include safety to all line personnel prior to each shift.

All wildfire suppression activities would provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and the use of critical firefighting resources.

Reviewed by: Ruth Scott_____ **Date:** 11-29-18
Wilderness Specialist

Edits have been incorporated into the PMRA based on IDT comments received.

Leadership Team Comments on Preferred Alternative (recommendation to Superintendent for final review and approval)

Administration Division comments/recommended mitigations:

Reviewed by Administrative Officer: _____ Date_____

Cultural Resources comments/recommended mitigations (include next steps for compliance with NHPA, other applicable cultural resource law/policy):

Reviewed by Section 106 Specialist: _____ Date_____

Interpretation Division comments/recommended mitigations:

Reviewed by Chief of Interpretation: _____ Date_____

Facilities Management Division comments/recommended mitigations:

Reviewed by Chief of Facilities Mgmt:_____ Date_____

Natural Resources comments/recommended mitigations:

T & E Species Determination of Effect (No Effect (NE), Not Likely to Adversely Affect (NLAA), Likely to Adversely Affect (LAA):

- **Bull Trout:_____**
- **Marbled Murrelet:_____**
- **Northern spotted owl:_____**
- **Other:_____**

Reviewed by Chief of RM: _____ Date_____

<u>Compliance Pathway Determination:</u>

Categorical Exclusion: _____ EA: _____ EIS: _____

Recommended by Env. Protection Specialist:_____ Date:_____

Approved by: Superintendent Date

APPENDIX F – SUMMARY OF IMPACT TOPICS AND ISSUES CONSIDERED FOR ANALYSIS IN THIS EA

IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS

NPS NEPA guidance directs that issues should be retained for consideration and assessment in the EA if:

- the environmental impacts associated with the issue are central to the proposal or of critical importance;
- a detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives;
- the environmental impacts associated with the issue are a big point of contention among the public or other agencies; or
- there are potentially significant impacts to resources associated with the issue. (NPS 2015a)

Based on input solicited from the public and agencies during the scoping period and input from park staff during internal scoping, the NPS identified a range of resource impact topics that are central to the assessment of potentially significant impacts from the alternatives assessment for the EA. Impact topics are resources or values that may be affected by implementation of the actions proposed under the FMP alternatives. Impact topics retained are discussed below.

Air Quality

Air quality would be impacted by proposed fire management activities within the park. Olympic National Park is a mandatory Class I area under the Clean Air Act, as amended. The impact of smoke to local communities and park visitors would depend on weather conditions when fires are active and an individual's sensitivity to smoke. Section 3.3 addresses potential impacts to air quality.

Vegetation

Fire management activities could result in impacts to vegetation from wildfire management activities within the park, including state-identified threatened or sensitive species. Several vegetation types located in the proposed project area could be impacted by the implementation of the FMP. Treatments for nonnative species eradication would also be considered under the proposed action, where suitable. Fire management activities also have the potential to introduce or further spread nonnative invasive vegetation. Section 3.4 addresses potential impacts to vegetation.

Fish and Wildlife

Fire management activities have the potential to impact fish and wildlife species known to occur within the park. Vegetation removal and other fire management activities could impact wildlife habitat, and disturbances could displace wildlife species. Section 3.5 addresses potential impacts to wildlife.

Threatened and Endangered Species

The federal Endangered Species Act prohibits harm to any species of fauna or flora listed by the U.S. Fish and Wildlife Service as being either threatened or endangered. Such harm includes not only direct injury or mortality, but also disrupting the habitat on which these species depend. There are several threatened or endangered species with habitat in areas of Olympic National Park where fire management actions could occur. Section 3.6 addresses potential impacts to federally-listed threatened and endangered species.

Water Quality

Pristine water quality is an intrinsic value of the park, which is important to maintain for a variety of beneficial uses, including freshwater fish and invertebrate habitat. Water quality could be impacted by sedimentation, removal of streamside vegetation, among other impacts caused by fire or fire management activities. Section 3.7 addresses potential impacts to water quality.

Wilderness Character

The congressionally designated Daniel J. Evans Wilderness was established in 1988, and comprises about 95% of the park. The primary management mandate of the Wilderness Act for the federal agencies administering wilderness is to preserve the wilderness character of the area, while administering the area for other purposes for which it may have been established. The agencies are also directed to preserve the wilderness character of an area. Section 3.8 addresses potential impacts to wilderness character.

Soundscapes

The natural soundscape (i.e., natural quiet) is a special park resource, especially to visitors in the wilderness portion of the park. The park is known as one of the best examples of a natural soundscape found anywhere in the national park system and includes natural sounds that are part of the biological or physical resources of the park (NPS 2008a). Section 3.9 addresses potential impacts to the park's soundscapes.

Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 provides the framework for federal review and protection of cultural resources and ensures that they are considered during federal project planning and execution. The park contains many cultural resource sites, including historic structures and historic landscapes. These resources could be affected by fire management activities. Section 3.10 addresses potential impacts to the park's archeological resources, ethnographic resources, historic resources (structures), and cultural landscapes.

Visitor Use and Experience

The Organic Act of 1916 directs the National Park Service to provide for public enjoyment of the scenery, wild life, and natural and historic resources of national parks "in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." Fire management activities could result in the temporary closure of certain areas and result in visual impacts that may affect visitor use and experience of the park. Section 3.11 addresses potential impacts to visitor use and experience, including visitor safety.

ISSUES CONSIDERED BUT DISMISSED FROM FURTHER CONSIDERATION

Socioeconomics

Fire management activities may bring a short-term need for additional personnel in the park, but this addition would be minimal and would not affect the overall population, income, and employment base of neighboring communities. Proposed fire management actions would not have a measurable impact on the local or regional economy. Therefore, this impact topic is dismissed from further analysis.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low-income populations. There are no proposed fire management actions that would disproportionately impact these populations. The issue is dismissed from further consideration in the EA.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by U.S. Department of the Interior agencies be explicitly addressed in environmental documents. Indian trust resources are

those resources held in trust for American Indians by the federal government. The issue is dismissed from further consideration in the EA because there are no Indian trust resources at Olympic National Park.

Night Sky

Adverse impacts to night sky could occur intermittently during wildland fire events from lighted equipment and the fire event. However, the impacts would be short-term and localized (in close proximity) to the wildland fire event. Due to the negligible impact to night sky, this impact topic is dismissed from further analysis.

Land Use

In accordance with NPS *Management Policies* (2006), the NPS must apply appropriate land protection methods to protect park resources and values from incompatible land uses. The overall land use of the park would not change under either alternative. Both alternatives would be consistent with the General Management Plan.

Human Health and Safety

In accordance with NPS *Management Policies* (2006), the NPS would seek to provide a safe and healthy environment for visitors and employees. Due to the emphasis placed on safety in all federal fire management policies and the current park practice of using available resources to notify the public of planned and unplanned ignitions, the revision of the FMP is not anticipated to impact public health and safety. Potential impacts of fire management on public health from the release of airborne constituents are discussed in Section 3.3, Air Quality, and potential impacts to visitor safety are addressed in Section 3.11, Visitor Use and Experience.

Operational guidance directs all fire management activities to be conducted to enhance and provide resource benefit and mitigate risk from unwanted wildfire while providing for firefighter and public safety. All actions would conform to safety policies defined in, but not limited to, the Interagency Standards for Fire and Fire Aviation Operations Guide (Red Book), Director's Order 18, and the Standards for Operations and Safety chapter in NPS Reference Manual 18 (NPS 2014a).

Firefighter safety is of primary concern and its procedures are dictated by laws, regulations, policies, and guidelines. National fire policy states that firefighter safety is the first priority in fire management activities. Director's Order 18 makes similar commitments. Firefighter safety is common to both alternatives and would not differ in either alternative. In addition, firefighter safety procedures are updated frequently and would be followed regardless of the alternative implemented. Therefore, this topic was dismissed from further analysis.

Soils

The park has not observed adverse impacts to soils from fire management activities implemented under the current FMP. Given the similarity of the proposed FMP revision to the existing FMP, negligible impacts to soils under either alternative are expected. Localized soil compaction and erosion could occur from fire management activities, but these impacts would be on a small scale and would be addressed using MIST. Therefore, this topic was dismissed from further analysis.

Floodplains and Wetlands

Executive Order 11988 (Floodplain Management) requires an examination of impacts to floodplains and potential risk involved in placing facilities within floodplains. Executive Order 11990 (Protection of Wetlands) requires federal agencies to avoid, where possible, adversely impacting wetlands. NPS *Management Policies* (2006) requires the park to take action to prevent the destruction, loss, or degradation of wetlands; and to preserve and enhance the natural and beneficial values of wetlands.

The proposed fire management activities would not place structures in floodplains or result in the loss, destruction, or degradation of wetlands in the park. The issues of floodplains and wetlands are dismissed from detailed analysis.

APPENDIX G – VEGETATION COMMUNITIES WITHIN THE PARK

Sitka Spruce Zone

This zone, with an overstory composed of primarily Sitka spruce, occurs on the wettest sites in the most humid regions of the park. The coastal strip as well as the Hoh, Queets, Quinault, and Bogachiel rainforest valleys are included in this zone. Common shrubs include salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), vine maple (*Acer circinatum*), red huckleberry (*Vaccinium parviflorium*), and Alaska huckleberry (*Vaccinium alaskaense*). Extensive fires in the Sitka Spruce Zone are rare due to heavy precipitation, frequent fog, and high fuel moisture. The scarcity of fire allows shallow-rooted, thin-barked, shade-tolerant tree species such as spruce, western hemlock, and western redcedar to dominate and to grow to enormous size. This zone also includes small, but biologically and culturally important coastal bogs and fens, known locally as "prairies" (NPS 2008a).

Western Hemlock 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. In the absence of major disturbances, western hemlock tends to dominate the canopy; however, much of the area is populated by subclimax Douglas-fir resulting from past fires or other disturbance. Common shrubs include salal, vine maple, Oregongrape (*Berberis nervosa*), red huckleberry, Alaska huckleberry, salmonberry, and rhododendron (*Rhododendron macrophyllum*). Fires occur more frequently in the Western Hemlock Zone than the Sitka Spruce Zone, and this favors the establishment and perpetuation of Douglas-fir, a fire-adapted species. Fire is the primary large-scale disturbance factor in this zone (NPS 2008a).

Douglas-fir Zone

This zone, dominated by Douglas-fir (*Pseudotsuga menziesii*), occupies the driest sites in the northeastern Olympics. Common shrubs include kinnikinnik (*Arctostaphylos uva-ursi*), Oregongrape, serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), baldhip rose (*Rosa gymnocarpa*), creeping snowberry (*Symphoricarpos mollis*), and salal. Stands in this dry zone have burned frequently in the past, and fire return intervals are among the shortest in the park (NPS 2008a).

Silver Fir Zone

This zone is located above the Western Hemlock Zone and below the Mountain Hemlock Zone. Common shrubs include Alaska huckleberry, red huckleberry, salmonberry, fool's huckleberry (*Menziesia ferruginea*), salal, and Oregongrape. The relatively cool, moist conditions of the Silver Fir Zone are less conducive to fire. Because of this, fires burning in the Western Hemlock Zone tend to go out when they reach the edges of the Silver Fir Zone except under extreme weather conditions (drought plus east wind). The infrequent fires that do occur are of high intensity (Agee 1993). Fires have burned rarely in this zone in the past 500 to 1,000 years, except in Silver Fir/Rhododendron (*Abies amabilis/Rhododendron macrophyllum*) and Silver fir/Rhododendron-Alaska Huckleberry (*Abies amabilis/Rhododendron macrophyllum-Vaccinium alaskaense*) plant associations, where frequent fires have occurred over the last 500 years (NPS 2008a).

Mountain Hemlock Zone

Found at upper elevations and particularly on wetter sites, the Mountain Hemlock Zone is known to grade into subalpine parkland in the upper portions of the zone. Winter snowpacks usually exceed 10 feet (3 m) in this zone. Common shrubs include Alaska huckleberry, oval-leaf huckleberry (*Vaccinium ovalifolium*), big huckleberry (*Vaccinium membranaceum),* white rhododendron (*Rhododendron albiflorum*), mountain ash (*Sorbus sitchensis*), fool's huckleberry, and red heather (*Phyllodoce empetriformis*). Many fires in this zone are limited by discontinuous fuels and high fuel moistures; however, when conditions are favorable, fires in this zone are characterized by erratic and unpredictable behavior and high severity (NPS 2008a).

Subalpine Fir Zone

This zone occurs at upper elevations also, but in only the drier parts of the Olympics such as the upper part of the Dungeness River. Snow accumulations are usually less than 10 feet (3 m). Vegetation patterns are characterized by tree

clumps interspersed with parkland and meadows. The fire return interval, averaging 208 years, is among the shortest on the Olympic Peninsula. Fire behavior and fire effects are similar to the Mountain Hemlock Zone. Fire is the primary large-scale disturbance in this zone, and tends to promote Douglas-fir and lodgepole pine in addition to subalpine fir. The harsh environment at upper elevations and the distance from seed sources can retard the reestablishment of trees in the Mountain Hemlock and Subalpine Fir Zones (NPS 2008a).

Subalpine Meadows

Subalpine heather/huckleberry meadows usually act as a barrier to the spread of fire, but under severe conditions may carry fire. Resprouting of heather or huckleberry may occur following fire. Meadows created by fire can persist for more than a century, as Olympic forests tend to fill in fire scars slowly, from the edges to the center. This contrasts with Rocky Mountain forests where fire scars are often quickly colonized by shade-intolerant trees such as aspen or lodgepole pine. Climate shifts to colder, wetter growing seasons favor tree establishment in burned subalpine meadows, while climate shifts to warmer, dryer growing seasons favor tree establishment in heather meadows (NPS 2008a).

Late Successional Old-growth

Old-growth forests are typically characterized as having trees older than approximately 200 years, abundant downed wood on the ground, a multi-layered canopy, and standing dead trees. Although much of the park consists of high-elevation forests and subalpine areas, there are significant areas of old-growth forests in the lowland valleys. Old-growth forests within the park are a key resource for plant and wildlife communities on the Olympic Peninsula. Many species dependent on old-growth forests are either absent or exist in greatly reduced densities outside the park where old growth is fragmented and sparse (NPS 2008a).

Vegetation Zones and Fire Return Intervals

Vegetation studies by Henderson et al. (1989) on the adjacent lands in Olympic National Forest, revealed that plant associations and vegetation zones correlate with patterns of past fire activity. They state, “In the cooler moister associations, fires appear to have been much less frequent than on drier or warmer types. An analysis of the reconstructed fire patterns showed that the Sitka Spruce, Silver Fir and Mountain Hemlock Zones had much less acres burned than the Western Hemlock, Subalpine Fir or Douglas-fir Zones. The fire return period for the Sitka Spruce, Mountain Hemlock and Silver Fir Zones were 900, 844 and 629 years respectively, and for the Western Hemlock, Subalpine Fir and Douglas-fir Zones they were 234, 208 and 138 years respectively (Henderson et al. 1989).

APPENDIX H – WILDLIFE SPECIES WITHIN THE PARK

It is estimated that there are approximately 300 avian, 65 mammalian, 13 amphibian, 29 freshwater fish, and 4 reptilian species on the Olympic Peninsula (NPS 2008a). The following paragraphs describe the wildlife species that are known to occur within the park.

Fish

Olympic National Park protects over 75 miles of Pacific Coast, 600 lakes, and 4,000 miles of rivers and streams that support some of the most extensive runs of wild salmon, trout, and char remaining in the Pacific Northwest. Through the management of fish and aquatic environments, the park works to preserve and restore native fish and their habitats (NPS 2018c). The park is home to more than 70 uniquely adapted local populations of salmonids, and numerous freshwater fish species, including: Puget Sound steelhead trout (*Oncorhynchus mykiss*), Crescenti cutthroat trout (*Oncorhynchus clarki clarki*), Puget Sound/Strait of Georgia coho salmon (*Oncorhynchus kisutch*), Hood Canal summer chum salmon (*Oncorhynchus keta*), Puget Sound pink salmon (*Oncorhynchus gorbushca*), Lake Ozette sockeye salmon (*Oncorhynchus nerka*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), Dolly Varden (*Salvelinus malma*), peamouth (*Mylocheilus caurinus*), mountain whitefish (*Prosopium williamsoni*), pygmy whitefish (*Prosopium coulteri*), Pacific lamprey (*Lampetra tridentatus*), river lamprey (*Lampetra ayersi*), western brook lamprey (*Lampetra richardsoni*), six species of freshwater sculpins, Olympic mudminnow (*Novumbra hubbsi*), threespine stickleback (*Gasterosteus aculeatus*), northern squawfish (*Ptychocheilus oregonensis*), longnose dace (*Rhinichthys cataractae*), speckled dace (*Rhinichthys osculus*), redside shiner (*Richardsonius balteatus*), eulachon (*Thaleichthys pacificus*), and longnose sucker (*Catostomus catostomus*). Additionally, the following nonnative fish species inhabit Olympic National Park waters: yellow bullhead (*Ictalurus natalis*), eastern brook trout (*Salvelinus fontinalis*), largemouth bass (*Micropterus salmoides*), and yellow perch (*Perca flavescens*) (NPS 2008a).

Federally listed fish

Bull Trout (*Salvelinus confluentus*): The Coastal-Puget Sound distinct population segment of bull trout was listed as threatened on December 1, 1999. Bull trout, members of the family Salmonidae, are char native to the Pacific Northwest and western Canada. In the park, Coastal-Puget Sound bull trout and/or Dolly Varden inhabit the Quinault, Queets, Hoh, upper Sol Duc, Elwha, Gray Wolf/Dungeness, and North Fork Skokomish River Basins.

The Coastal-Puget Sound bull trout distinct population segment encompasses all Pacific Coast drainage areas within the coterminous United States north of the Columbia River in Washington, including those flowing into Puget Sound. Thirty-four bull trout subpopulations exist in the Coastal-Puget Sound distinct population segment, with distributions and abundance thought to be declining (USFWS 1999). The designated sections of Olympic National Park include portions of the marine habitat in the coastal strip of the park, and numerous rivers and streams in or adjacent to the park, including the Elwha, Hoh, South Fork Hoh, North Fork Quinault, Quinault, North Fork Skokomish, Queets, and the Gray Wolf Rivers.

The status of bull trout as a threatened species is a result of a myriad of factors including habitat degradation and fragmentation from past and ongoing land management activities. Over-fishing and interspecies competition among introduced nonnative fish such as brook trout (*Salvelinus fontinalis*) and lake trout (*Salvelinus namaycush*) are also contributing factors in their decline (NPS 2003).

Bull trout primarily inhabit colder streams, although individual fish are often found in larger river systems (NPS 2003). Areas such as side channels, stream margins, and pools are frequently used by juvenile and adult bull trout, and are sensitive to activities that directly or indirectly affect stream channel stability or alter natural flow patterns. Altered stream flow in the fall may disrupt adult bull trout during the spawning period and channel instability may function to decrease egg and juvenile survival by disrupting substrate embeddedness during the winter and spring months (NPS 2003).

On the Olympic Peninsula, bull trout typically spawn from October to December during periods of decreasing water temperatures, with adult migratory bull trout beginning migratory routes as early as April.

Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*): The Puget Sound Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on May 24, 1999. The ESU encompasses all naturally spawned runs of Chinook salmon that occur below impassable natural barriers in the Puget Sound region from the North Fork Nooksack

River in northeastern Puget Sound to the Elwha River on the Olympic Peninsula. This ESU includes Chinook in the Elwha, Dosewallips, and Gray Wolf River Basins in the park. Hatchery Chinook in the Dungeness River (spring run) and Elwha River (fall run) also are considered part of the ESU. Additionally, land-locked Chinook that inhabit Lake Cushman and the North Fork Skokomish River Basin are included in the Puget Sound ESU (65 CFR 7764).

Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait, and the Strait of Juan de Fuca, to a straight line extending north from the west end of Freshwater Bay. Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Within fresh waters, the necessary habitat includes those areas with substrates suitable for egg deposition, juvenile feeding, sheltering, migratory pathways, and refugia.

Overall, abundance of Chinook salmon in this ESU has declined substantially from historical levels, and spring Chinook populations are chronically low in abundance. The Dungeness River has a 5-year geometric mean of 105 Chinook and the Elwha River has a 5-year geometric mean escapement of 1,800 adults (Myers et al. 1998). These populations are heavily augmented by hatchery supplementation.

Several anthropogenic factors such as habitat degradation, water diversions, harvest, and artificial hatchery supplementation along with various negative natural events (e.g., ocean conditions, weather patterns, and environmental variability) have served to adversely impact Chinook salmon populations. Abundance information, through 1997–1998, for 36 streams with available data in this ESU shows declines in estimated numbers. Of these streams, 10 showed positive trends; however, seven of these were heavily influenced by hatchery production (NPS 2003).

Chinook salmon in the Puget Sound ESU all exhibit an ocean-type life history (Myers et al. 1998). The ocean-type migrate to the sea during their first year of life, usually within 3 months of emergence, spend most of their life in coastal waters, then return to their natal streams in the fall only a few days to weeks prior to spawning (NPS 2003).

Lake Ozette Sockeye (*Oncorhynchus nerka*): Lake Ozette sockeye salmon were listed as threatened on March 25, 1999. The ESU includes all naturally spawned populations of sockeye salmon in Ozette Lake, Ozette River, Coal Creek, and other tributaries flowing into Ozette Lake. Within the park, critical habitat was designated for the Lake Ozette sockeye salmon in the Hoh/Quillayute Subbasin, in the Ozette River, and Ozette Lake and several of its tributaries including Umbrella Creek, Big River, Crooked Creek, North Fork Crooked Creek, and South Fork Crooked Creek.

Spawning in Lake Ozette generally occurs from mid-November through early February, and is currently restricted to submerged beaches where upwelling occurs along the shore. The Lake Ozette sockeye population comprises two spawning aggregates: a beach spawning component and a tributary spawning component. Beach spawning in the lake is distributed from the seasonally inundated upper littoral zone, down to a depth of 10 meters or more. The lake level fluctuates by about 3 meters from its low stage during the summer to its high stage in the winter. The entire beach spawning habitat for the population lies within the park.

At this time, just two beach spawning locations are used at a fraction of their historic extent, although a number of other locations around the lake are likely to have been important historically. Tributary spawning of sockeye occurs outside of the Olympic National Park boundary, primarily in the Umbrella Creek and Big River watersheds. The tributary population is supplemented through a hatchery program originally developed from the beach spawning component.

Puget Sound Steelhead Trout (*Oncorhynchus mykiss*): The Puget Sound steelhead was listed as threatened on June 11, 2007. The listing covers naturally spawned steelhead from river basins in the Puget Sound, Hood Canal, and the eastern half of the Strait of Juan de Fuca from the Elwha River east. They are found in the Elwha River and Graywolf River within the park.

In the park, in the Gray Wolf River, steelhead spawn primarily in the spring from February to late May. They may rear for up to 2 years prior to going to the ocean. They live in the ocean for 2 to 4 years before returning to spawn. They may spawn several times, though most only spawn once. According to NOAA, the principal factor for the decline of Puget Sound steelhead is the destruction, modification, or curtailment of its habitat or range. Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetlands and riparian habitat, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitat

in Puget Sound (NOAA 2007). In addition, NOAA concluded that ocean and climate conditions can have a profound impact on the continued existence of steelhead populations.

Mammals

Sixty-five mammal species live in the park, including Roosevelt elk (*Cervus elaphus roosevelti*), one of the main reasons the park was established. Other common mammals are the black-tailed deer (*Odocoileus hemionus columbianus*), black bear (*Ursus americanus*), marmot (*Marmota olympus*), and raccoon (*Procyon lotor*). More elusive mammals include the mountain lion (*Puma concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), beaver (*Aplodontia rufa*), river otter (*Lutra canadensis*), mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), spotted skunks (*Spilogale gracilis*), and a variety of other small mammal species such as moles, bats, and voles (NPS 2008a). The Douglas squirrel (*Tamiasciurus douglasii*) is common in subalpine areas (NPS 2008a).

Birds

Approximately 243 bird species use the park and adjoining coastal waters. Birds that are prevalent include American crow (*Corvus brachyrhynchos*), common raven (*Corvus corax*), varied thrush (*Ixoreus naevius*), American robin (*Turdus migratorius*), winter wren (*Troglodytes hiemalis*), Steller's jay (*Cyanocitta stelleri*), gray jay (*Perisoreus canadensis*), ruffed grouse (*Bonasa umbellus*), sooty grouse (*Dendragapus fuliginosus*), belted kingfisher (*Megaceryle alcyon*), and a variety of warblers, woodpeckers, kinglets, and sparrows (NPS 2008a).

Federally listed birds

Northern Spotted Owl (*Strix occidentalis caurina*): The northern spotted owl is listed as threatened under the ESA and as endangered in the state of Washington. 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 park's 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 Queets River corridor) contains about 494,000 acres of forested areas that are considered potential or suitable northern spotted owl habitat.

Characteristics of northern spotted owl habitat include moderate to high canopy closure, a multilayered, multispecies canopy dominated by large overstory trees; a high incidence of large trees with large cavities, broken tops, and other indications of decadence; numerous large snags; heavy accumulations of logs and other woody debris on the forest floor; and considerable open space within and beneath the canopy. For the purpose of analysis, northern spotted owl breeding season in Washington is broken into two periods: early breeding season is March 1 through July 15, and late breeding season is July 16 through September 30. Most pairs do not nest every year, nor are nesting pairs successful every year. Incubation lasts about 30 days and young leave the nest at about 5 weeks. After leaving the nest, young depend on their parents until they are able to fly and hunt on their own. During the first few weeks, the adults often roost with young during the night (NPS 2008a).

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 feet elevation on the west side of the park, or above 4,000 feet elevation on the east side of the park (USFWS 2008).

A 2014 workshop analyzed data collected from several demography studies conducted from 1990 to 2013. This analysis estimated a rangewide rate of population decline of 3.8% per year and a 3.9% annual decline for the Olympic Peninsula. NPS monitoring sites detected northern spotted owl pairs at three sites and single northern spotted owls at three sites, which represents the lowest number of sites with detections for any year of the study. Competition with the barred owl (*Strix varia*) appears to be the primary threat to the conservation of northern spotted owls in protected areas (Dugger et al. 2016; Gremel 2014).

Forested areas in the interior of the park represent the largest contiguous block of suitable nesting habitat remaining within the listed range of northern spotted owls. However, lower elevations of this habitat are being invaded and almost

exclusively used by nonnative barred owl, which displace northern spotted owls because they are slightly larger and more aggressive (NPS 2008a). Additionally, spotted owl habitat within the park has been lost due to the past development of roads, campgrounds, other facilities, and natural disturbances including windthrow and wildfire (USFWS 2008).

Marbled Murrelet (*Brachyramphus marmoratus*): The marbled murrelet is listed as a threatened species under the ESA, and as an endangered species by the State of Washington. This small seabird lives primarily in the near-shore marine environment, but nests in old-growth forests 50 or more miles inland. Suitable nesting habitat for murrelets consists of old-growth coniferous stands that are multilayered with moderate to high canopy closure.

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. Marbled murrelet will occasionally nest in younger stands if remnant large trees or deformities provide large enough limbs. Marbled murrelet nesting season is April 1 through September 23. Nestlings typically fledge in 27 to 40 days (NPS 2008a).

The park is located in two different marbled murrelet recovery zones (Zone 1: Puget Sound, and Zone 2: Western Washington Coast Range) with the line between the two zones bisecting the park from northwest to southeast (NPS 2008a). Approximately 453,000 acres of forested area within the park are considered suitable nesting habitat, representing the largest contiguous block of suitable nesting habitat remaining within the listed range of marbled murrelet in the lower 48 states. Inland surveys were conducted in the park according to Pacific Seabird Group Inland Survey protocol in all developed areas and in a sampling of backcountry valleys from 1995 to 1999 (Hall 2000). 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 biological assessment within the Rehabilitate Hurricane Ridge RoadEA, suitable habitat in the park is used more intensively than that surrounding the park (Hall 2000). Currently, no research on the marbled murrelet is being conducted in the park.

Similar to northern spotted owls, marbled murrelet habitat within the park has been lost due to past development of roads, campgrounds, and other facilities. Threats to marbled murrelets within the park are now associated with natural disturbances, such as wildfire and windthrow. Additional threats include corvid predation associated with human activities near developed areas.

Climate change will likely alter forest ecosystems as a result of the frequency, intensity, duration, and timing of disturbance factors such as fire, drought, introduced species, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, landslides, and flooding (Littell et al. 2010). Effects on the murrelet food supply (amount, distribution, quality) within the marine environment provide the most likely mechanism for climate change impacts to murrelets. Murrelet recovery may be affected as long-term trends in ocean conditions affect prey resources and murrelet reproductive rates (Becker and Beissinger 2006; Norris et al. 2007).

Reptiles and Amphibians

Reptiles present within the park include the northern alligator lizard (*Elgaria coerulea*), common garter snake (*Thamnophis sirtalis*), northwestern garter snake (*Thamnophis ordinoides*), and rubber boa (*Charina bottae*). Amphibians that may inhabit the park include the tailed frog (*Ascaphus* spp.), red-legged frog (*Rana aurora*), cascade frog (*Rana cascadae*), northwestern salamander (*Ambystoma gracile*), western red-backed salamander (*Plethodon vehiculum*), and Van Dyke's salamander (*Plethodon vandykei*) (NPS 2008a).

Invertebrates

Although information on invertebrates is limited, several rare butterfly taxa are known to occur in remnant coastal prairies (Rooses and Ahlstroms Prairies) within the park. These include the Makah copper (*Lycaena mariposa charlottensis*) and the Ozette skipper (*Ochlodes sylvanoides*), and the primary nectar source for these butterflies is the Douglas gentian (*Gentiana douglasiana*), a state sensitive-listed plant.

Several invasive and nonnative-invasive invertebrates affect vegetation in the park. Balsam woolly adelgid (*Adelges piceae*) is an introduced insect that has affected true firs (*Abies* spp.) in the park since 1970. Western black-headed budworm (*Acleris gloverana*) populations have waxed and waned since 1949. Mountain pine beetle (*Dendroctonous*

ponderosae) and silver fir beetle (*Pseudohylesinus sericeus*) have been mostly absent since 2000 (U.S. Department of Agriculture 2018).

Federally listed invertebrates

Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*): The Taylor's checkerspot butterfly is listed as endangered under the Endangered Species Act and as endangered in the state of Washington. This species was once found throughout native grasslands of the north and south Puget Sound, south Vancouver Island, and the Willamette Valley of Oregon. The historical range and the species abundance is not precisely known because exhaustive searches did not occur until recently. Northwest grasslands were formerly more widespread, larger, and interconnected—conditions that likely would have supported a greater distribution and abundance of Taylor's checkerspot. Before its decline, the Taylor's checkerspot was documented at more than 70 sites in British Columbia, Washington, and Oregon. These sites included coastal and inland grasslands (prairies) on southern Vancouver Island and islands in British Columbia and the San Juan Island archipelago, as well as open prairies on post-glacial gravelly outwash prairies and balds in Washington's Puget Trough and Oregon's Willamette Valley. In Oregon, there were 14 recorded sites from which this subspecies had been either collected or observed over the last century.

Today, the Taylor's checkerspot is extirpated (locally extinct but exists elsewhere) from British Columbia and all but two locales in the Willamette Valley. By 1989, fewer than 15 populations remained in the Pacific Northwest, and by October 2002, there were only four confirmed populations. At the time of listing in 2013, several new populations had been identified on the north Olympic Peninsula and there are now 11 known populations in Washington, one in British Columbia, and two in the Willamette Valley of Oregon.

Habitat requirements for the Taylor's checkerspot consist of open grasslands and native grass/oak woodland sites where abundant food plants are available for larvae and adult feeding. These sites include inland prairies on post-glacial, gravelly outwash, coastal bluffs, and balds. In Washington and Oregon, Taylor's checkerspot larvae feed on native plants from the broomrape (*Orobanchaceae*) family (*Castilleja hispida, C. levisecta, Tryphasaria*) in addition to the nonnative *Plantago lanceolata* and the native *Plantago maritima* of the *Plantaginaceae* family. Throughout the entire range of the Taylor's checkerspot, prairie habitat was historically maintained, in part, through frequent burning by American Indians.

The major limiting factors affecting the Taylor's checkerspot butterfly are related to the significant loss of suitable habitat that is largely due to agricultural and urban development, encroachment of trees, and spread of invasive plants which threaten the native grasslands in which the species is found. Pesticide use and recreational activities may pose a direct threat to the butterflies themselves. The impact of these threats has led to a smaller and smaller number of existing populations. Most of the remaining Taylor's checkerspot habitat patches are a considerable distance from one another, likely well beyond dispersal distance. Natural recolonization is unlikely as populations disappear, but captive breeding and reintroduction have been shown to be successful for creating new populations for the subspecies (USFWS 2018a).

Endemic Wildlife Species

The diversity of wildlife within the park includes several endemic species and subspecies. Endemic species include the Olympic marmot (*Marmota olympus*), Olympic yellow-pine chipmunk (*Tamias amoenus caurinus*), Olympic snow mole (*Scapanus townsendii olympicus*), Olympic pocket gopher (*Thomomys mazama melanops*), Olympic ermine (*Mustela ermine olympica*), Olympic torrent salamander (*Rhyacotriton olymicus*), and Olympic grasshopper (*Nisquallia olympica*) (NPS 2008a).

APPENDIX I – CULTURAL RESOURCES WITHIN THE PARK

Archeological Resources

The earliest systematic inventories at Olympic National Park started in the 1940s, with the first archeological surveys along the coast. The 1970s brought expanded archeological surveys to include areas other than the coast, such as river valleys and subalpine parklands, and inventory efforts have continued to identify cultural resources, including cultural landscapes and historic structures, and evaluate their importance. Approximately 1% of the park's lands have been surveyed, resulting in the identification of approximately 350 prehistoric and 300 historic-era archeological sites (NPS 2008a).

Archeological resources provide information associated with the broad patterns of our multicultural history. Prehistoric archeological resources are those human-made sites, structures, features, or objects that pre-date the arrival of Euro-Americans. These resources also precede the beginning of the written record in the area. Prehistoric site types located within the park include flaked stone tool scatters, campsites, shell midden deposits, petroglyph sites, and culturally modified trees. Flaked stone sites represent the most abundant class of prehistoric archeological resources in the park, located in the mountain and subalpine areas, as well as in river valleys and lowland prairies. Shell middens (the most visible site type in the park) and petroglyph sites are located mainly along the coast, and culturally modified trees have been documented within a variety of forested settings (NPS 2008a).

Prehistoric archeological resources, by definition, are synonymous with use of the area by American Indian populations of the Olympic Peninsula, distinguished by features such as highly developed woodworking technology, twined basketry, woolen and vegetable-fiber textiles, large dugout canoes, and permanent villages or towns built of plank houses.

There are currently eight federally recognized tribes associated with the Olympic Peninsula, including the Lower Elwha Klallam Tribe, the Jamestown S'Klallam Tribe, the Port Gamble S'Klallam Tribe, the Makah Tribe, the Quileute Nation, the Hoh Tribe, the Quinault Indian Nation, and the Skokomish Indian Tribe. At the time of historic contact, these tribes were largely based out of permanent villages located mostly along the shoreline and lowland areas. Oral history, ethnographic research, and archeological research have all demonstrated that American Indians also used the interior of the park for food gathering, travel, and cultural purposes. This use goes back at least 12,000 years in the interior (NPS 2017) and includes all ecological zones of the park.

Historic-era archeological resources are those human-made sites, structures, features or objects, which date from the time of the arrival of Euro-Americans up until the middle of the twentieth century (i.e., at least 50 years of age). Historic-era archeological sites can include the remnants of American Indian-associated structures and places, but most often they are associated with the Euro-American settlement era. Starting in the mid-1850s, Euro-American explorers and settlers began to enter the area (NPS 2008a). Settlement of the coastal areas and lowlands on the Olympic Peninsula began in the 1850s, coinciding with the beginnings of the early timber and mining industries. Military expeditions were launched, and many of the place names for rivers, canyons, valleys, and mountains are due to these explorers, as are portions of the trails they blazed, now part of the current park trail system. Remnants of homesteads, as well as logging and mining operations, and trash dumps can be found throughout areas of the park, representing the early Euro-American settlement of the park. Approximately 300 historic-era archeological sites have been identified in the park from historical maps and documents, but many have not been formally documented or evaluated (NPS 2008a).

Olympic National Park's *Archeological Research Design* (NPS 1988) provides a general context and guidance for evaluating the park's archeological resources.

Ethnographic Resources

Ethnographic resources combine elements of cultural and natural resources values. The distinction traditionally made by agency managers between cultural and natural resources will not apply when discussing ethnographic resources because natural and cultural resources are viewed as being inextricably enmeshed from an ethnographic perspective. The NPS reports approximately 1,100 ethnographic sites within the park boundary. These areas may have had, or still have, important meaning to cultural groups. Areas located within the park that can be described as ethnographic resources include cultural features including archeological sites, village sites, campsites, gravesites, as well as natural features like vistas, glaciers, and rivers. They may also include structures, features, objects, or landscapes that may be used by the group, and often include plant and animal communities, as well as ceremonial or subsistence grounds as gathering areas (NPS 1994).

Ethnographic resources are valued by traditional societies beyond the scientific data or important information they contain. Collectively, these resources, including archeological sites, prehistoric and historically used trails and routes, springs, and gathering areas, form traditional landscapes that maintain cultural associations for a group of people. While physical manifestations may have disappeared over time, traditional association and cultural importance may remain. Park ethnographic studies have found that the Olympic Peninsula and its waters are crucial for subsistence activities as well as important as "a place of power and identity" for associated American Indian groups (NPS 2008a:207). The NPS continues to consult with the associated tribes to learn more about traditional and ethnographic resources and how to preserve them.

Native plant communities on a natural landscape are central to traditional tribal activities, and the park has researched the relationship of Native practices to the overall health of the ecosystem (NPS 2008a). Fire and fire management have important ties to ethnographic resources as traditionally associated groups used fire to maintain certain landscapes for a variety of cultural purposes.

Olympic National Park's Ethnographic Overview and Assessment (NPS 1997) provides guidance for identifying and evaluating the park's ethnographic resources.

Historic Resources (Structures)

Historic structural resources are those that are at least 50 years of age and do not qualify as archeological properties (that is, they are intact and are not in a state of ruin). All historic resources in which the NPS has a legal interest are to be managed as cultural resources, and are to receive full consideration for historical value whenever a decision is made that might affect the resource integrity (NPS 2008a).

The last years of the nineteenth century and those of the early twentieth century brought the area under the jurisdiction of the Forest Reserves (later the USFS), and the recreational development of the Olympic Peninsula. The USFS constructed communications sites, ranger stations, fire lookouts, and trails to facilitate better land management. One of the most important routes of this integrated system was the Elwha-Quinault route, a natural north-to-south route crossing the low divide between the Elwha River and the North Fork of the Quinault River (NPS 2008a). In addition to mountaineering and hiking, other recreational activities grew in popularity in the early 20th century as resorts were built, offering visits to the natural hot springs found along the Sol Duc and Elwha Rivers (NPS 2008a).

Historic resources associated with early Euro-American settlement and exploration of the park include settlers' cabins and outbuildings, planted trees, Civilian Conservation Corps-era community kitchens and campgrounds, ranger stations, shelters, guard stations, fire lookouts, and other buildings and structures related to USFS and NPS management. Recreational resorts and cabins, like the Rosemary Inn, Lake Crescent Lodge, and Wendell Cabin, as well as wilderness and trail shelters, are also part of the historic landscape. Other important historic resources include hydroelectric dams, an airfield, roads and trails, and post-World War II homes and structures.

There are currently 119 historic structures located within the park boundary that are on the List of Classified Structures, of which 40 are located within designated wilderness (including 16 shelters) (NPS 2008a).

Cultural Landscapes

NPS defines a cultural landscape as a geographic area, including cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values. Cultural landscapes are essentially settings that human activity has shaped in the natural world, reflecting the relationships between people and the land. There are four general types of cultural landscapes: historic designed landscapes; historic vernacular landscapes; historic sites; and ethnographic landscapes (NPS 1994).

Cultural landscapes comprise cultural resources, including archeological sites, historic buildings and structures, and ethnographic resources. Most historic properties have a cultural landscape component that is integral to the significance of the resource (NPS 1994). Although the park has documented some cultural landscapes, documentation, evaluation, and registration of all 31 cultural landscapes identified in the park is not yet complete. Two cultural landscape studies have been completed (in 1984 and 1987), summarizing four cultural landscapes in the park including Lake Crescent Lodge, Rosemary Inn, park headquarters, and Humes Ranch (homestead) (NPS 2008a). Park headquarters, Graves Creek Ranger Station, Rosemary Inn, and Lake Crescent Lodge have been documented and have completed certified cultural landscape inventories. Other cultural landscapes include Roose's Homestead, Enchanted Valley Chalet, Olympus Guard Station, Olympic Hot Springs Resort and Campground, the USFS trail system, and several others. Appendix E of NPS (2008a) provides a list of all 31 cultural landscapes identified in the park.

APPENDIX J - CONSULTATION AND COORDINATION

The NPS has taken several steps to coordinate and consult with local governments, federally recognized tribes, and state and federal agencies.

Letters will be sent to the following parties during the Draft EA public review period to inform them of the revised Fire Management Plan and to solicit input in the environmental compliance process.

- Washington SHPO
- Lower Elwha Klallam Tribe
- Jamestown S'Klallam Tribe
- Port Gamble S'Klallam Tribe
- Makah Tribe
- Quileute Nation
- Hoh Tribe
- Quinault Indian Nation
- Skokomish Indian Tribe.

On February 20, 2018, NPS submitted the Programmatic Biological Assessment (BA) for the park's General Management Plan, which included a section for fire management, to the USFWS identifying potential effects to marbled murrelet, northern spotted owl, and bull trout.

On December 10, 2018, NPS submitted a revised BA to NMFS and USFWS identifying potential effects federally listed species and critical habitat (Table J.1). EFH is present for Pacific Coast salmon, and this information was also included in the BA.

Table J.1. Federally listed species identified for Endangered Species Act Section 7 consultation with USFWS and NMFS

Species	Status	Critical Habitat Status
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Designated: none in action area
Northern spotted owl (*Strix occidentalis*)	Threatened	Designated: none in action area
Bull trout (*Salvelinus confluentus*)	Threatened	Designated: present in action area
Puget Sound Chinook salmon (*Oncorhynchus tshawytscha)*	Threatened	Designated: present in action area
Puget Sound Steelhead trout (*Oncorhynchus mykiss*)	Threatened	Designated: present in action area
Lake Ozette sockeye salmon (*Oncorhynchus nerka*)	Threatened	Designated: present in action area
Taylor's checkerspot butterfly (*Euphydryas editha taylori*)	Endangered	Designated: present in action area

Coordination with USFWS, NMFS, and the NPS is ongoing.

APPENDIX K – REFERENCES AND LITERATURE CITED

Agee, J.K.
1993 *Fire Ecology of Pacific Northwest Forests*. Washington, D.C.: Island Press.

1994 An Analysis of Catastrophic Forest Disturbance on the Olympic Peninsula. Unpublished report prepared for Rayonier Inc., Hoquiam, WA.

2005 *The Complex Nature of Mixed-Severity Fire Regimes*. Available at: https://www.ltrr.arizona.edu/~ellisqm/outgoing/dendroecology2014/readings/Agee2005.pdf. Accessed December 5, 2018.

Agee, J.K., and R. Flewelling
1983 A fire cycle model based on climate for the Olympic Mountains, Washington. *Fire and Forest Meteorology Conference Proceedings* 7:32–37.

Agee, J.K., and M.H. Huff
1987 Fuel succession in a western hemlock/Douglas-fir forest. Reprinted from *Canadian Journal of Forest Research* 17(7):697–704.

Ammann, H., R. Blaisdell, M. Lipsett, S.L. Stone, and S. Therriault
n.d. [ca. 2002] *Wildfire Smoke A Guide for Public Health Officials*. Available at: http://www.arb.ca.gov/smp/progdev/pubeduc/wfgv8.pdf. Accessed May 20, 2018.

Becker, B.H., and S.R. Beissinger
2006 Centennial decline in the trophic level of an endangered seabird after fisheries decline. *Conservation Biology* 20(2):470-479.

Boyd, R.
1999 *Indians, Fire and Land in the Pacific Northwest*. Corvallis: Oregon State University Press.

Broyles, G., C.R. Butler, C.A. Kardous
2017 Noise exposure among federal wildland fire fighters. *Journal of the Acoustical Society of America* 141 (2). Available at: https://asa.scitation.org/doi/pdf/10.1121/1.4976041. Accessed May 30, 2018.

California Air Resources Board
2003 Air Quality and the Wildland Fires of Southern California October, 2003. A preliminary review of particulate matter, air toxics, and carbon monoxide.

Department of Ecology
2018 State of Washington. Determining if areas in Washington meet national air quality standards. Available at: https://ecology.wa.gov/Regulations-Permits/Plans-policies/Areas-meeting-and-not-meeting-air-standards. Accessed May 30, 2018.

Dugger, K.M., E.D. Forsman, A.B. Franklin, R.J. Davis, G.C. White, C.J. Schwarz, K.P. Burnham, J.D. Nichols, J.E. Hines, C.B. Yackulic, P.F. Doherty, Jr., L. Bailey, D.A. Clark, S.H. Ackers, L.S. Andrews, B. Augustine, B.L. Biswell, J. Blakesley, P.C. Carlson, M.J. Clement, L.V. Diller, E.M. Glenn, A. Green, S.A. Gremel, D.R. Herter, J.M. Higley, J. Hobson, R.B. Horn, K.P. Huyvaert, C. McCafferty, T. McDonald, K. McDonnell, G.S. Olson, J.M. Eilers, C.L. Rose, and T.J. Sullivan

1994 *Final Report- Status of Air Quality and Effects of Atmospheric Pollutants on Ecosystems in the Pacific Northwest Region of the National Park Service*. Air Quality Division National Park Service.

Fire Executive Council

2009 Guidance for Implementation of Federal Wildland Fire Management Policy. Available at: https://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf. Accessed July 3, 2018.

Franklin, J.F., and T.A. Spies

1991 Composition, function, and structure of old-growth Douglas-fir forests. In *Wildlife and Vegetation of Unmanaged Douglas-fir Forests*, edited by L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M.H. Huff, pp. 71–80. USDA Forest Service General Technical Report PNW-GTR-285.

Fryer, J.L., and P.S. Luensmann, compilers

2012 Fire regimes of the conterminous United States [Online]. In *Fire Effects Information System (FEIS)*. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at: www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html. Accessed May 30, 2018.

Gremel, S.

2014 *Spotted Owl Monitoring in Olympic National Park: 2014 Annual Report*. Prepared by NPS Olympic National Park. Available at: https://reo.gov/monitoring/reports/nso/OLY%20NPS%20nso%20demog%20annual%20repor t%202014.pdf. Accessed May 2108.

Haas, G.E., and T.J. Wakefield

1998 *National Parks and the American public: A Summary Report of the National Parks Conservation Association*. Fort Collins: Colorado State University.

Hall, S.L.

2000 Land Management Strategies and Marbled Murrelet Occurrence on the Olympic Peninsula, WA. M.S. thesis, University of Washington, Seattle.

Hardy, C.C., R.D. Ottmar, J.L. Peterson, J.E. Core, and P. Seamon

2001 *Smoke Management Guide for Prescribed and Wildland Fire*: 2001 edition. PMS 420-2. NFES 1279. Boise, ID: National Wildfire Coordinating Group.

Henderson, J.A., D.H. Peter, R.D. Lesher, and D.C. Shaw

1989 *Forested Plant Associations of the Olympic National Forest*. USDA Forest Service, Pacific Northwest Region.

Huff, M.H.

1984 *Post-Fire Succession in the Olympic Mountains, Washington: Forest Vegetation, Fuels, and Avifauna.* Seattle: University of Washington.

Huff, M.H., and J.K. Agee

1980 Characteristics of large lightning fires in the Olympic Mountains, Washington. *Fire and Forest Meteorology Conference Proceedings* 6:117–123.

International Code Council

2015 *International Urban-Wildland Interface Code*. Available at: http://shop.iccsafe.org/media/wysiwyg/material/3850X12-toc.pdf.

Landres, P., C. Barns, S. Boutcher, T. Devine, P. Dratch, A. Lindholm, L. Merigliano, N. Roeper, and E. Simpson
2015 *Keeping It Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*. General Technical Report RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Available at: https://www.wilderness.net/toolboxes/documents/WC/Keeping%20It%20Wild%202,%20GTR-340.pdf.

Lee, C., and J. MacDonald
2016 *Olympic National Park: Acoustical Monitoring 2010*. Natural Resource Report NPS/NRSS//NSNSD/NRR—2016/1310. Fort Collins, CO: National Park Service.

Littell, J.S., E.E. Oneil, D. McKenzie, J.A. Hicke, J.A. Lutz, R.A. Norheim, and M.M. Elsner
2010 Forest ecosystems, disturbances, and climatic change in Washington State, USA. *Climatic Change* 102:129–158.

Lynch, E., D. Joyce, and K. Fristrup
2011 An assessment of noise audibility and sound levels in U.S. National Parks. *Landscape Ecology* 26:1297–1309. Available at: http://www.soundandlightecologyteam.colostate.edu/pdf/landscapeecology2011b.pdf. Accessed May 10, 2018.

McCusker, V., and K. Cahill
2009 Integrating Soundscapes into National Park Service Planning. In *Park Science Special Issue: Soundscapes Research and Management* 26(3):37–42. Available at: https://www.nature.nps.gov/ParkScience/archive/PDF/ParkScience26(3)Winter2009-2010.pdf. Accessed May 10, 2018.

McDonald, C.D., R.M. Baumgartner, and R. Iachan
1995 *Aircraft Management Studies*. USDI Report 94-2. Denver, CO.

Miller, C.
2018 Christina Miller, Planning and Compliance Lead, Olympic National Park, email communication to Coleman Burnett, SWCA Environmental Consultants, May 16, 2018.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples
1998 Status review of chinook salmon from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-35.

National Marine Fisheries Service
2007 *Puget Sound Salmon Recovery Plan*. Available at: http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/puget_sound/chinook/pugetsoundchinookrecoveryplan_wo_exec_summary.pdf. Accessed May 30, 2018.

National Oceanic and Atmospheric Administration (NOAA)
2007 Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead. *Federal Register*. 50 CFR Part 223. May 11, 2007.

National Park Service (NPS)
1988 *The Evolution and Diversification of Native Land Use Systems on the Olympic Peninsula: A Research Design*. Prepared by Randall Schalk, University of Washington, Institute for Environmental Studies. Port Angeles, WA: U.S. Department of the Interior, National Park Service, Olympic National Park.

1994 *Preservation Brief No. 36—Protecting Cultural Landscapes: Planning, Treatment, and Management of Historic Landscapes.* Washington, D.C.: U.S. Department of the Interior, National Park Service, Cultural Resources, Preservation Assistance Division.

1997 *Olympic National Park Ethnographic Overview and Assessment.* Port Angeles, WA: U.S. Department of the Interior, National Park Service, Olympic National Park.

2003 *Olympic National Park Fire Management Plan EA*. Port Angeles, WA: U.S. Department of the Interior, National Park Service, Olympic National Park.

2004 *Reference Manual 77: Natural Resource Management*. Available at: https://www.nature.nps.gov/rm77/.

2005 *Olympic National Park Fire Management Plan*. Port Angeles, WA: U.S. Department of the Interior, National Park Service, Olympic National Park.

2006 Chapter 6: Wilderness Preservation and Management. In *NPS Management Policies 2006: The Guide To Managing the National Park System.* Available at: https://www.nps.gov/subjects/wilderness/upload/2006_WildernessManagementPolicies.pdf. Accessed May 21, 2018.

2008a *Olympic National Park General Management Plan.* Port Angeles, WA: Olympic National Park. Available at: https://parkplanning.nps.gov/projectHome.cfm?projectID=10233. Accessed May 10, 2018.

2008b Director's Order #18: Wildland Fire Management. Effective January 16, 2008. Available at: https://www.nps.gov/policy/DOrders/DO_18.pdf. Accessed May 30, 2018.

2010 *Olympic National Park Long-Range Interpretive Plan*. Prepared by Harpers Ferry Center for Interpretive Planning, National Park Service. Available at: https://www.nps.gov/olym/learn/management/upload/2011-02-07-OLYM-FinalDocument.pdf.

2014a *Reference Manual 18: Wildland Fire Management*. U.S. Department of the Interior, National Park Service, Branch of Wildland Fire, Division of Fire and Aviation. Available at: https://www.nps.gov/fire/wildland-fire/about/nps-reference-manual-18.cfm.

2014b *Climate Change Resource Brief: Recent Climate Change Exposure of Olympic National Park.* Available at: https://irma.nps.gov/DataStore/DownloadFile/497286. Accessed May 2018.

2015a *National Park Service NEPA Handbook*. Washington, D.C.

2015b Olympic Fun Facts. Olympic National Park website. Available at: https://www.nps.gov/olym/learn/management/olympic-fun-facts.htm. Accessed October 28, 2015.

2017 *Foundation Document Olympic National Park, Washington*. September 2017.

2018a NPS Park Conditions and Trends, Olympic National Park–Air Quality. Available at: https://www.nps.gov/subjects/air/park-conditions-trends.htm. Accessed May 7, 2018.

2018b Guidelines for the Treatment of Cultural Landscapes. Available at: https://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm. Accessed May 2018.

2018c Fishing in Olympic National Park. Available at: https://www.nps.gov/olym/planyourvisit/fishing.htm. Accessed May 2018.

2018d *Final Environmental Impact Statement for the Olympic National Park Mountain Goat Management Plan*. Available at: https://parkplanning.nps.gov/document.cfm?parkID=329&projectID=49246&documentID=87542. Accessed May 30, 2018.

2018e National Park Service Visitor Use Statistics- Olympic National Park. Available at: https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=OLYM. Accessed May 8, 2018.

2019 Olympic National Park Fire History Spreadsheet. Provided by Todd Rankin, Interagency Fire Management Officer for National Park Service, U.S. Fish and Wildlife Service, and Olympic National Forest. In project file.

National Wildfire Coordinating Group
2013 *Wildland Fire Incident Management Field Guide.* Available at: https://www.nifc.gov/nicc/logistics/references/Wildland%20Fire%20Incident%20Management%20Field%20Guide.pdf.

2017 *Interagency Prescribed Fire Planning and Implementation Procedures Guide*. PMS 484. Available at: https://www.nwcg.gov/sites/default/files/publications/pms484.pdf. Accessed May 2018.

Newman, P., R.B. Manning, and K. Trevino
2009 From the Guest Editors: From landscapes to soundscapes: Introduction to the special issue. In *Park Science* 26(3). Winter 2009-2010. Available at: https://www.nature.nps.gov/ParkScience/archive/PDF/ParkScience26(3)Winter2009-2010.pdf. Accessed May 10, 2018.

Nikolov, N.
n.d. [ca. 2007] *Impact of Wildland Fires and Prescribed Burns on Ground Level Ozone Concentration: Review of Current Science Concepts and Analytical Approaches*. Fort Collins, CO: Rocky Mountain Center for Advanced Modeling of Meteorology and Smoke. Available at: https://www.nifc.gov/smoke/documents/Impact_Wildland_fire_on_Ozone.pdf. Accessed May 2018.

Norris, D.R., P. Arcese, D. Preikshot, D.F. Bertram, and T.K. Kyser
2007 Diet reconstruction and historic population dynamics in a threatened seabird. *Journal of Applied Ecology* 44(4):875–884.

Perry, R.W.
2011 Proceedings of the 4th Fire in Eastern Oak Forests Conference. 2011 May 17-19; Springfield, MO. General Technical Report NRS-P-102. Hot Springs, Arkansas: U.S. Department of Agriculture, Forest Service, Southern Research Station.

Rabin, L.A., R.G. Coss, and D.H. Owings
2006 The effects of wind turbines on antipredator behavior in California ground squirrels (*Spermophilus beecheyi*). *Biological Conservation* 131:410–420.

Rankin, T.
2018 Todd Rankin, Interagency Fire Management Officer, National Park Service, email communication to Coleman Burnett, SWCA Environmental Consultants, April 29, 2018.

Rinne, J.N., and G. Jacoby
2005 Aquatic biota, fishes, invertebrates. In *Wildland Fire in Ecosystems: Effects of Fire on Soils and Water* (revised 2008), edited by D.G. Neary, K.C. Ryan, and L.F. DeBano, pp. 135–143. General Technical Report RMRS-GTR-42-vol.4. Ogden, Utah: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Rochester, C.J., C.S. Brehme, D.R. Clark, D.C. Stokes, S.A. Hathaway, and R.N. Fisher
2010 Reptile and amphibian response to wildfires in southern California. *Journal of Herpetology* 44(3):333–351.

Ryan, K.C., A.T. Jones, C.L. Koerner, and K.M. Lee
2012 *Wildland Fire in Ecosystems: Effects of Fire on Cultural Resources and Archeology*. General Technical Report RMRS-GTR-42-vol. 3. Fort Collins, CO: U.S. Department of Agriculture, Forest Service. Available at: http://www.fs.fed.us/rm/pubs/rmrs_gtr042_3.html. Accessed May 2018.

Sandberg, D.V., R.D. Ottmar, J.L. Peterson, and J. Core
2002 *Wildland Fire on Ecosystems: Effects of Fire on Air*. General Technical Report RMRS-GTR-42-vol. 5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann, and D.L. Bunnell
2002 *Development of Coarse-Scale Spatial Data for Wildland Fire and Fuel Management*. General Technical Report RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.
Schweizer, D., and R. Cisneros

2014 Wildland fire management and air quality in the southern Sierra Nevada: Using the Lion Fire as a case study with a multi-year perspective on PM2.5 impacts and fire policy. *Journal of Environmental Management* 144:265–278.

Shannon, G., M.F. McKenna, L.M. Angeloni, K.R. Crooks, K.M. Fristrup, E. Brown, K.A. Warner, M.D. Nelson, C. White, J. Briggs, S. McFarland, and G. Wittemyer
2016 A synthesis of two decades of research documenting the effects of noise on wildlife. *Biological Reviews* 91(4):982–1005. Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/brv.12207. doi: 10.1111/brv.12207.

Union of Concerned Scientists
2018 Coal and Air Pollution. Available at: https://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/coal-air-pollution#.WxQfCaaWw2w. Accessed May 2018.

U.S. Department of Agriculture (USDA)
2018 Olympic National Park Forest Health Advisory. Available at: https://foresthealth.fs.usda.gov/fhas/CreateAdvisory/1/328. Accessed May 30, 2018.

U.S. Department of the Interior and U.S. Department of Agriculture (DOI and USDA)
2009 *Guidance for Implementation of Federal Wildland Fire Management Policy*. Available at: https://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf. Accessed May 18, 2018.

2018 *Interagency Standards for Fire and Fire Aviation Operations*. NFES 2724. Available at: https://www.nifc.gov/PUBLICATIONS/redbook/2018/RedBookAll.pdf.

U.S. Environmental Protection Agency
1996. Areas Affected by PM-10 Natural Events. Memorandum signed 5-30-1996. Available at: https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19960530_nichols_pm10_natural_events.pdf. Accessed August 2018.

1998 *Interim Air Quality Policy on Wildland and Prescribed Fires*. Research Triangle Park, NC: Office of Air Quality Planning and Standards.

2018 NAAQS Table. Available at: https://www.epa.gov/criteria-air-pollutants/naaqs-table. Accessed May 2018.

U.S. Fish and Wildlife Service (USFWS)
1999 Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the coterminous United States. *Federal Register* 64(210):58910–58933.

2008 *Final Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina).* U.S. Fish and Wildlife Service, Portland, Oregon.

2018a Taylor's Checkerspot Butterfly. Washington Fish and Wildlife Office. Available at: https://www.fws.gov/wafwo/articles.cfm?id=149489655. Accessed May 2018.

2018b Species Profile for Dolly Varden (*Salvelinus malma*). Available at: https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E09Z. Accessed May 30, 2018.

Urbanski, S.P., Wei Min Hao, and S. Baker
2009 Chapter 4: Chemical Composition of Wildland Fire Emissions. In *Developments in Environmental Science*, Volume 8, edited by M. Bytnerowicz, M. Arbaugh, A. Riebau, and C. Andersen. Available at: https://www.nifc.gov/smoke/documents/Chem_Comp_Wildland_Fire_Emissions.pdf. Accessed August 24, 2017.

Van Ormer, C., M. Littlejohn, and J. Gramann
2001 *Olympic National Park Visitor Study, Summer 2000*. Visitor Services Project Report 121. Moscow: University of Idaho Cooperative Park Studies Unit. Available at: https://www.nps.gov/olym/learn/management/upload/onpvisitorstudy2000.pdf.

Ware, H.E., C.J.W. McClure, J.D. Carlisle, and J.R. Barber
2015 A phantom road experiment reveals traffic noise is an invisible source of habitat degradation. *Proceedings of the National Academy of Sciences of the United States of America* 112:12105–12109.

Washington Department of Fish and Wildlife
2018 Salmon/Steelhead Species Information. Available at: https://wdfw.wa.gov/fishing/salmon/pink.html. Accessed May 30, 2018.

Washington State Department of Natural Resources (DNR)
1998 *Smoke Management Plan*. 1993, Rev. 1998. Available at: https://www.dnr.wa.gov/publications/rp_burn_smptoc.pdf?o24ew. Accessed May 7, 2018.

Weinzimmer D., P. Newman, D. Taff, J. Benfield, E. Lynch, and P. Bell
2014 Human responses to simulated motorized noise in national parks. *Leisure Sciences* 36:251–267. Doi 10.1080/01490400.2014.888022.

Wetzel, S.A., and R.W. Fonda
2000 Fire history of Douglas-fir forests in the Morse Creek drainage of Olympic National Park, Washington. *Northwest Science* 74(4):263–279.

Wood, L.
2015 *Acoustic Environment and Soundscape Resource Summary, Olympic National Park*. NPS Natural Sounds and Night Skies Division. Available at: https://irma.nps.gov/DataStore/Reference/Profile/2225861.