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# Abbreviations

| | |
|---|---|
| BWCAW | Boundary Waters Canoe Area Wilderness |
| EIS | Environmental impact statement |
| ASL | At sea level |
| FSM | Forest Service Manual |
| NEPA | National Environmental Policy Act |
| PSD | Plastic sphere dispenser |

# 1. Introduction

## 1.1 Background

The Boundary Waters Canoe Area Wilderness (BWCAW) is the most heavily visited wilderness in terms of over-night use. Encompassing over 1,000,000 acres of woods and lake country in northern Minnesota on the Superior National Forest, the wilderness extends from Lake Superior in the east to Voyageurs National Park in the west. Quetico Provincial Park also borders it to the north. The natural features and opportunities for continuous recreation provide days or weeks of unique, uninterrupted wilderness travel.

Wildfire has played the role of natural disturbance in the boreal forest ecosystem in the BWCAW. Pre-settlement fire rotations are estimated to be every 50 to 100 years for the majority of the BWCAW. However, management policies that exclude fire have been in place since 1911. The relatively recent natural prescribed fire program, called "Wildland Fire Use," did not return the Wilderness to a natural fire regime. The exclusion of fire has established a 500-year burning cycle that has resulted in an unnatural perpetuation of maturing forest and accumulation of fuel for wildfires.

### The July 4th 1999 blowdown resulted in an increased risk of wildfire exiting the BWCAW

On July 4, 1999, a massive wind- and rainstorm hit the BWCAW, affecting approximately 367,000 acres in the Wilderness. This storm was an extreme weather event and one of the largest blowdowns ever recorded in North America (Frelich 2000). The storm left heavy fuel loads in the form of downed trees on federal and non-federal land in and around the BWCAW. Fuel loads on the forest floor increased from 5 to 20 tons per acre to 50 to 100 tons per acre over many thousands of acres in the Wilderness.

It is likely that lightning strikes will be more successful at igniting wildfires in the blowdown, and fires that do start are more likely to become plume-dominated fire that exhibit extreme fire behavior. Furthermore, because of expected fire intensities and flame lengths in these heavy fuels, fires will be much more difficult to control over a wider range of weather conditions. Because of the high fuel density, the higher fire-spread rate expected under moderate fire weather conditions, the potential for plume-dominated fire, and the difficulty in controlling wildfires in blowdown, it is expected that fires will be larger than prior to the blowdown and may occur under more moderate weather conditions than before (Leuschen et al. 2000).

A path of heavy, continuous fuels extends from the Wilderness to areas at risk outside of the BWCAW. There is an increased risk that wildfire will exit the Wilderness and threaten lives and property outside the BWCAW.

## The elevated risk of a wildfire exiting the BWCAW would likely remain for a number of years

The Forest and other landowners have been reducing fuels with salvage harvesting and prescribed burning in high-risk areas. The Forest has focused its efforts on critical areas around homes, cabins, and businesses. Even with these fuel reduction activities being implemented, the risk of wildfire spreading from the Wilderness still remains at a higher than normal level.

Under natural decay processes, dead and down woody fuel currently on the forest floor would most likely not return to pre-blowdown conditions for 15 years or more in hardwood stands and 30 or more years in conifer stands (Spaulding and Hansbrough 1944). It is highly likely that fire would occur in many of these areas before the downed materials have completely decayed.

## Purpose and Need for Action

The Superior National Forest has prepared a final environmental impact statement (EIS) and issued a Record of Decision for treating fuel in the BWCAW. The Forest Service will treat the downed fuel in the Wilderness with prescribed burning. The primary purpose and need for this action is to improve public safety by reducing the potential for high-intensity wildland fires to spread from the BWCAW into areas of intermingled ownership, which have homes, cabins, resorts, and other improvements. Wildland fires could also cross the international border and move into Canada.

The project will be implemented in a manner that is sensitive to ecological and wilderness values and in a way that protects fire personnel and BWCAW visitor safety during implementation. To implement the proposed action, an Amendment to the Superior National Forest Land

and Resource Management Plan will be required to allow management-ignited fires (also called "prescribed fires") in the BWCAW.

Potential effects of five alternatives for treating fuel are disclosed in the Final EIS prepared by the Forest. The BWCAW Fuel Treatment Final EIS analyzes fuel treatment strategies for reducing fuel concentrations that threaten lives and property outside the BWCAW. It discusses all of the environmental effects of alternative methods for treating fuel in the BWCAW. The Record of Decision describes the Forest Supervisor's decision to implement Modified Alternative B from the Final EIS (the Selected Alternative). The Final EIS examines the equipment that would be used to implement the prescribed burns, however it does not meet the requirements of the Minimum Requirement and Minimum Tool Analysis. The purpose of the Minimum Tool Analysis is to analyze tool use more closely. The Minimum Requirement and Minimum Tool Analysis is a part of the project file for the Final EIS.

## Wilderness Values

The National Wilderness Preservation Act of 1964 defined wilderness as an area of undeveloped, federally owned land designated by Congress. It is affected primarily by the forces of nature, where people are visitors and do not remain. It may contain ecological, geological, or other features of scientific, educational, scenic, or historical value. Wilderness areas are large enough so that continued use will not change its unspoiled natural condition. The four major wilderness attributes described by the Wilderness Act (1964) are the following:

- ***Natural Integrity*** – The degree that an area's long-term ecological processes are intact and operating.
- ***Apparent Naturalness*** – The degree to which human impacts are apparent to most visitors.
- ***Outstanding Opportunities for Solitude*** – The opportunity to be isolated from the sights, sounds, and presence of others from the developments and evidence of humans.
- ***Outstanding Opportunities for Primitive Recreation*** – The opportunity for isolation from the evidence of humans, vastness of scale, feeling a part of the natural environment, having a high degree of challenge and risk, and using outdoor skills.

Wilderness areas are also important for their scientific and cultural resource values. They preserve remnants of natural, ecological systems that function with minimum influence from humans. They can serve as reservoirs of biological and genetic material for the future needs of humans. Archaeological and historical sites are also a unique and nonrenewable part of the wilderness resource. Wilderness provides an opportunity to view these remnants in a natural setting.

## 1.2 What You will Find in This Document

This document and analysis were prepared by following the *Minimum Requirement Decision Guide* developed by the Arthur Carhart National Wilderness Training Center. The agencies that manage wilderness, Bureau of Land Management, National Park Service, US Fish and Wildlife Service, and the US Forest Service, all use the Decision Guide when making decisions about actions, projects, and activities in designated wilderness areas.

### Minimum Requirement

The minimum requirement asks if prescribed burning is necessary in the BWCAW.

The “minimum requirement” is an action that is determined to be absolutely necessary and results in the least discernible impact on all wilderness values. For this project, the minimum requirement analysis studies the question: Is management-ignited fire necessary in the BWCAW? The minimum requirement analysis ties into the purpose and need for the project that was stated previously.

### Minimum Tool

The minimum tool is the least manipulative means of achieving a management objective in wilderness.

The minimum tool represents the “how question.”

The Wilderness Act prohibits the use of motorized equipment and mechanized transport but not mechanized equipment. Mechanized transport includes travel by motorized vehicle of any kind. It also includes mechanical devices that provide transportation such as bicycles. Mechanized tools are those that give a mechanical advantage such as wedges, block and tackles, and hand winches.

“Primitive” tools are any non-motorized device such as handsaws or axes. However, “minimum” tool is not synonymous with “primitive” tool. In some cases, the minimum tool could be a motorized tool or a form of mechanical transport. The minimum tool is the method, equipment, device, force, regulation, practice, or use with the least impact that will meet management objectives in a wilderness context. This represents the “how” question that must be asked to ensure that the process to implement the minimum required action will minimize impacts to social and biophysical wilderness values.

The minimum tool analysis is based on the activities of the Selected Alternative, which is Modified Alternative B in the BWCAW Fuel Treatment Final EIS. The activities in the Selected Alternative are described below.

## The Administrative Decision

The minimum requirement and minimum tool analyses assist the decision maker in determining the minimum requirement and the minimum tool for this project. This document records the minimum requirement analysis and minimum tool determination for tool use in this project. Tool use in wilderness is an administrative decision.

This document discusses all potential mechanized and motorized tools as well as non-mechanized and non-motorized tools to compare the effects of tool use on wilderness values. This document also considers the feasibility of implementing fuel treatment in the BWCAW with all potential tools.

In this document, you will find the minimum requirement analysis in the second section, which is a series of questions and answers that illustrate the necessity for and the potential effects of the project (these effects are described in detail in the Final EIS). In the third section, the minimum tool analysis, describes the fuel treatments in the Selected Alternative. The minimum tool analysis also considers three different options for equipment that could be used to implement the project. Equipment options are used to compare the effects of different tool use. It also discusses the following for each tool option: biophysical, social, recreational, and experiential effects; societal and political effects; health and safety concerns; and economic and timing considerations. Finally, the fourth section identifies a preferred equipment option and summarizes the minimum tool determination.

This document uses many fire and wilderness terms. Please refer to Appendix A for definitions of key terms. Appendix B describes the mitigation measures that relate to tool use and will be in place to limit the effects of tool use.

# 2. Minimum Requirement Analysis and Determination

Wilderness managers are required to weigh and evaluate every project or activity to determine if it is essential for administering wilderness. If a project or activity is found to be necessary, an additional analysis is completed to insure that the minimum tool or the least impacting, manipulative, or restrictive means of achieving a wilderness management objective is used.

## 2.1 Minimum Requirement Key

The following questions and answers address the question: Is management-ignited fire necessary in the BWCAW?

**Minimum Requirement Key**

| Question | Response |
|---|---|
| 1.Is this an emergency? (A situation that involves an inescapable urgency and temporary need for speed beyond that available by primitive means, such as fire suppression, health and safety of people, law enforcement efforts involving serious crime or fugitive pursuit, retrieval of the deceased or an immediate aircraft accident investigation.) | NO<br>Health and safety risks can only be practically reduced through fuel treatment. While the fuel treatment does not meet the definition of an emergency, it is considered urgent to reduce the risk of wildfire exiting the Wilderness (Leuschen et al. 2000, BWCAW Fuel Treatment Final EIS).<br><br>(‘No’ leads to the next question.) |
| 2. Does the project or activity conflict with the stated wilderness goals, objectives, and desired future conditions of applicable legislation, policy, and management plans? | NO<br>One of the objectives stated in the Forest Service Manual (FSM) is to reduce risk and consequences of wildfire escaping wilderness (FSM 2324.21 (2)). The purpose of the proposal is to reduce the risks and consequence of a wildfire escaping the BWCAW.<br><br>NO<br>Another objective stated in the FSM is to allow naturally occurring, lightning-ignited (Wildland Fire Use) fire to play its |

## Minimum Requirement Key

| Question | Response |
| --- | --- |
| | natural role (FSM 2324.21) (1)). The proposed action would better support the long-term goals by moving toward Wildland Fire Use in the BWCAW without the high risk of the fire exiting the Wilderness.<br><br>NO<br>FSM 2324.22 Policy:<br>1. Two types of prescribed fire may be approved for use within wilderness: those ignited by lighting and allowed to burn under prescribed conditions and those ignited by qualified Forest Service officers.<br>6. Forest Service managers may ignite a prescribed fire in wilderness to reduce unnatural buildups of fuels only if necessary to meet at least one of the wilderness fire management objectives set forth in FSM 2324.21 and if all of the following conditions are met:<br>a. The use of prescribed fire or other fuel treatment measures outside of the wilderness is not sufficient to achieve fire management objectives within wilderness.<br>b. An interdisciplinary team of resource specialists has evaluated and recommended the proposed use of prescribed fire.<br>c. The interested public has been involved appropriately in the decision.<br>d. Lightning-caused fires cannot be allowed to burn because they will pose serious threats to life and/or property within wilderness or to life, property, or natural resources outside of wilderness.<br><br>Fuel treatments outside of the wilderness are not sufficient to meet this policy. An interdisciplinary team evaluated the proposal and the public had the opportunity to comment through the National Environmental Policy Act (NEPA) process (BWCAW Fuel Treatment Final EIS). Wildland Fire Use cannot be relied on to reduce the fuel to the extent needed because unplanned fires in the heavy fuel pose a serious threat to life and property. Where possible Wildland Fire Use would be used; however, under the current fuel conditions in the BWCAW, Wildland Fire Use cannot meet the objectives of reducing the risk of a wildfire exiting the Wilderness (Leuschen et al. 2000, BWCAW Fuel Treatment Final EIS). |

## Minimum Requirement Key

| Question | Response |
|---|---|
| | NO<br>The BWCA Wilderness Management Plan states (page 3-26):<br>The Forest Service will analyze and assess planned ignitions in the Wilderness.<br><br>NO<br>The effects of the proposed action would not detract from the long-term management goals of managing the BWCAW as directed in the 1964 Wilderness Act and the 1978 BWCA Act. Even before the blowdown event increased fuel loads in the Wilderness, there was an unnatural buildup of fuel due to fire suppression. Prescribed burning would reduce fuel loads so that in the long term lightning-ignited fire can play its natural role. If fuel loads are not reduced, Wildland Fire Use would be severely restricted in the Wilderness until current fuel conditions improve due to wildfire or decay.<br><br>NO<br>The Record of Decision for the Forest Plan (page 24) stated that:<br>The Forest will study the natural role of fire in the BWCAW ecosystems and determine how to reintroduce this natural factor safely before a large program is undertaken.<br><br>The Record of Decision for the Forest Plan also recommended beginning an annual program of Wildland Fire Use of 1,500 acres annually of Wildland Fire Use would occur within Management Area 5.1. This project would enhance the Forest's ability to implement Wildland Fire Use.<br><br>('No' leads to the next question.) |
| 3. Are there other, less intrusive actions that should be tried first (such as, signing, visitor education, or information)? | NO<br>The Forest is using less intrusive measures, e.g., increased fire prevention and suppression efforts and fuel reduction treatments around structures outside the Wilderness, but those actions are not enough to reduce the risk of wildfire exiting the Wilderness.<br>• The level of suppression abilities and resources is near the maximum of what can reasonably be implemented.<br>• Increasing the level of prevention could not reduce the fire danger to an acceptable level because only one-half of wildfires are started by people and the other half are started by lightning.<br>• Closing the Wilderness to visitors to prevent human-caused fires would be contrary to wilderness values in that |

## Minimum Requirement Key

| Question | Response |
| --- | --- |
| | opportunities for solitude and primitive recreation would be limited. It would also be impractical to keep all users out of the Wilderness. Again, only one-half of wildfires are started by people, the other half are started by lightning. Closures would also have severe negative economic effects on surrounding communities.<br>• Wildland Fire Use will be used when predetermined criteria such as location of the fire, time of year, actual and forecasted fire weather, and availability of fire fighting resources can be met. However, in many cases, it will not be practical to use Wildland Fire Use in blowdown areas, given the unpredictable nature of ignition and the volume and volatility of the fuel loads.<br><br>('No' leads to the next question.) |
| 4. Can this activity be accomplished outside of wilderness and still achieve its objectives? | NO<br>Fuel treatments outside the Wilderness have been planned and are being implemented but are not considered sufficient to reduce the risk of a wildfire exiting the Wilderness; therefore, fuel treatment is required in strategic locations inside the BWCAW. The recent decisions for fuel treatment outside of the Wilderness include the Little East Creek, Gunflint Trail Corridor, Rusty Diamond, Otto Pine Salvage, and Crescent Lake fuel reduction decisions. On the intermingled ownership, state and county land managers have been dealing with the increased fire danger in addition to efforts by private landowners, including numerous sprinkler system installations in the Gunflint Trail corridor. Fuel treatments outside of the Wilderness will not sufficiently mitigate the risk to life and property from wildfire exiting the Wilderness.<br><br>While not part of Forest Service actions, the Canadian government and private landowners have been harvesting outside of Quetico Provincial Park and using prescribed fire to reduce fuel loads on private and crown land in Canada.<br><br>('No' leads to next question.) |
| 5. Is this activity subject to a valid existing rights (a mining claim or right-of-way easement)? | NO<br>This project is not mandated by existing rights, However rights were considered.<br><br>('No ' leads to the next question.) |

**Minimum Requirement Key**

| Question | Response |
|---|---|
| 6. Is there a special provision in legislation (the 1964 Wilderness Act or subsequent wilderness legislation) that <u>allows</u> this project or activity? | NO<br><br>('Yes' leads to the proposed project or activity being considered but not necessarily required just because it is mentioned n legislation. 'No' leads to Minimum Requirements Analysis, Part B, Effects of Taking Action.) |

## 2.2 Minimum Requirement Determination

The responses in this section indicate potential adverse impacts to wilderness character. Whether or not the project should proceed is evaluated. If the decision is made to proceed, the Minimum Tool Analysis is completed.

**Minimum Requirement Determination**

| Question | Response |
|---|---|
| **Effects of Taking Action on Wilderness Character** | |
| 1. How does the project or activity benefit the wilderness as a whole as opposed to maximizing one resource? | Prescribed burning would not maximize any of the following wilderness attributes (the effects to wilderness attributes are further discussed in the BWCAW Fuel Treatment Final EIS).<br><br><u>Natural Integrity</u> - Smoke would be a short-term, negative impact. Vegetation would be removed and mineral soil exposed in control lines, however mineral soil would only be exposed in a portion of the control line. Impacts depend on species and are discussed in the BWCAW Fuel Treatment Final EIS. Vegetative species diversity may change. Effects would be monitored. The ability to allow for Wildland Fire Use is important in maintaining the natural integrity of the BWCAW. The prescribed burning would result in substantial improvement in this ability over the next 10 years.<br><br><u>Apparent Naturalness</u> - Prescribed fire mimics a natural event, and a layperson would not be able to distinguish between an area that was burned by a naturally ignited fire and an area that was ignited by a prescribed fire. Visual diversity would increase as more background would be visible, e.g., there would be more natural-appearing openings. However, control lines may appear unnatural. |

## Minimum Requirement Determination

| Question | Response |
|---|---|
| | Opportunities for Solitude - Sites and sounds from motorized tools and an increase in people in some areas would be a short-term negative impact. This impact would occur throughout the summer and fall season. During the burns, visitors could hear and see helicopters, water pumps, and crews using chainsaw and hand tools, which would also be short-term impacts. Burned areas would be more open, so visitors may see more people.<br><br>Opportunities for Primitive Recreation - There may be short-term closures in burn areas, including campsites and portages, which would affect wilderness visitors' recreation opportunity. For some visitors, the activities could decrease the "isolation from the evidence of man."<br><br>Scientific Values - Prescribed burning would provide opportunities to study the role of disturbances (fire and blowdown) in the ecosystem. The Forest is involved with research in this area and would monitor the effects of prescribed fire and blowdown.<br><br>Cultural Resource Values - Known historic sites would be protected during burning. Pre-historic sites would not be affected by prescribed fire because they are protected by soil and they would be avoided during control line and helispot construction. |
| 2. If this project or activity were **NOT** completed, what would be the beneficial and detrimental effects to wilderness resources? | The beneficial effects would be no short-term intrusions to Wilderness visitors from the prescribed burning activities. However, if a wildfire occurred, it is likely that visitors would be impacted by closure of the Wilderness to greater extent than by implementing prescribed fire activities.<br><br>If prescribed burning were not implemented, the risk of wildfire and subsequent effects on wilderness values and on life and property outside the Wilderness would increase. During wildfire suppression in the Wilderness, wilderness values would be protected by using unique fire fighting protocol for the Wilderness. The detrimental effects would be the following.<br><br>Natural Integrity - Suppression actions could be more severe and require more equipment and personnel than prescribed burning. The Forest would not be able to control the amount of smoke in the air. Intense wildfires that could burn hotter and cover a larger distance than prescribed burns could reduce seed sources and seedbeds, limiting regeneration. Intense wildfires would also damage the soil more than prescribed fire, increasing the potential for erosion. Threatened, endangered, and sensitive (TES) species are not likely to be protected from a wildfire itself; however, during |

## Minimum Requirement Determination

| Question | Response |
|---|---|
| | a wildfire, mitigative measures could be taken such as locating fire camps and control lines to avoid these species if their location were known. Much of the BWCAW has not been surveyed and some TES species in unknown locations could be destroyed during suppression actions. The urgency of a wildfire would create a situation where TES species could not be surveyed. Suppression activities on intense wildfires could negatively impact ecological values, e.g., retardant use would not be planned in advance and could affect sensitive areas.<br><br>Apparent Naturalness - Fire suppression activities may not leave a landscape that appears natural.<br><br>Opportunities for Solitude - A benefit to the Wilderness would be that burn crews would not be entering the BWCAW to construct pre-planned control lines for prescribed fires or to ignite fires. However, if there were a wildfire, there could be large amounts of equipment and control lines and large numbers of fire fighting personnel in the Wilderness to suppress the fire. Fire patrols with aircraft would also be increased during a wildfire. Increased fire danger would further restrict use and could potentially close the Wilderness to users.<br><br>Opportunities for Primitive Recreation - The increased fire danger could result in limited Wilderness use. During wildfires, there would be further restricted use or closure of the Wilderness. |
| 3. How would the project or activity help ensure that human presence is kept to a minimum and that the area is affected primarily by the forces of nature rather than being manipulated by humans? | Prescribed burning with minimum tools would have less impact on the natural condition of the Wilderness than repeated entries into the Wilderness for fire suppression activities on unplanned high-intensity wildfires, which would require more motorized and mechanized equipment than prescribed burns. Motorized and mechanized use is normally approved for wildfire suppression because of the emergency nature of the event. Prescribed burns would be conducted primarily in the spring and the fall during times of less use, so fewer visitors would notice human manipulation. Control lines for the prescribed burns would be natural features where possible and there would be mitigation measures in place to rehabilitate control lines to appear natural. In the long term, prescribed burns would allow for a higher probability of Wildland Fire Use (lightning ignition). It should be noted that the risk of wildfire would not be eliminated by prescribe burning, however the risk of a large wildfire exiting the Wilderness would be reduced. |

## Minimum Requirement Determination

| Question | Response |
|---|---|
| 4. How would the project or activity ensure that the wilderness provides outstanding opportunities for solitude or a primitive and unconfined type of recreation? | In the short term, during the proposed actions particularly ignition, activities would be intrusive to visitors' solitude. Additionally, areas immediately next to the prescribed burns would be closed to visitors for a period of five to six days. In the event of wildfire, a closure could cover a larger area and last longer than closures during prescribed burns. During the Sag Corridor wildfire in 1995, four entry points including two of the most heavily used in the BWCAW were closed for up to two weeks during the busiest part of the tourist season. Areas that could dramatically affect recreation use would be burned in the spring and fall when use is low. In the long term, established visitor use is not expected to change after prescribed burns. |

## Management Situation

| | |
|---|---|
| 5. What does your management plan, policy, and legislation say to support proceeding with this project? | Wilderness Act 1964, Limitation of Use and Activity, Sec.4.(d): The following special provisions are hereby made: 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 measures may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.<br><br>FSM 2324.21- Objectives:<br>1. Reduce, to an acceptable level, the risks and consequences of wildfire within or escaping from wilderness.<br><br>FSM2324.22-Policy:<br>6. Forest Service managers may ignite a prescribed fire in wilderness to reduce unnatural buildups of fuel only if necessary to meet at least one of the wilderness fire management objectives set forth in FSM 2324.21 and if all of the following conditions are met:<br>a. The use of prescribed fire or other fuel treatment measures outside of wilderness is not sufficient to achieve fire management objectives within wilderness.<br>b. An interdisciplinary team of resource specialists has evaluated and recommended the proposed use of prescribed fire. |

## Minimum Requirement Determination

| Question | Response |
| --- | --- |
| | c. The interested public has been involved appropriately in the decision.<br>d. Lightning-caused fires cannot be allowed to burn because they will pose serious threats to life and/or property within the wilderness or to life, property, or natural resources outside the wilderness.<br><br>Superior National Forest Fire Management Plan (FY 2000) (III.B (2-a)). One of the specific priorities for hazard fuel reduction for the Superior National Forest is:<br>8. Analyze the need for the addition of the tool of Prescribed Fire (management-ignited) in the BWCAW to treat areas in the Hi-Risk Zone (as determined by RERAP) in order to allow naturally ignited WFUs (Wildland Fire Use) to more nearly play their natural role.<br><br>BWCA Wilderness Management Plan and Implementation Schedule, Fire Management, Role in Ecosystem Management (page 3-26):<br>Since fire is an important factor in the wilderness ecosystem and can reduce fuels buildup, lightning fires will be allowed to play a more natural role. The BWCAW Fire Management Plan lists specific objectives, standards, and conditions for application of prescribed fire. The Forest Service will analyze and assess planned ignitions in the Wilderness. |
| 6. How did you consider wilderness values over convenience, comfort, political, economic, or commercial values while evaluating this project or activity? | Proposed activities are based on tools and techniques required to successfully fulfill the goal of reducing risk to life and property. Economic, commercial, and political values were considered but were not given priority over wilderness values. The Forest would require primitive tools during the prescribed burning, except when crew safety is at risk or to ensure that the management objectives of treating fuels can be reached. |

## Minimum Requirement Determination

| Question | Response |
|---|---|
| **Should the project proceed?** | **YES**<br><br>**Through this analysis, the decision has been made to evaluate the proposal through the NEPA process.**<br><br>The Forest has prepared a final environmental impact statement that discloses the potential effects of five alternatives for treating fuel. The BWCAW Fuel Treatment Final EIS analyzes fuel treatment strategies for reducing fuel concentrations that threaten lives and property outside the BWCAW. The Final EIS discusses all of the environmental effects of alternative methods for treating fuel in the BWCAW. However, the Final EIS does not examine the equipment that would be used to implement the prescribed burns. The purpose of the next section, Minimum Tool Analysis, is to analyze tool use. |

# 3. Minimum Tool Analysis

The Final EIS examines the equipment that would be used to implement the prescribed burns, however it does not meet the requirements of the Minimum Tool Analysis. The purpose of the Minimum Tool Analysis is to analyze tool use more closely.

## 3.1 Selected Alternative for BWCAW Fuel Treatment from the Final EIS

This section explains the fuel treatments for which the minimum tools would be used, Modified Alternative B from the BWCAW Fuel Treatment Final EIS.

### Types of Prescribed Burns

**Broadcast burn at Emerald Lake, Canada**. A broadcast burn is a prescribed fire that is allowed to burn over the entire treatment unit. Large burns in moderate to heavy blowdown would be ignited so that heat is created quickly in the center of the burn, which pulls in the fire at the edge of the burn into the middle. This allows fire personnel to have more control over the direction of the burn.

The emphasis of the Selected Alternative is the use of prescribed burning in high- and moderate-risk blowdown areas. The Selected Alternative responds to the issue of wildfire risk reduction and public safety by treating the largest amount of the blowdown in a pattern that is expected to achieve a high rate of risk reduction of a wildland fire exiting the BWCAW. Areas with a high incidence of fire would be given a high priority for treatment in this alternative. Treatment units are strategically positioned throughout the blowdown area in order to slow the rate of spread of potential fires and make fires smaller that may ignite within the blowdown area, thus reducing the risk of a plume-dominated wildland fire developing in the blowdown area. Notably, the design of the Selected Alternative would also increase the potential for Wildland Fire Use in the future within the blowdown areas in the Wilderness.

Three kinds of burns would be implemented: broadcast burn, patch burns, and a combination of patch and understory burns.

**Broadcast Burn**

A broadcast burn is a prescribed fire that is allowed to burn over the entire treatment unit. In areas proposed for this type of fuel treatment, the majority of the trees were blown down over large areas. Broadcast burn units would be between 201 and 3,612 acres. Following the burn, the landscape would consist of a large area burned with patches and individual green standing trees, depending on fuel conditions and topographic features.

**Underburn at Locket Lake, Gunflint Ranger District**. Understory burns remove small, down, dead, and woody material as well as shrubs from the forest floor to eliminate fuel ladders for wildfires, which allow fire to reach the canopy and become crown fires. Some live trees are burned during understory burns, but the objective is to maintain the forest cover.

**Patch Burn**

Patch burns would be used in areas where there are isolated patches of fuel among standing forest. Patch burns would only be used in close proximity to the Wilderness boundary. In patch burns, the entire treatment unit would not be burned, only individual patches would be burned. In general, individual patch burns would be between 5 and 100 acres in size. Following the burn, the landscape would consist of small burned areas among standing forest.

**Combination Patch and Understory Burn**

A combination of patch and understory burns would occur where patches of blowdown fuel are interspersed with standing forest that is dominated by red and white pine. An understory burn is a prescribed fire often used in red and white pine forests, which are adapted to low- and moderate-intensity fire, with the intention of maintaining the forest canopy in the non-blowdown forest. Understory burns remove small, down, dead, and woody material as well as shrubs from the forest floor to eliminate fuel ladders for potential wildfires from reaching the canopy and becoming crown fires. Some live trees are burned during understory burns, but the objective is to maintain the forest cover. In general, the size of combination patch and understory burns would be between 86 and 3,036 acres. Following burns, the landscape would consist of small burned areas among standing forest that is open underneath from the burning.

**Fuel Treatments**

Figure 1 illustrates the location of each treatment unit. A total of 79 units will be treated, including 46 broadcast burns, 18 combination patch and understory burns, and 15 patch burns (Table 1). Approximately 75,605 acres will be treated. In addition, 193 miles of control line will be constructed in the Wilderness (Table 2). Approximately 10 to 15 temporary helispots will also be required within the Wilderness.

More information on the Selected Alternative can be found in the BWCAW Fuel Treatment Final EIS under Modified Alternative B in Chapter 2.

**Table 1. Estimated Acres and Anticipated Number of Units to be Treated by Year and Treatment Type (includes only burnable acres)**

| Year of Treatment | Treatment Type | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Broadcast | | Understory/Patch | | Patch | | | |
| | Acres | #Units | Acres | #Units | Acres | #Units | Acres | #Units |
| 2001 | 2,702 | 4 | 1,034 | 1 | 370 | 1 | 4,105 | 6 |
| 2002 | 6,516 | 7 | 4,525 | 7 | 174 | 2 | 11,215 | 16 |
| 2003 | 19,702 | 13 | 2,625 | 2 | 422 | 4 | 22,749 | 19 |
| 2004 | 11,256 | 10 | 6,600 | 4 | 312 | 3 | 18,168 | 17 |
| 2005 | 4,348 | 5 | 690 | 1 | 1,456 | 3 | 6,494 | 9 |
| 2006 | 4,668 | 3 | 3,645 | 3 | 684 | 1 | 8,996 | 7 |
| 2007 | 3,707 | 4 | 0 | 0 | 172 | 1 | 3,879 | 5 |
| **Total Inside BWCAW** | 51,720 | 46 | 18,040 | 18 | 3,365 | 15 | 73,124 | 79 |
| **Total Outside BWCAW** | 1,180 | 8 | 1,078 | 5 | 223 | 1 | 2,481 | 14 |
| **Grand Total** | ***52,899*** | ***46*** | ***19,118*** | ***18*** | ***3,588*** | ***15*** | ***75,605*** | ***79*** |

| Table 2. Estimated Width and Estimated Total Length of Control Lines for Prescribed Burning in the BWCAW | | |
|---|---|---|
| **Ground Conditions** | **Width (ft.)** | **Length (mi.)** |
| **Standing Forest,** at least partially standing forest | 10 – 15 | 76 |
| **Blowdown Forest** | 15 – 30 | 35 |
| **Open Corridors,** often along streams or wetlands that require little or no clearing | Less than 15 | 82 |
| Total | | 193 |

**Control line through standing forest.** In areas with light fuel loads, only fine fuels, such as leaf litter and small trees and shrubs, would be removed from the control line. Lower limbs may also be taken off large trees. The forest canopy would generally stay in tact.

**Control line through blowdown.** In areas with heavy fuel loads, fine fuels and downed trees would both be removed.

**Control line through open corridor.** In open areas with light fuel loads, minimal clearing would be required. Fine fuels, such as leaf litter, grass, and small shrubs, would be removed.

# Figure 1. Map of the Selected Alternative from the Final EIS

# Figure 1

## 3.2 Equipment Options

The **minimum tool** is the method, equipment, device, force, regulation, practice, or use with the least impact that will meet management objectives in a wilderness context. However, it is not synonymous with primitive tool.

**Primitive tools** are any non-motorized device such as handsaws or axes.

**Mechanized transportation** includes travel by a motorized vehicle of any kind. It also includes mechanical devices that provide transportation such as bicycles.

To determine the minimum tools for the project, the Forest Service considered three different approaches to the equipment that would be used to implement the project. Each equipment option has a different level of motorized equipment and mechanized transportation. The minimum tool analysis uses the equipment options to compare the effects of different tool use.

Mitigations that provide direction on tool use are described in Appendix B. Mitigations would apply to tools in every option. Many tools also have standards and guides for their use.

Some assumptions were made for how tools would be used during implementation and these assumptions are described below. Three options for tool use are outlined in this section and the use of the primary motorized tools and mechanized transportation in each option are described. The equipment options are used to compare the effects, feasibility, and safety of the tools. The effects of each tool option are discussed and then a preferred equipment option will be identified. Please refer to Appendix A for definition of terms and tools.

### Option 1

**Primarily motorized equipment and mechanized transport**

If Option 1 were selected, the Forest would primarily use motorized equipment and mechanized transport to implement the burns. The analysis of this option illustrates the effects of a high level of motorized equipment use and mechanized transportation. Some of the motorized equipment that is analyzed includes chainsaws and motorized water pumps. Mechanized transportation that is discussed includes helicopters, airplanes, and motorboats. Liquid fire retardants would also be used to pre-treat control lines.

### Option 2

**Primarily non-motorized equipment and non-mechanized transportation**

If Option 2 were selected, the Forest would primarily use non-motorized equipment and non-mechanized transportation to implement the burns. The analysis of Option 2 demonstrates the effects of only using non-motorized equipment and non-mechanized transportation. Some of the non-motorized equipment that is analyzed includes crosscut saws and backpack pumps. The non-mechanized transportation that is discussed includes canoes and dogsleds.

## Option 3

**A combination of motorized and non-motorized equipment and mechanized and non-mechanized transportation.**

The analysis of Option 3 illustrates the effects of tool use that protects both wilderness values and safety. Non-motorized equipment and non-mechanized transportation would primarily be used. However, some motorized equipment and some mechanized transportation would be used when safety is a concern especially during lighting and holding and mopup phases. For example, after a burn is ignited helicopters would be used to drop water on the edge of the burn if necessary to keep the burn in control. Mechanized tools or motorized transportation would also be used when primitive tools and transportation are not adequate to meet the project's fuel treatment objectives.

### Reconnaissance Phase

***Transportation:*** For gathering site-specific information on the ground, canoes, dogsleds, and motorboats (only on motorized routes) would be used. Helicopters would be used for helispot verification. Airplanes would fly above 4,000 ft. to survey control lines, but they would fly below 4,000 ft. at sea level (ASL) for bald eagle surveys. Approval is not required for flights above 4,000 ft. ASL.

### Preparation Phase

***Transportation***: Canoes and motorboats (only on motorized routes) would be used to get crews and equipment into place to clear control lines.

***Tools***: Crews would use hand tools (e.g., shovels and axes), drip torches, fusees, and crosscut saws to clear vegetation for control lines. Crosscut saws would be the primary cutting tools, however chainsaws would be used in unsafe sawing situations such as lodged trees that are under tension. In unsafe sawing situations, an alternative tool to chainsaws, such as explosives, would be used instead of chainsaws if it were effective.

### Lighting and Holding Phase

***Personnel Transportation***: Crews would be transported to treatment units by canoes and motorboats (only on motorized routes). During burn plan development, an Implementation Team would decide if aircraft below 4,000 ft. would be used to move crews into place. The Team would consider safety, logistics, and wilderness values. It is anticipated that most of the burns would require at least some personnel to be transported by aircraft for safety sweeps. Egress under Option 3 would use as much primitive transportation as possible and would be pre-determined in burn plans.

***Equipment Transportation***: Equipment would be transported to treatment units by canoes and motorboats (only on motorized routes). During burn plan development, an Implementation Team would decide if helicopter sling-loads would be necessary to move some equipment into place. The Team would consider safety, logistics, and wilderness values. It is anticipated that most of the burns would require some equipment to be sling-loaded to the treatment unit for either safety or timing reasons. In contingency situations, equipment would be transported by aircraft. Egress under Option 3 would use as much primitive transportation as possible and would be pre-determined in burn plans.

**Contingencies**

Contingencies are unexpected situations encountered during lighting and holding and mopup phases, such as a burn crossing control lines. It may be necessary to take action to keep the burn within prescription and ensure firefighter and public safety.

***Lighting Tools***: Depending on fuel loads and burning conditions the following could be used to ignite burns: drip torches, fusees, flare pistols, helitorches, plastic sphere dispensers, and ignition explosives. In order to safely manage the burn, crews would also use fuel and air moisture meters, portable radio repeaters, and portable weather equipment.

***Holding Tools***: Helicopters and other aircraft below 4,000 ft. would drop water or foam in order to secure control lines or put out spot fires. Liquid fire retardants would only be used if fire threatens to escape. Aircraft would also be used below 4,000 ft. for surveillance. Crosscut saws would be the primary cutting tool during holding. However, during holding chainsaws would be used as needed to ensure the safety of the burn. Motorized water pumps, sprinkler systems, and backpack pumps would also be used to secure the control lines.

### Mopup and Rehabilitation Phase

***Transportation***: Crews and equipment would be transported by canoes and motorboats (only on motorized routes). Aircraft would only be used in case contingency response is required.

***Tools***: Crews would use hand tools (e.g., pulaskis), drip torches, fusees, motorized water pumps, backpack pumps, hand-held heat location equipment, and crosscut saws to mopup and rehabilitate treatment units. During active mopup, motorized water pumps, aircraft water drops, and chainsaws, may be needed. Chainsaws could also be used in unsafe sawing situations and contingency response. Aircraft and aerial heat location equipment would be used below 4,000 ft. for patrol.

## 3.3 Criteria used to Assess the Impacts of Each Option

To determine the appropriate suite of tools for the project, this section explores the differences in impacts that tool use could have on the BWCAW. This document only discusses the effects of tools. Full disclosure of effects of the project is in the Boundary Waters Canoe Area Wilderness Fuel Treatment Final EIS. The following criteria were used to assess the impacts of each option:

1. Biophysical effects
2. Social, recreational, and experiential effects
3. Societal and political effects
4. Health and safety concerns and
5. Economic and timing considerations

Analysis of the effects for each phase of implementation follows the criteria discussion below.

### Biophysical Effects

Biophysical effects relate to the environmental resource issues that would be affected by the project; any effects to the natural conditions in the regional landscape, i.e., non-native insects and disease or noxious weed control; and biological and physical effects. The Boundary Waters Canoe Area Wilderness Fuel Treatment Final EIS analyzes the biophysical effects of the entire project. The discussion of biophysical effects in this document is only for tool use. The Final EIS also describes mitigations and standards and guides for tool use.

### Social, Recreational, and Experiential Effects

The social, recreational, and experiential effects relate to how the proposed action may affect the wilderness experience; effects to recreation use and wilderness character; and effects the proposed action may have on the public and their opportunity for discovery, surprise, and self-discovery.

Visitors usually have expectations for their wilderness experience. Values prized by wilderness users include natural integrity, apparent naturalness, opportunities for solitude, and opportunities for primitive recreation. To some extent, human activity during implementation would affect these values and the area's physical characteristics. Impacts to natural integrity are primarily discussed in the Biophysical Effects Section.

## Societal and Political Effects

Societal and political effects relate to considerations such as memorandums of understanding, agency agreements, local positions that may be affected by the proposed action, and relevant laws. Long-term management goals for the BWCAW are stated in the 1964 Wilderness Act and in the 1978 BWCAW Act. They are also discussed under Section II, Part A, Question 2 of this document. Based on legislated direction, policies are in place to encourage fire's natural role and reduce the risks and consequences of wildfire.

After the blowdown event, the Forest focused its efforts on rescuing visitors in the BWCAW and clearing roads, portages, and trails for access. All of the roads and the majority of trails have been cleared. Efforts now focus on activities such as reducing fuel outside of the Wilderness by salvaging timber and prescribed burning, cleaning up fuel around summer homes and resorts, increasing fire suppression, promoting fire prevent and education, and planning in the event of a wildfire.

The Echo, Fernberg, and Gunflint corridors are potentially in the path of wildfires exiting the BWCAW. The Gunflint Corridor in particular is directly downwind from the heavy storm damage and fuel loads in the BWCAW. All of these areas have high recreation use and many recreational and residential facilities, including homes, cabins, resorts, campgrounds, youth camps, wilderness entry points, and boat landings. A wildfire exiting the Wilderness has the potential to threaten life, property, and natural resources.

This project's purpose and need addresses the necessity of reducing the risk of wildfire outside of the BWCAW and recognizes the complex political conditions and agency responsibility inherent in the situation. If the blowdown were not treated, the risk of wildfire exiting the Wilderness boundary would remain high for 15 years or more. Private commercial property, residential property, and personal safety are at risk.

State fire protection and County law enforcement agencies have vested interests in the successful implementation of the project, which gives the project a sense of urgency. Conversely, there are those who strongly advocate protection of wilderness values and feel fuel treatment should be limited to primitive tools only or treatment be foregone entirely.

The amount of time it would take to implement the project would depend, in part, on which equipment option is selected. Implementation time would also depend on weather conditions and how many days per year have ideal burning conditions that would allow for safe and effective prescribed fire (referred to as 'burn windows').

## Health and Safety Concerns

Health and safety concerns relate to effects that the proposed action may have on public health and safety. The primary purpose and need for this action is to improve public safety by reducing the potential for high-intensity wildland fires to spread from the BWCAW into areas of intermingled ownership, which have homes, cabins, resorts, and other improvements. The project would be implemented in a manner that protects the safety of fire personnel. BWCAW visitors would also be protected during implementation.

Health and safety concerns relate to issues associated with the proposed action, such as the types of tools used, training, certification, and other administrative needs to ensure a safe work environment for employees. It is Forest Service policy that no job is too important to be done in an unsafe manner. If implementation were unsafe for personnel or other people inside and outside the Wilderness, it would not be considered feasible.

Only personnel with nationally approved wildland firefighting training would work on burns. This training includes instruction on things such as how to use fire fighting tools, fire behavior, and risk management. Personnel that operate other equipment would be required to have additional training. All crews would be briefed on the special situation with the blowdown fuel type.

**Prescribed fire has unique safety concerns**

The underlying reason for the project is to reduce the risk of wildfire exiting the Wilderness, however prescribed fire has its own safety concerns and is very different from other management activities in wilderness. Some safety concerns are the exposure to risk associated with implementing the project and whether this exposure to risk can be mitigated. For instance, paddling a canoe exposes the individual to risk of drowning, which can be mitigated by requiring the use of life jackets and proper training in wilderness canoe travel.

Exposure to risk for this project can be broken into two categories: risk during non-fire phases and risk during fire phases. Non-fire phases include reconnaissance, preparation, patrol, and monitoring. During these phases, timing is generally not as critical as during burn phases. However, following proper procedures is critical during non-burn phases. Threats to safety are primarily associated with travel, carrying firefighting tools, and cutting and moving blowdown material that is under tension.

Burn phases include igniting the burn, holding the burn within control lines, and mopping up the burn. During these phases, both timing and following procedures are critical. Threats to safety include those mentioned for non-fire phases and include threats from the fire itself. These threats are primarily to firefighters, but an escaped burn could potentially threaten the public both inside and outside of the BWCAW.

It should be kept in mind that the risk of wildfire exiting the Wilderness has always been present and regardless of how the fuel treatment project is implemented, some risk will remain.

## Economic and Timing Considerations

Economic and timing considerations relate to the costs and timing associated with implementing each option and the urgency and potential cumulative effects from the proposed action.

The timing of moving crews and equipment into place would be crucial to meeting management objectives because of the large scale of the project. Implementing the prescribed burns would occur in the phases that are described below. Each phase has a critical timeframe within which it must be completed to not compromise its objective. These critical timeframes are taken into account in determining the minimum tools necessary for each phase.

# 3.4 Effects of Tool Use in each Phase of Implementation

The following is an analysis of the effects of tool use during each phase of implementation based on the previously described criteria. Mitigation measures would be in place for many of these effects (see Appendix B for mitigation measures that relate to tool use). Please refer to Appendix A for definitions of terms and tools.

## Effects of Reconnaissance

Reconnaissance involves conducting resource surveys and preparing burn plans. This phase involves gathering the site-specific information that is necessary to prepare the burn plan, as well as locating control lines, safety zones, and escape routes. Reconnaissance would occur several months to several weeks before the burn.

**Assumption - An interdisciplinary team will prepare burn plans for prescribed burning in the BWCAW**

An interdisciplinary team with both fire and wilderness staff will develop each burn plan for prescribed burning the BWCAW. The Team will ensure that fuel treatment objectives are met while minimizing negative effects on wilderness values. During the planning stage, the Team will determine how to deal with safety and logistical issues using the minimum tool. The Team will also be involved with implementation and monitoring.

**Table 3. Tools and Transportation for each Equipment Option during Reconnaissance**

| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized& Non-mechanized | **Option 3** Combination | **Approval Required?** |
|---|---|---|---|---|
| **Transportation** | | | | |
| Motorboats everywhere accessible by motorboats (including non-motorized routes) | | | | Yes |
| Motorboats only on motorized routes | | | | No |
| Canoes | | | | No |
| Dogsleds | | | | No |
| Helicopters* (below 4,000 ft. ASL) for helispot verification | | | | Yes |
| Aircraft (above 4,000 ft. ASL) to survey control lines | | | | No |
| Aircraft for bald eagle surveys (below 4,000 ft. ASL) | | | | Yes |

*Mitigation measure would be in place

**Mitigation Relative to Minimum Tool Use and Wilderness Values during Reconnaissance**

- Use the minimum actions and tools necessary within the Wilderness to meet the purpose and need based on the Minimum Tool Analysis.
- Review the minimum tool concept during preparation of each burn plan to assure that the minimum tools are being used.
- Locate portable weather equipment and radio repeaters outside of the Wilderness where possible.
- Conduct reconnaissance flights at or above 4,000 feet above mean sea level. One flight below 4,000 feet will be needed to identify bald eagle nests prior to burning. Also, helicopters will fly below 4,000 ft. to potential helispots in order to assure the helispots meet standards.
- Ground access for reconnaissance and line and helispot construction will be by hiking, canoeing, or dogsledding with the exception that motorboat access is permitted in areas with established motorized routes.

**Biophysical Effects of Reconnaissance**

***Accidental fuel spills while refueling motorboats could affect aquatic resources, wetlands, and riparian areas***

Option 1 – The risk of negative effects from accidental fuel spills would be greater than under the other options because there would be more motorboat use. If there were negative impacts from fuel spills, they would be minor.

Options 2 and 3 - Motorboat use would be small, so less fuel would be required than Option 1, resulting in a very small risk of accidental spills.

***Flights below 4,000 ft. could disturb some wildlife***

Options 1 and 3 - Nesting birds that may be present in the area could be affected by reconnaissance with flights below 4,000 ft. Any potential effects to wildlife would be localized and short-term in nature and would have no long-term effects on wildlife population viability in the BWCAW. Effects to wildlife are discussed in the BWCAW Fuel Treatment Final EIS.

Option 2 – Aircraft would not fly below 4,000 ft., so no negative impacts on wildlife would be expected.

***Bald eagle survey flights would not be effective above 4,000 ft.***

The Endangered Species Act requires the Forest to protect the habitat of endangered species. The Forest currently conducts bald eagle surveys every 3 to 5 years in the BWCAW. Bald eagle survey flights would not be effective above 4,000 ft. because it would not be possible to accurately determine the location of nests at that height.

During the year that a treatment unit would be burned, survey flights below 4,000 feet above sea level (ASL) to locate bald eagle nests will be done once for each burn unit before the prescribed burn is ignited. As a part of monitoring, survey flights will be flown to determine whether any eagle nests were impacted during prescribed burns. Surveys will be done in and adjacent to treatment units and helispot locations during standard survey time prior to control line construction and burning.

Survey flights could disturb some wildlife species. Nesting birds that may be present in the area could be affected by monitoring with mechanized transport. Any potential effects to wildlife would be localized and short-term in nature and would have no long-term effects on population viability in the BWCAW. Effects to wildlife are discussed in the BWCAW Fuel Treatment Final EIS.

Options 1 and 3 – Aircraft below 4,000 ft. would be used to do bald eagle surveys.

Option 2 – Aircraft would not be allowed below 4,000 ft. Bald eagle surveys would be done by canoe, an inaccurate method of surveying for nests.

**Social, Recreational, and Experiential Effects of Reconnaissance**

Use of mechanized transport is, by definition in the 1964 Wilderness Act, “non-conforming” with wilderness values because the sights and sounds of the equipment are not within the expectations of typical wilderness visitors. However, the 1978 Boundary Waters Canoe Area Act allowed motorized transportation on designated lakes.

Option 1 - In terms of visual impacts to the visitor’s sense of solitude, Option 1 would be more disruptive than Option 2 because aircraft would be below 4,000 feet and would be more apparent. In terms of audible impacts to visitors’ experience, Option 1 would be more disturbing than Options 2 and 3 because there would be more motorboat use. Option 1, with the most mechanized transport, would also have the most impact on apparent naturalness of the area and is the option that is least in harmony with wilderness philosophy.

Option 2 - Use of non-mechanized transport does conform to wilderness values because the sights and sounds of the equipment are within the expectations of typical wilderness visitors. In terms of visual impacts to the visitor’s sense of solitude, Option 2 would have the least disruptive aircraft use because flights would be above 4,000 feet. Option 2 would also have the fewest audible impacts to visitors’ experience because motorboats would only be on motorized routes. In terms of wilderness philosophy, this option with the least mechanized transport, would have the smallest impact on apparent naturalness of the area.

Option 3 - In terms of visual impacts to the visitor’s sense of solitude, Option 3 would be more disruptive than Option 2 but less than Option 1 because aircraft would be below 4,000 feet but there would be less motorboat use than Option 1. In terms of audible impacts to visitors’ experience, Option 3 would be more disturbing than Option 2 but less than Option 1.

**Social and Political Effects of Reconnaissance**

Some segments of the public would like the project to be implemented with primitive tools only. While others would oppose doing bald eagle surveys above 4,000 ft. because the surveys are thought to be ineffective at that height.

Option 1 - There would be some public opposition to the use of aircraft below 4,000 feet. However, it is likely that there would be more opposition to the use of motorboats on non-motorized routes. Option 1 would also allow for bald eagle surveys below 4,000 ft.

Option 2 – There would be support for only using primitive tools and could satisfy advocates of primitive tool use. However, bald eagle surveys would not be effective above 4,000 ft.

Option 3 - There would be some public opposition to the use of aircraft below 4,000 feet. The use of mechanized transportation in Option 3 would allow for effective bald eagle surveys, but otherwise primitive transportation would be used.

**Health and Safety Concerns of Reconnaissance**

Options 1 and 3 – Helicopters would be allowed, so helispot verification would be required. Potential helispots would first be identified on maps. In order to verify helispots, helicopter flights (below 4,000 ft. ASL) would be necessary for helicopter pilots to assess the feasibility and safety of an area as a helispot.

Option 2 - Helicopter use would not be allowed, so helispot verification would not be required.

**Economic and Timing Concerns of Reconnaissance**

Table 4 lists the estimated cost of reconnaissance for an average burn.

**Table 4. Estimated average cost of reconnaissance for one burn**

| Option 1 | Option 2 | Option 3 |
|---|---|---|
| $833 | $1,504 | $1,059 |

Option 1 – Mechanized transportation in Option 1 would make reconnaissance less expensive than the other options because less personnel would be required.

Option 2 – Using canoes and dogsleds for all reconnaissance work would be more expensive than the other two options because more personnel would be required.

Option 3 – Aircraft would be used for bald eagle surveys and helispot verification. Canoes and dogsleds would be used for other surveys. Therefore, the cost of reconnaissance under Option 3 would be between Options 1 and 2.

**Summary of Reconnaissance**

Table 5 summarizes the level of potential negative effects of reconnaissance.

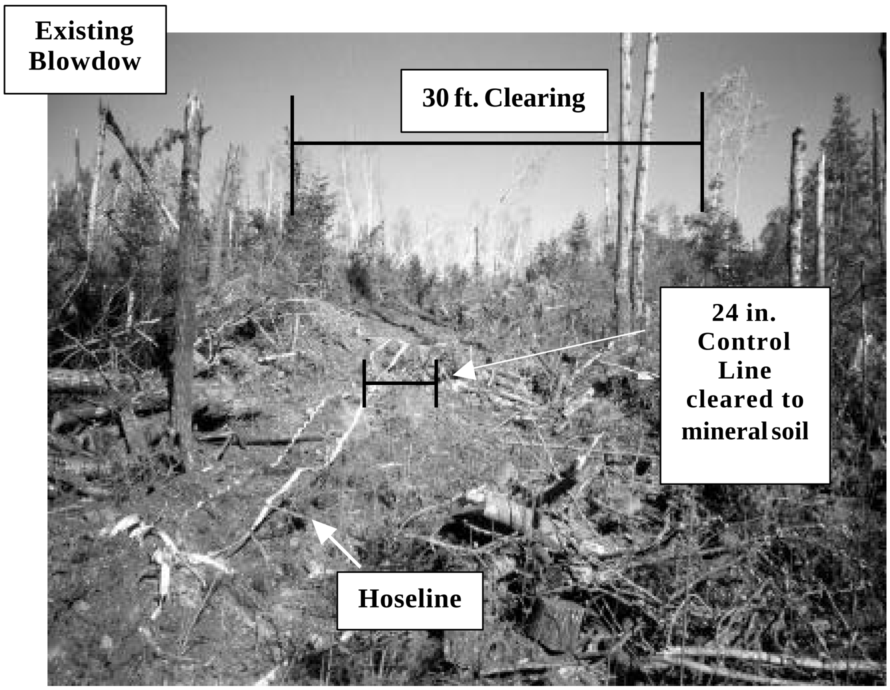
**Table 5. Summary of the Potential Negative Effects during Reconnaissance***

| | **Option 1** Motor/ Mech. | **Option 2** Non-motor/ Non-mech. | **Option 3** Combina. | **Key Issues** |
|---|---|---|---|---|
| **Biophysical Effects** | Low | High | Low | Bald Eagle Surveys: Under Option 2, surveys would not be effective because flights below 4,000 ft. would not be allowed, which could result in bald eagle nests being destroyed during implementation. Under Options 1 and 3, surveys would be below 4,000 ft. |
| **Social/ Recreational/ Experiential Effects** | High | Low | Moderate | Sense of Solitude: Under Options 1 and 3, aircraft below 4,000 ft. would decrease visitors' sense of solitude and would result in more audible impacts than Option 2. However, there would be less aircraft use in Option 3 than 1. |
| **Social/ Political Effects** | High | Moderate | Moderate | Bald Eagle Surveys: There would be some public opposition to flying below 4,000 ft. for bald eagle surveys (Options 1 and 3). If flights below 4,000 ft. were not allowed (Option 2), there would be opposition to surveying for bald eagle nests with ineffective methods. Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| **Health/Safety Concerns** | Low | Low | Low | Helispot Verification: Helispot verification would be required and allowed in Options 1 and 3 to ensure safe helicopter operation. There would be no helicopter use in Option 2. |
| **Economic/ Timing Concerns** | Low | Moderate | Moderate | Personnel Required: Primitive transportation in Options 2 and 3 would require more personnel to accomplish reconnaissance goals than the mechanized transportation under Option 1, so Options 2 and 3 would be more expensive than Option 1. |

*Low, medium, and high are summaries of each effect or concern. The importance of each effect or concern varies by implementation phase.

## Effects of Preparation

Preparation involves clearing control lines and making helispots. Work on control lines and helispots would occur several weeks to several months before burns are ignited.




**Control line width**. The width of control lines would depend, in part, on the reinforcements that could be used during lighting and holding. Motorized pumps with hoselines are one such reinforcement.

**Assumption – The width of control lines would be determined, in part, by control line reinforcements and fuel loads**

The width of a control line is usually not constant throughout a treatment unit. Control line width will be based on the expected flame length, anticipated wind direction, the amount of fuel on the site, and control line reinforcements.

Burn plans will refine the placement of control lines, and the length of control lines is not expected to change much. The length would be the same under all equipment options, only the width of the control lines would vary based on the equipment option that is selected.

If an equipment option with motorized and mechanized tools were selected, water and foam could be used to pretreat areas adjacent to the control line immediately before ignition in order to reduce the width of the control line needed to be effective. Most likely, control lines on the front end of a fire (downwind side), where the fire is hot, would require pretreatment with water and foam. In some cases, 30-ft.-wide control lines would be required on the front end of a burn where the fire is harder to control. On the back end (upwind side) of a burn where the fire is cooler and the fire is easier to control, control lines would be narrower.

Experience with prescribed fire in blowdown areas on the Gunflint Ranger District has shown that a 30-foot width can hold a control line with the pretreatment measures. With no pretreatment measures, a width of 65 feet would be necessary in blowdown areas to keep fires from spreading across control lines by radiation (Cohen 2000). However, wind could still carry embers across control lines, resulting in "spot fires."

Fuel loads and fuel type influence control line width. In standing forest, where the forest is at least partially standing and fuel loads are relatively light, control lines would be approximately 10 to 15 feet wide. Where trees have been blown down and fuel loads are heavy, control lines would generally be 15 to 30 feet wide. In open corridors, often along streams or wetlands, little clearing would be required and control lines would be less than 15 feet wide. For this project, 39% of all control lines will be constructed through standing forest, 18% through blown down forest, and 43% through open corridors.

In areas where fuel volume is high, woody material could be piled and burned before the entire treatment unit is burned during preparation to clear the control line. This burning could occur at a time when it would have less effect on Wilderness users, most likely in the fall. In the remainder of the control lines, woody material would be tossed outside of the treatment unit.

Some areas inside the treatment unit, such as sedge meadows, may be burned prior to the burning the entire unit, to reduce fine fuels and create a wider control line. This would only occur in early spring or late fall when fire could not spread to the surrounding high ground. If a motorized and mechanized equipment option were selected, sprinkler systems could also be used during burns along the control line to make the line more effective.

If aircraft below 4,000 ft. were approved, the use of helicopters and airtankers to drop water or foam is possible on all types of prescribed fires. Water drops with small floatplanes would be most effective with the patch burns and the combination patch and understory burns. The large airtankers and water-scooping aircraft would be used for mainly broadcast burns in heavy to moderate blowdown. Helicopter bucket drops would be used on all burns (if helicopter buckets are used in areas outside the wilderness, they will be cleaned before used in the BWCAW). Water applied with hoses and sprinklers or dropped from aircraft would be preferred to using foam.

**Assumption - The rate at which control lines could be cleared would depend, in part, on tool use and ground conditions**

In order to evaluate the feasibility of the equipment options, production rates for control line construction were estimated for crosscut saws and chainsaws. Table 6 lists the estimated rates of control line construction with crosscut saws and chainsaws in different blowdown and forested conditions. The chainsaw production rates were taken from the Fireline Handbook (National Wildfire Coordinating Group 1998). Based on trail clearing statistics, the Superior National Forest's Wilderness Staff estimated the rates for crosscut saws.

Conditions on the ground would vary the rate at which control lines could be built. For instance, building a 15-foot wide line through blowdown with a chainsaw could be done at 35 ft. per person per hour, while building the same line with a crosscut saw could only be done at 8 ft. per person per hour (Table 6).

**Table 6. Estimated production rates for control line construction**

| Ground Conditions | Tool | Line Width (ft.) | Production Rates (ft./person/hr.) |
|---|---|---|---|
| Forest Blowdown | Crosscut Saw | 30 | 4 |
| | | 15 | 8 |
| | Chainsaw | 30 | 18 |
| | | 15 | 35 |
| Forest Not Blowdown | Crosscut Saw | 10-15 | 26 |
| | Chainsaw | 10-15 | 66 |
| Minimal Line in Non-blowdown** | Crosscut Saw | 10* | 53* |
| | Chainsaw | 10* | 198* |

*These production rates are taken from the Fireline Handbook and the width of the line cleared is assumed to be 10 feet on average.
**Areas where minimal line is required are areas such as sedge meadows and other wet areas with little standing vegetation.

**Assumption – Helispots would be required to support ignition with helitorch under Options 1 and 3**

If helicopter use were approved, landing pads for helicopters, called "helispots," would be required for refueling helitorches. A helispot is an open area that is dry enough to support a helicopter and clear of trees and brush.

Under ideal conditions, a minimum of five helispots could service the 16 treatment units that are farther than five miles from an established helispot outside the Wilderness. However, due to wind direction on day of the burn, additional helispots may be necessary because the closest one could be downwind of the smoke. Therefore, it is assumed that a range of helispots from 5 to 15 would be used.

Where possible, helispots would be located outside of the Wilderness. Helispots would be constructed in areas that are not generally visible to the public and, wherever possible, would be located in natural clearings or areas with sparse vegetation. Generally, construction would involve clearing the area to allow safe access for the helicopter and providing a hard surface for landing. This could involve laying down logs on boggy sites. These areas would be rehabilitated after use.

Forest Service aviation regulations require helispots to have a minimum 90-foot diameter cleared area for one medium helicopter and 180-foot diameter for two helicopters and must have at least one safe approach and take off lane, which may result in vegetation being cleared in addition to the 90- or 180-foot diameter. The majority of the helispots would be designed for two helicopters. An alternative helispot may be required in the event that wind direction changes during operations. The total area that would be utilized would be small, less than an acre.

Helispots would be constructed only for units that are 5 miles or more from an improved helispot location outside the Wilderness boundary. For units that are within 5 miles of the boundary, helispots outside of the Wilderness would be used. Helitorch is a method of aerial ignition in which a fuel ignition device is suspended beneath a helicopter and drops ignited jellied gasoline onto material that is to be burned. Helitorches require refueling approximately every 15 to 20 minutes. Helicopter and fire specialists have determined that in the BWCAW 5 miles is the maximum distance that a helispot could be located from the treatment unit and still maintain necessary ignition pattern and intensity during barrel changes.

In heavy blowdown, the helitorch may be the only ignition method that is safe for burn crews and that would allow burns to quickly reach high enough temperatures to carry the fire, requiring many helicopter trips to refuel with helitorch fuel. Shortening the distance that a helicopter would have to fly would lessen the amount of time that the pilot is in the air, which decreases the safety risk to helicopter pilots. Refueling the helicopter would occur at helispots located outside of the Wilderness because helicopter-operating time is much longer than helitorch operating time.

**Assumption – If equipment must be maintained or refueled in filter strips, it would be done in a catchment basin**

If refueling or maintenance of equipment must occur within filter strips, riparian management zones, or wetlands, catchment basins would be used to prevent potential spills from contaminating soils or entering riparian areas, wetlands, or waterways. A spill kit with absorbent pads and materials would be on site to clean up fuel in the event of a spill.

| Table 7. Tools and Transportation for each Equipment Option during Preparation | | | | |
|---|---|---|---|---|
| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized & Non-mechanized | **Option 3** Combination | **Approval Required?** |
| **Transportation** | | | | |
| Aircraft (below 4,000 ft. ASL) | | | | Yes |
| Motorboats everywhere accessible by motorboats (including non-motorized routes) | | | | Yes |
| Motorboats only on motorized routes | | | | No |
| Canoes | | | | No |
| **Tools** | | | | |
| Pulaskis, axes, shovels, bowsaw, Nippers, log carriers, hand winch | | | | No |
| Chainsaws* and brushsaws as primary cutting tools | | | | Yes |
| Crosscut saw as primary cutting tool | | | | No |
| Chainsaw* only for unsafe sawing situations | | | | Yes |
| Drip torch and fusees | | | | No |
| Portable weather equipment* | | | | No |

*Mitigation measure would be in place

### Mitigation Relative to Minimum Tool Use and Wilderness Values during Control Line Preparation

- Follow the control line construction guidelines identified below to minimize the impact on Wilderness Value *where possible*:
  - o Use water as a control line tactic.
  - o Use natural firebreaks instead of artificial ones.
  - o Consider explosives as a tactic for control line building and removal of necessary trees and snags.
  - o Roll logs out of the control line instead of bucking.
  - o Minimize cutting trees (especially live trees) and limbs unless necessary to prevent the spread of fire across the control line or for worker safety.
  - o Where tree cutting occurs along portages or trails, cut stumps as close to the ground as possible.
  - o Construct control line to the minimum width and depth necessary to control the prescribed fire; widen minimal control lines by carefully burning fuel on the inside of the line and by soaking the area adjacent to the line with water or foam. Liquid fire retardant will not be used for pretreatment.
  - o Locate constructed control lines in areas requiring a minimum of scraping and cutting and design them to follow irregular lines.
  - o Use chainsaws only when safety precludes the use of hand tools.
  - o Follow Minimum Impact Management Tactics mop-up guidelines to minimize the impact on wilderness values.
  - o Avoid tool scars where possible by using water or wetting agents (foam) to extinguish fire when necessary.
- Protect individual sites where possible (e.g., administrative structures, bridges, stairway portages) from the effects of control line construction.
- To reduce the visibility of control lines, leave a screen of vegetation between the ends of control lines and lakeshores or consider angling the control line so it is not visible from the water, as long as control line effectiveness is not compromised. This will be determined by the topography, fuel levels near the control line, and the potential for an escaped prescribed burn.

**Biophysical Effects of Preparation**

The impacts of clearing control lines on soil resources, aquatic resources, wetlands, riparian areas, vegetation, and wildlife are discussed in the BWCAW Fuel Treatment Final EIS. This minimum tool analysis discusses the biophysical effects of tools use.

***Wide control lines would result in more vegetation being cut***

As stated previously, the width of control lines would be based, in part, upon control line reinforcements, how intense the fire is expected to be, wind direction, and the amount of fuel available. During any prescribed burning activity, known populations of sensitive species will be flagged and avoided.

<u>Option 1</u> - Control lines would mainly be 15-30 ft. wide in blowdown areas. Water, foam, and fire retardant could be used to pretreat areas adjacent to the control line immediately before ignition in order to reduce the width of the control line needed to be effective. Because control lines would be relatively narrower under Option 1compared to Option 2 less vegetation would be cut from control lines.

<u>Option 2</u> –Without the use of motorized control line reinforcements, control lines would be wider under Option 2 than under Options 1 and 3. In blowdown areas, control lines would be a maximum of 65 ft. wide, and the average width would be wider than 15-30 ft. under Option 2, resulting in more vegetation being cleared.

<u>Option 3</u> - Control lines would mainly be 15-30 ft. wide but could be as wide as 65 ft. in blowdown areas. Water and foam could be used to pretreat areas adjacent to the control line immediately before ignition in order to reduce the width of the control line needed to be effective. Because motorized control line reinforcements would be used under Option 3, control lines would be relatively narrow under these options compared to Option 2. This would mean that less vegetation would be cleared from control lines than under Option 2. In contrast to Option 1, Option 3 would favor control line reinforcement with water instead of foam.

**Mitigation Relative to Minimum Tool Use and Wilderness Values during Helispot Preparation**

- If helispots are necessary, use the following helispot construction guidelines:
  - Construct helispots only for units that are 5 miles or more from an improved helispot location outside of the wilderness boundary. For units that are within 5 miles from the boundary, helispots outside of the Wilderness will be used.
  - Use natural openings (e.g., open sedge- or grass-dominated areas), units that have been already burned, or areas in units that will be burned in the future, wherever possible. Cut only the trees necessary to permit safe operation.
  - Avoid construction of helispots in high visitor-use areas or sites with sensitive plants or heritage sites.
  - Transport helitorch fuel into the wilderness immediately prior to igniting the burn and remove the fuel from the site within 72 hours after the fuel is no longer needed for treating the unit.
  - Refuel helicopters directly from fuel trucks outside of the BWCAW. Helicopter fuels would not be cached within the BWCAW.
- Protect individual sites where possible (e.g., administrative structures, bridges, stairway portages) from the effects of helispot construction.

***More motorized equipment and mechanized transportation would result in greater risk of accidental fuel spills***

During refueling motorized equipment or pre-placement and while refueling motorboats, accidental fuel spills could affect soil resources, aquatic resources, wetlands, and riparian areas.

Option 1 **-** The risk of negative effects from accidental spills while refueling chainsaws, brushsaws, and motorboats would be greater than under the other options because more of this motorized equipment would be used under Option 1. However, impacts from spills would likely be minor.

Option 2 – Motorized equipment and mechanized transportation use would very small under Option 2, so there would be a very small risk of accidental spills negatively impacting soil or water resources.

Option 3 **-** Chainsaws and motorboats would rarely be used under Option 3, so less chainsaw fuel would be required, reducing the risk of accidental spills. Impacts from any spills would be minor.

**Social, Recreational, and Experiential Effects of Preparation**

***Wilderness values***

Use of non-motorized equipment and non-mechanized transport conforms to wilderness values because the sights and sounds of the equipment are within the expectations of typical wilderness visitors. However, motorized equipment and mechanized transportation do not conform to wilderness values.

Option 1 – In terms of audible impacts to visitors' experience, Option 1 would be the most disturbing because chainsaws would be the primary cutting tool. Option 1, with the most mechanized transport, would have the most impact on apparent naturalness of the area and is the option that is least in harmony with wilderness philosophy.

Option 2 – In terms of audible impacts to visitors' experience, it would be the least disturbing because crosscut saws would be the primary cutting tool. In terms of wilderness philosophy, this option with minimal mechanized and motorized equipment, would have the least impact on visitor's sense of solitude while it would have the most impact on apparent naturalness of the area because the widest control lines would be cleared.

Option 3 – In terms of audible impacts to visitors' experience, it would be less disturbing than Option 1 but more disturbing than Option 2. Control lines under Option 3 would be more narrow than under Option 2 and would have less impact on apparent naturalness.

***Personnel presence in the Wilderness***

The more crews required to implement preparation, the more contact there would be with visitors, reducing visitors' sense of solitude.

<u>Option 1</u> – This would be least labor-intensive of the options because motorized tools would be used for constructing control lines and mechanized transportation would be used for crews and equipment. The use of mechanized and motorized control line reinforcements during holding in Option 1 would allow for narrow control lines, which would take less personnel to build than wide control lines. There would be less personnel present in the BWCAW under Option 1 than the other options, which would result in less contact with visitors.

<u>Option 2</u> – More personnel would be in the Wilderness than under the other options because wider control lines would have to be prepared and control lines would be cleared with crosscut saws, resulting in more contact with visitors than Options 1 and 3.

<u>Option 3</u> - Personnel presence would be moderate. Hand tools would be predominantly used for construction of control lines and non-mechanized transportation would be used for crews and equipment under Option 3. However, using motorized control line holding support during the lighting and holding phase would allow for narrower control lines under Option 3 than Option 2, resulting in proportionally less personnel required to clear control lines and less contact with visitors.

***Campsites***

Visitors could be displaced from established campsites by fire crews if the Interdisciplinary Implementation Team determines that burn crews would have the least adverse impact on the wilderness resource at these sites. Some campsites will be used by fire personnel during all phases of prescribed burning operations. All crews will use leave-no-trace practices during all phases of implementation. There will be no limit on party size but crews will travel in small groups when possible.

<u>Option 1</u> - Of all the options, this would be least disruptive under Option 1 because it would take fewer personnel to accomplish management goals.

<u>Option 2</u> – This would be most disruptive under Option 2 because it would take the most personnel to reach preparation objectives.

<u>Option 3</u> - Displacement from campsites under Option 3 would be moderately disruptive because of the moderate amount of personnel it would take to accomplish management goals.

**Mitigation Relative to Minimum Tool Use and Wilderness Values during Camp construction**

Use the following camp construction guidelines:

- Identify camps in thhe Burn Plan.
- Locate camp outside of the wilderness, wherever possible.
- Locate camps at existing campsites or where they would have the least impact on wilderness values.

***Portages and Hiking Trails***

Some portages and hiking trails would be part of control lines and some vegetation might be removed during preparation. This clearing would be minimal because the portage or trail would already have vegetation removed, unless the area was blown down. These portages and trails would appear unnatural for a period of time and visitors could see evidence of tree and shrub clearing. Visitors might also be offended to see evidence of chainsaw use. Control lines would be rehabilitated where portages and hiking trails intersect them (see Effects of Mopup and Rehabilitation and Appendix B Mitigation Relative to Tool Use).

Option 1 – Narrow control lines would reduce the amount of vegetation cleared from portages and hiking trails, however chainsaw use would be most noticeable.

Option 2 – Chainsaws would not be used so chainsaw use would not be noticeable. However, this option would require wider control lines so there would be more vegetation cleared from portages and hiking trails.

Option 3 - Narrow control lines would reduce the amount of vegetation cleared from portages and hiking trails and chainsaw use would be limited and would not be nearly as noticeable as under Option 1.

**Social and Political Effects of Preparation**

Some segments of the public would like the project to be implemented with primitive tools only.

Option 1 - Option 1 would allow the objectives of preparation to be reached with the least personnel, however it would use the least amount of primitive tools. There would be much public opposition to the use of motorboats on non-motorized routes under Option 1.

Option 2 - This option would satisfy advocates of primitive tool use and would not allow motorboats on non-motorized routes.

Option 3 - Because more narrow control lines would be used, Option 3 would require fewer personnel than Option 2 even though crosscut saws would be used in preparation, except when safety is an issue. Option 3 would use more primitive tools and transportation than Option 1. Motorboats would not be allowed on non-motorized routes.

**Health and Safety Concerns of Preparation**

***Sawing on unsafe, lodged trees***

Some control lines would be cleared through blowdown that has downed trees piled on top of each other. These trees are under tension, under compression, and may not present a safe point from which to operate a crosscut saw. Chainsaw operation carries some risk, but under certain situations, chainsaw operation is safer with lodged material than crosscut saw operation. Standard saw techniques generally allow the safe release of bound material.

Option 1 - Chainsaws and brushsaws would be the primary cutting tools during preparation, so sawing on lodged material would not be as much of a safety issue as under Option 2.

Option 2 - Crosscut saws would be the primary cutting tool. There would be a safety risk to crews without the ability to use chainsaws on lodged material. Alternative methods of removing the material, such as explosives could be used.

Option 3 – Crosscut saws would be the primary cutting tool. Alternative methods of removing the material, such as explosives could also be used. However, chainsaws could be used to operate on unsafe, bound material that could not be removed from the control lines with alternative means.

**Economic and Timing Concerns of Preparation**

***Cost of preparation would depend, in part, on control line width and transportation***

Table 8 lists the estimated average costs of preparing control lines for one burn. An average of 3.28 miles would be cleared for one burn.

**Table 8. Estimated average costs of clearing vegetation from control lines for an average burn**

| | **Option 1** | **Option 2** | **Option 3** |
|---|---|---|---|
| Cost per mile for an average burn | $1,453 | $12,049 | $5,339 |
| Overall cost for an average burn | $4,767 | $39,522 | $17,512 |

Option 1 - Preparation of treatment units would be less expensive under Option 1 than the other options. Using chainsaws to cut line and the use of control line reinforcements, which would allow less vegetation to be cut in control lines, would reduce the personnel required to clear control lines and reduce the cost.

Option 2 – Preparation of treatment units would be more expensive because more vegetation would have to be cleared in control lines under Option 2 and vegetation would be cleared with crosscut saws. Therefore, it would take more personnel to clear control lines under Option 2.

Option 3 – The cost of preparing treatment units would be more than Option 1 but less than Option 2 because control lines under Option 3 would be narrower than Option 2 but would be cleared using crosscut saws.

**Summary of Preparation**

Table 9 summarizes the level of potential negative impacts of preparation.

**Table 9. Summary of the Potential Negative Effects during Preparation***

| | Option 1 Motor/ Mech. | Option 2 Non-motor/ Non-mech. | Option 3 Combina. | Key Issues |
|---|---|---|---|---|
| **Biophysical Effects** | Low | Moderate | Low | Vegetation Cut: Option 2 would require wide control lines to be cleared, which would result in more vegetation being cut than the other options. |
| **Social/ Recreational/ Experiential Effects** | Moderate | Moderate | Low | Audible Impacts: Audible impacts would be greatest under Option 1. Audible impacts would be the smaller under Options 2 and 3 because noise from chainsaws would not bother visitors. Personnel Presence: Option 2 would require more personnel then the other two options, which could mean more contact with visitors and more displacement from campsites. Apparent Naturalness: Option 2 would require wider control lines to be cut than the other two options, which would be more noticeable along the portages hiking trails used in control lines. |
| **Social/ Political Effects** | High | Moderate | Low | Chainsaw Use: Under Option 1, there would be public opposition to using only chainsaws to clear control lines when crosscut saws could be used. However, under Option 2, there would also be opposition to not being able to use chainsaws in unsafe sawing situations, putting crew safety at risk. Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| **Health/Safety Concerns** | Low | High | Low | Chainsaw Use: Under Option 2, the safety risk of using crosscut saws on lodged trees under tension would be considerable. Option 1 would allow for chainsaw use all the time. Option 3 would only allow chainsaw use for unsafe sawing situations if an alternative method (e.g. explosives) would not be effective. |

| Table 9. Summary of the Potential Negative Effects during Preparation* | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Economic/ Timing Concerns** | Low | High | Moderate | Personnel Required: Using chainsaws to clear control lines (Option 1) would require fewer crews than using crosscut saws (Options 2 and 3). However, under Option 3, control lines could be cleared with a moderate amount of crews even though crosscut saws would be the primary cutting tool because control lines would be narrower than they would be under Option 2. |

*Low, medium, and high are summaries of each effect or concern. The importance of each effect or concern varies by implementation phase.

## Effects of Lighting and Holding

Lighting and holding involve igniting a prescribed burn and securing control lines after the fire is lit.

**Preparations immediately before ignition**

Preparations 1 to 3 days before a burn and the day of a burn could involve setting up pumps, sprinkler systems, explosive ignition systems, and transporting equipment and prescribed burn personnel. The mineral soil line would also be cleared at this time. (Note: the Final EIS describes these activities in Preparation of Treatment Units in Chapter 2.)

**Ignition**

Prior to igniting the entire unit, a test fire would be ignited in representative locations within the unit to determine if key fire characteristics in the prescription would be met. Ignition could take several minutes to several hours. In some cases, multiple days may be necessary to ignite larger units. Most burns would be lit in the spring and fall, especially in late September and early October.

The number of days is limited that weather conditions allow for the safe and effective ignition of prescribed burns. Burn windows vary by year with some years having several suitable days and other years having few suitable days. In most cases there is little advance warning of ideal burning conditions. Due to the limitations of weather forecasting, oftentimes, the decision to burn on a given day may only be made 24 hours or less in advance.

Most units would be ignited using a combination of helitorch and other means such as hand-held drip torches.

**Holding**

Holding involves keeping the prescribed burn inside control lines, which could require treatment of control lines that make the control lines more secure. These reinforcements could include pumps, sprinkler systems, and hoselays as well as aerial application of water or foam. It may also be necessary to use chainsaws during holding in order to, for example, respond quickly to fire crossing the control line. Holding occurs within several minutes before the burn until the burn is complete, which could be within 6 hours to 6 days from initial ignition.

After the ignition is complete, fire personnel would make sure that the fire is out in critical areas where fire is most likely to escape. This would involve cooling hotspots along the control line immediately after ignition has been completed.

Timing of the transition from holding to mopup will depend on how a burn plays out, which largely hinges on weather and fuel conditions. It is anticipated that holding would generally be complete within 2 days of ignition, however conditions will vary on each burn and reaching the objectives of holding could take longer than 2 days. During holding chainsaws and motorized pumps would be needed to ensure the burn is safely executed.

Before moving to the mopup phase, crews would create a “cold line” around the burn. A cold line is an area in which all hot spots are completely put out. The width and location of the cold line would be pre-determined in burn plans. After the cold line is established, work would shift to mopup and chainsaws and motorized pumps would no longer be used unless there is a safety risk from, for example, a hot spot flaring up or for contingency situations.

**Assumption – An 18- to 48-inch-wide line would be cleared to mineral soil on control lines in upland areas**

Regardless of the amount of blowdown and regardless of which equipment option were selected, a minimum 18- to 48-inch width would be cleared to mineral soil in control lines that are in uplands. This would be done with either hand tools or control line explosives after vegetation and downed fuel is removed from the control line.

In many cases, the mineral soil line would be cleared with explosives that would need to be transported by helicopter sling-load for safety reasons. Mineral soil lines are less effective if created well in advance of ignition because vegetation can grow into the line and freshly exposed soil has a higher water content than soil that has been exposed for a time. Control line explosives would be deployed as close as possible to when a fire is lit, within 1 to 3 days of ignition. However, in some units, logistical issues may require explosive to be deployed more than 1 to 3 days in advance.

**Assumption – During lighting and holding helitorch fuel would be stored and mixed in impermeable basins**

In order to reduce biophysical impacts, helitorch fuel would be mixed and stored in impermeable basins. If any fuel were spilled in the basin, it would not negatively affect water or soil resources. However, a risk of spills during transportation would remain. A spill kit with absorbent pads and materials would also be on site to clean up fuel in the event of a spill.

**Assumption – All burn plans would consider safety, logistics, and wilderness values to determine the transportation needs during lighting and holding for each burn**

Because the transportation needs for each treatment unit will be different, the Interdisciplinary Prescribed Burn Team would consider safety, logistics, and wilderness values to determine transportation for each burn.

It is anticipated that most of the burns would require some equipment to be sling-loaded to the treatment unit for either safety or timing reasons. Egress would use as much primitive transportation as possible.

Burn plans will have flexibility to use mechanized transportation in certain situations if it is the minimum tool. However, there would be limitations on mechanized transportation. Where possible, the Forest would limit the amount of mechanized transportation with careful planning. The rationale for any mechanized transportation use would have to be explained in a burn plan with the following questions.

1. What are the equipment and personnel needs?
2. Does the burn require any equipment that would be unsafe to transport by canoe, e.g., explosives?
3. If airplanes or helicopters are used, what are the anticipated impacts on wilderness values (for instance natural integrity, apparent naturalness, outstanding opportunities for solitude, and outstanding opportunities for primitive recreation)?
4. Would equipment have to be pre-placed if it were transported into the Wilderness with primitive means? If so, how much equipment would have to be pre-placed and for how long?
5. What are the logical transportation routes to get crews and equipment into place?
6. What is the relationship between the equipment in this burn and other burns, e.g., is there another burn that is planned to be lit shortly after this burn and would it make sense to move the equipment to that treatment unit immediately after this burn is completed?
7. Because the urgency of meeting a burn window would no longer be present, are the transportation needs for egress different from the needs for getting things into place?
8. What are the transportation needs for the few days before ignition, i.e., deploying control line explosives, and the day of ignition?
9. What equipment must be removed by mechanized transportation and why?

In addition, there will be an annual logistic analysis that will examine the transportation needs for all burns each year. This will allow for transportation planning to consider all of the logistical issues of moving equipment into the Wilderness and to coordinate movements between treatment units if timing is a concern.

| Table 10. Tools and Transportation for each Equipment Option during Lighting and Holding | | | | |
|---|---|---|---|---|
| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized& Non-mechanized | **Option 3** Combination | **Approval Required?** |
| **Clearing Mineral Soil Line** | | | | |
| Helicopter* sling-loads only for deploying control line explosives | | | | Yes |
| Hand tools | | | | No |
| Control line explosives | | | | No |
| **Personnel Transportation** | | | | |
| Motorboats everywhere accessible by motorboats (including non-motorized routes) | | | | Yes |
| Motorboats only on motorized routes | | | | No |
| Aircraft (below 4,000 ft. ASL) | | | | Yes |
| Aircraft (below 4,000 ft. ASL) would be pre-approved on a case-by-case basis in burn plans | | | | Yes |
| Aircraft (below 4,000 ft. ASL) for contingency and crew safety | | | | Yes |
| Aircraft (below 4,000 ft. ASL) for safety sweep | | | | Yes |
| Canoes | | | | No |
| **Equipment Transportation** | | | | |
| Motorboats everywhere accessible by motorboats (including non-motorized routes) | | | | Yes |
| Motorboats only on motorized routes | | | | No |
| Helicopters* to sling-loading equipment | | | | Yes |
| Helicopters* for sling-loading equipment would be pre-approved on a case-by-case basis in burn plans | | | | Yes |
| Canoes | | | | No |
| **Lighting Tools** | | | | |
| Helicopters*, helitorch, helitorch fuel*, plastic spheres, plastic sphere dispenser | | | | Yes |

**Table 10. Tools and Transportation for each Equipment Option during Lighting and Holding**

| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized& Non-mechanized | **Option 3** Combination | **Approval Required?** |
|---|---|---|---|---|
| Drip torch ignition tools, drip torch fuel, fusees, flare pistols | | | | No |
| Explosives for ignition | | | | No |
| Fuel/air moisture meters | | | | No |
| Portable radio repeaters* and portable weather equipment* | | | | No |
| **Holding Tools** | | | | |
| Helicopter*, bucket water drops | | | | Yes |
| Aircraft* (below 4,000 ft. ASL) for surveillance and water/retardant drops | | | | Yes |
| Aircraft* (below 4,000 ft. ASL) for surveillance and water drops | | | | Yes |
| Aircraft* (below 4,000 ft. ASL) for surveillance and retardant drops only if fire threatens to escape | | | | Yes |
| Aircraft (above 4,000 ft. ASL) Surveillance | | | | No |
| Chainsaws* and brushsaws as primary cutting tool | | | | Yes |
| Crosscut saw as primary cutting tool | | | | No |
| Chainsaw* to ensure the safety of burn | | | | Yes |
| Chainsaw* for contingency response | | | | Yes |
| Sprinkler systems | | | | Yes |
| Portable water pumps hoses and hose fitting | | | | Yes |
| Backpack pumps | | | | No |
| Fuses, drip torches, and drip torch fuel | | | | No |
| Portable radio repeaters* | | | | No |

*Mitigation measure would be in place

**Biophysical Effects of Lighting and Holding**

***Risk of negative impacts from fire retardant and foam***

The effects of fire retardant and foam on aquatic resources, riparian areas, and wetlands are discussed in the BWCAW Fuel Treatment Final EIS.

Option 1 – Retardant and foam would be allowed, however there would only be negative impacts if they were accidentally applied directly on water bodies, riparian areas, or wetlands.

Option 2 – Retardant and foam use would not be allowed.

Option 3 – Foam would be allowed in pre-treatment of control lines and during holding, however there would only be negative impacts if it were accidentally applied directly on water bodies, riparian areas, or wetlands. Retardant would not be used for pre-treatment.

***Risk of negative impacts to wildlife***

Potential effects from lighting and holding to wildlife include disturbance or displacement. Nesting or breeding individuals could be disturbed by crews and equipment (e.g., aircraft and chainsaws). These effects are described in detail in the BWCAW Fuel Treatment Final EIS.

Option 1 – This option would use the most motorized equipment and mechanized transportation and could result in the most impacts to wildlife.

Option 2 – This option would be the least disruptive because it would use the smallest amount of motorized equipment and mechanized transportation.

Option 3 – This option would result in more disturbance than Option 2 but less than Option 1.

***Risk of negative impacts to vegetation from clearing mineral soil line***

Regardless of the amount of blowdown and regardless of which equipment option were selected, a minimum 18- to 48-inch width would be cleared to mineral soil in control lines that are in uplands. This would be done with either hand tools or control line explosives after vegetation and downed fuel is removed from the control line. Vegetation grows back more quickly in a mineral soil line that was cleared with explosives than in a mineral soil line that was cleared with hand tools.

Options 1 and 3 – Mineral soil line would be cleared with some hand tools but primarily explosives, reducing revegetation time.

Option 2 – Mineral soil line would be cleared with hand tools, increasing revegetation time.

***Risk of negative impacts during refueling***

During refueling motorized equipment and ignition tools, accidental fuel spills could affect soil resources, aquatic resources, wetlands, and riparian areas. (Aircraft would be refueled outside of the Wilderness.)

Under Options 1 and 3, a gasoline and diesel fuel mixture would be used for hand-held drip torches, jellied gasoline would be used for helitorches, and potassium permanganate and ethylene glycol would be used for PSDs to light the fires. Water pumps and chainsaws would also require fuel. During operations, these fuels and chemicals could accidentally spill and impact aquatic resources, wetlands, and riparian areas.

Option 1 - The risk of negative effects from accidental spills while refueling chainsaws, brushsaws, and motorized water pumps would be greater than under the other options because more of this motorized equipment would be used. If refueling or maintaining equipment must occur within filter strips, riparian management zones, or wetlands, catchment basins would be used to prevent potential spills from contaminating soils or entering riparian areas, wetlands, or waterways. All aerial and ground-based ignitions would also be used under Option 1. Helitorch use could result in impacts near or on helispots from helitorch fuel spills; however, helitorch fuel would be mixed in an impermeable basin in order to reduce the risk of spills negatively affecting resources. However, a risk of spills would remain from carrying the fuel to and from the basin.

Option 2 - Chainsaws would not be used under Option 2, so there would be no risk of accidental spills of chainsaw fuel. However, there would be a risk of spilling drip torch fuel.

Option 3 - The risk of negative effects from accidental spills while refueling chainsaws and motorized water pumps would be smaller than under Option 1 because there would be much less chainsaw use. If refueling or maintaining equipment must occur within filter strips, riparian management zones, or wetlands, catchment basins would be used to prevent potential spills from contaminating soils or entering riparian areas, wetlands, or waterways. As in Option 1, however, all aerial and ground-based ignitions would be used. Helitorch use could result in impacts near or on helispots from helitorch fuel spills; however, helitorch fuel would be mixed in an impermeable basin in order to reduce the risk of spills negatively impacting resources. However, a risk of spills would remain from carrying the fuel to and from the basin.

**Social, Experiential, Recreational Effects of Lighting and Holding**

Regardless of which equipment option is selected, campsites and other areas around treatment units would be closed or limited to the public during burns for safety reasons, affecting access to the area and freedom of movement for recreation, challenge, solitude, etc. These effects are discussed in detail in the Final EIS. All options would allow for motorized equipment and mechanized transport in certain contingency situations, which could disrupt wilderness experiences.

***Lighting and holding operations would displace some visitors from campsites***

Visitors could be displaced from established campsites by fire crews during lighting and holding if the Interdisciplinary Team determines that burn crews would have the least adverse impact on the wilderness resource at these sites. (Regardless of which equipment option is chosen, some areas would be closed to visitors during lighting and holding for safety reasons.)

Options 1 and 3 – These options would be least disruptive because they would take fewer personnel to light and hold the burns.

Option 2 - It would take more personnel with Option 2, so it would be more disruptive.

***Motorized equipment and mechanized transportation would be more disturbing to visitors but would require fewer personnel***

Although wilderness visitors usually prize solitude, typical BWCAW visitors have also come to expect sights or sounds of non-motorized equipment and non-mechanized transportation. These tools are considered more conforming to wilderness values than motorized equipment or mechanized transportation.

Option 1 – Transportation would be more disruptive to visitors' sense of solitude than under Options 2 and 3 because there would be more flights below 4,000 ft. In terms of audible impacts to visitors' experience, it would be the most disturbing. Mechanized transportation would also have more impact on apparent naturalness of the area and would be least in harmony with wilderness philosophy. However, it would affect apparent naturalness for a shorter period of time than Option 2. Option 1 would also allow the use of motorized water pumps and some visitors might notice evidence of this use after the burn is completed.

Option 2 – Transportation would be the least disruptive under Option 2 because aircraft would fly above 4,000 ft. and would be less apparent than Options 1 and 3. In terms of audible impacts to visitors' experience, it would be the least disturbing. The extended human activity of Option 2 would impact visitors for the longest period, although the minimal use of motorized equipment and mechanized transportation would be more in conformity with apparent naturalness than the other options. There would also be no evidence of high-pressure pumps under Option 2.

Option 3 – Mechanized transportation would be approved for certain situations under Option 3 and it is anticipated that most of the burns would require some, but not all, equipment to be sling-loaded to the treatment unit for either safety or timing reasons. Egress transportation would typically require less mechanized transportation because timing would not be an issue.

Transportation would be more disruptive to visitors than under Option 2 because aircraft would be below 4,000 ft. and would be more apparent. However, Option 3 would also be less disruptive to visitors than Option 1 because as much primitive transportation as possible would be used for egress. Option 3 would affect apparent naturalness for a shorter period of time than Option 2. Option 3 would also allow the use of motorized water pumps and some visitors might notice evidence of this use after the burn is completed.

***Some equipment would need to be pre-placed just before ignition***

Shortly before some prescribed burns are ignited, some equipment may be put into place on a short-term basis (referred to as pre-placement). Some tools would be pre-placed under all of the options. Most equipment would be removed within 3 to 5 days of mopup being completed and the remainder would be removed when the burn is declared out.

If equipment is put into place for a burn and it is decided that because of unforeseen circumstances the burn will not be ignited at that time and it is predicted that there will be another burn window within 1 to 5 days, the equipment would remain in place in order to meet the second burn window. Pre-placement under these circumstances would only occur if it were thought that the next burn window would be within 1 to 5 days. Pre-placement would be decided on a case-by-case basis during burn plan development, with the Interdisciplinary Team considering safety and potential impacts to wilderness resources from pre-placement. It is unlikely that visitors would notice pre-placed tools under any of the options.

<u>Options 1 and 3</u> **-** Pre-placement would reduce impacts to wilderness visitors because fewer trips with aircraft would be required to bring in equipment just before a burn.

<u>Option 2</u> – Pre-placement would be required because of the large number of trips and long time period that it would take to move equipment into place.

**Social and Political Effects of Lighting and Holding**

Some people would object to motorized equipment and mechanized transportation. Others might object to the Forest implementing the project without protecting public safety and the safety of burn crews (see the discussion on health and safety concerns that follows).

<u>Option 1</u> – Motorized equipment and mechanized transportation would be allowed, but the project could be implemented safely. There would be much public opposition to motorboat use on non-motorized routes.

<u>Option 2</u> – Motorized equipment and mechanized transportation would not be allowed and the project could not be implemented safely. Motorboats would not be allowed on non-motorized routes.

Option 3 – Less motorized equipment and mechanized transportation would be allowed than in Option 1, but the project could still be implemented safely. Motorboats would not be allowed on non-motorized routes.

**Health and Safety Concerns of Lighting and Holding**

During the lighting and holding of a prescribed burn, ground crews in treatment units with moderate and heavy blowdown would have limited escape options so personnel on the ground would be in safety zones near treatment units ready to respond if control lines needed additional reinforcements or if contingency response action were required. No personnel would be in a treatment unit during ignition because it would be unsafe.

**Aerial Ignition with Helitorch**. Helitorch ignition allows heat to build quickly to create a smoke column that will allow burn personnel to control the burn, which is safer than allowing the wind to control the burn. Aerial ignition also would not require ground crews to be in the treatment unit during ignition.

***Aerial ignition would be the safest ignition method in moderate to heavy blowdown***

Fuel specialists have determined that in treatment units with moderate and heavy blowdown, helicopter use would be necessary to ensure proper and safe ignition. In these units, helicopters would be used with a helitorch or plastic sphere dispenser (PSD).

In areas of moderate to heavy blowdown, controlling and manipulating the intensity and pattern of the ignition is crucial to controlling the burn. By building heat quickly in the middle of the treatment unit, the Burn Boss can influence the smoke column (convection column) by creating indrafts into the column. This in turn can influence the intensity of the heat at the perimeter of the burn by drawing the heat into the center of the burn, away from the perimeter. This is a safer situation than the wind controlling the direction of the burn, which is the case in some wildfires. In large-scale burns (larger than 100 acres), the primary tool to maintain this type of control is aerial ignition with either PSDs or helitorches. Land-based ignition, such as hand-held drip torches, cannot generate the precision required to maintain control of the convection column because it cannot generate heat as quickly.

Most importantly, in moderate to heavy blowdown, a person on the ground manually lighting the fire would quickly be overtaken by the fire they have lit because the fire would burn faster than a person can walk through the tangled, downed trees. There would be serious risk to burn crews if they ignited large units with hand-held drip torches as they walked through blowdown treatment units. Therefore, in moderate and heavy blowdown the only safely ignition method may be a helitorch or PSD.

Hand-held drip torches or other hand-held ignition tools could safely be used for ignition for some patch burns but they would mainly be used for ignition of the combination of patch and understory burns where there is less blowdown.

As burns are implemented, it may be determined that plastic spheres would be sufficient to ignite the burns, in which case PSDs would be considered instead of helitorch. Use of a PSD is normally more successful when igniting fine fuels under drier conditions such as during the spring (when there is more cured fuel) while the helitorch is most effective igniting heavier fuels and during the cooler fall burning season, which is when the majority of the burns would occur. PSD also poses fewer safety risks to crews than helitorch. Final determination of which device would be used would be made in the individual burn plan for each unit.

Options 1 and 3 – Aerial ignition would be allowed. Helitorch fuel would be moved to the helispot within a day or two of ignition. In areas with moderate to heavy blowdown, aerial ignition with a helitorch or PSD would be the safest ignition method, and therefore ignition under Options 1 and 3 would be safer than Option 2, which would only allow manual ignition. In addition to not requiring personnel in the unit during ignition, aerial ignition would also allow more control of the burn itself, making the burn safer. In units with lighter fuel loads where underburns or patch burns are planned, prescribed fires could be safely ignited by hand because they are meant to be cool burns and burn crews would not be in extreme fuel loads during ignition.

Option 2 - Manual ignition would put ground crews at an unacceptable level of risk. Therefore, ignition in the large broadcast burns under Option 2 would be more dangerous to crews than the other options. However, underburns or patch burns could be safely ignited by hand because they are meant to be cool burns and burn crews would not be in extreme fuel loads during ignition.

***Aircraft and motorized water pumps would be needed to hold control lines***

Aircraft would be required to drop water or foam on or near the control line in order to hold the line. Retardants would only be dropped if a burn threatened to cross the control line. Motorized control line reinforcements and their associated mechanized transport, such as water pumps and water drops from helicopters, would be required to hold the control line because heavy fuels could result in fire crossing the control line that exceeds the ability of burn crews to safely respond with backpack pumps. In addition, if fire conditions change rapidly and create a potentially unsafe situation, aircraft may be the best way to quickly get water, retardant, or foam where it is needed to hold the control line. Sling-loading equipment, i.e., explosives or pumps, to a spot fire or water drops on spot fires may also be required to ensure public safety.

Foams and retardants coat vegetation, decreasing vegetation's ability to burn. They also last longer than water. Using foams on the control line means that the line would be more secure. Foam is more effective at controlling fire than water; so fewer aircraft trips to drop foam would be required, which would reduce the risk to airtanker crews.

Option 1 - Motorized water delivery equipment and aircraft water and retardant drops would be allowed. Using sprinkler systems and/or hoselays on the control line means that the line would be more secure.

Option 2 - In heavy fuels, holding control lines only with hand tools in the heavy fuels would require a burn with flame lengths manageable by backpack pumps, less than 4 ft. Fire specialists question whether the existing fuel load would allow a prescribed fire to burn cool enough for flame lengths to be 4 ft. or less. Water could only be applied with backpack pumps. Foam and fire retardants would also not be allowed. Due to high intensities generated by the fire, the risk to holding crews would be unacceptable from being on the control line during a burn under Option 2.

Option 3 - Motorized water delivery equipment and aircraft water drops would be allowed. Using sprinkler systems and/or hoselays on the control line means that the line would be more secure. Water use would be preferred to foam use. Fire retardant use would only be allowed if a burn threatened to escape.

***Aircraft would be needed to patrol for spot fires***

Aircraft would be needed during holding to patrol the burn area for spot fires.

Options 1 and 3 - Planes would fly below 4,000 ft. to patrol the area for spot fires outside of the burn unit.

Option 2 - Surveillance above 4,000 ft. would be allowed and would help locate large spot fires, however locating spot fires would be hindered if aircraft flew above 4,000 ft. because it would be difficult to see smoke at that height.

***Large amounts combustible materials would be unsafe to transport by canoe***

In the past, there has not been a need to carry in large amounts of combustible material into the Wilderness. Small amounts of explosives for trail and portage work have been safely carried in by canoe. However, some of the treatment units in this project would require large amounts of combustible materials (e.g., fire line explosives) to be transported into the BWCAW. Crew safety could be at risk if crews transported large amounts of combustible materials by canoe.

Each burn would have a Blaster that is certified to work with explosives. This person would decide if control line explosives could safely be transported by canoe. The Blaster must retain physical control and oversight of explosives at all times, therefore it would not be feasible to transport many small amounts of explosives in numerous canoes at one time. If the amount of explosives required for one burn cannot be safely transported by canoe or motorboat (on motorized routes), it would have to be sling-loaded to the treatment unit.

Option 1 – Sling-loading equipment would be allowed.

Option 2 **-** Combustible materials would have to be transported by canoe, putting crew safety at risk.

Option 3 – Sling-loading equipment would be pre-approved on a case-by-case basis in burn plans. The burn plans will consider safety, logistics, and wilderness values.

***Equipment that is heavy or bulky would be unsafe to transport by canoe***

Equipment that is heavy or bulky would be unsafe for ground crews to transport into the Wilderness with canoes. This equipment includes items such as helitorch fuel barrels, which weigh 400 lbs. when full, and water delivery equipment. The configuration of some equipment makes it unsafe for ground crews to carry it in with canoes because it is too bulky and heavy to be stable in a canoe.

Table 11 lists the average and the range of weight of just the water delivery equipment needed to reinforce control lines on a burn, such as pumps and hoses. Control lines in blown down forest areas that have heavy fuel loads would need more equipment than control lines in the forested areas that were not blown down and riparian areas.

**Table 11. The weight of only the water delivery equipment required to reinforce control lines to implement Alternative B**

| Weight | Pounds |
|---|---|
| **Average** per burn | 5,357 |
| **Lowest** for one burn (control line through a riparian areas or forested areas that were not blown down) | 2,201 |
| **Highest** for one burn (control line through blowdown) | 14,621 |

The pumps that are required to support a sprinkler system are packaged as a kit. Separating the kit into its components (transporting many lighter pieces) could compromise the ability of crews to effectively use the pump and its ability to hold the control line would subsequently be compromised.

It would also be unsafe to transport heavy water delivery equipment by canoe because it would be heavy to portage and many trips would be required to carry the equipment in, which could result in personal injury. The Mark 3 pump itself weighs 58 lbs. without the rest of the kit, which includes the standard complement of fittings, suction hose, tool kit, etc. Standard issue portable pump kits weigh 105 lbs., not including fuel, hose, and sprinkler systems. Although smaller pumps are available and are used for initial attack in the Wilderness during wildfires, the majority of the pumps would be used for the sprinkler systems require higher water volume than the smaller pumps are capable of providing.

For burns that only require smaller pumps, if sprinkler systems were not needed for example, the pumps would be transported by motorboats on motorized routes and by canoe on non-motorized routes.

Transporting heavy and/or large equipment by canoe and portaging could be unsafe for personnel and in some cases would require water delivery equipment to be transported into and out of the BWCAW by helicopter sling-load.

Option 1 – Sling-loading equipment would be allowed.

Option 2 - Equipment would have to be transported by canoe, putting crew safety at risk.

Option 3 – Sling-loading equipment would be pre-approved on a case-by-case basis in burn plans. Burn plans will consider safety, logistics, and wilderness values.

***Response to urgent, contingency situations may require chainsaw and aircraft in order to keep the burn under control***

Contingencies are unexpected circumstances encountered during lighting and holding and mopup phases of project implementation. Actions to respond to contingencies may be necessary to meet the objectives of the project, keep the burn within prescription, and ensure firefighter and public safety. They are potentially hazardous situations possible during prescribed burns. A quick response to contingencies during holding is critical and action may need to be taken within minutes or seconds to keep the burn in the treatment unit. For instance, if a spot fire starts outside a treatment unit during a prescribed fire, ground crews would need to quickly get to the spot fire to contain it, which may require transporting a crew by helicopter.

The wildland fire fighting protocol established for the Wilderness considers its remoteness and unique features and values (Fire Management Plan). In the event of an unintentional fire-start outside treatment units during prescribed fires, this protocol would be employed. The approval for motorized and mechanized equipment under these circumstances would follow the Fire Management Plan decision-making procedure. In contingency situations, motorized equipment and mechanized transportation would be pre-approved. In blowdown areas, the Fire Management Plan requires immediate full suppression on all spot fires or any fire that would be considered outside of a burn plan's prescription.

Examples of these contingencies and the potential tools required to respond to them are outlined in Table 12. These contingency response actions would apply regardless of which equipment option is chosen.

**Table 12. Possible contingencies and contingency responses during lighting and holding**

| Possible Contingency | Contingency Response Action |
|---|---|
| Spot fire-<br>Potential fire escape | Fly in additional firefighting resources. This is necessary because timely control line reinforcement could mean the difference in keeping burn in prescription. Reinforcements would be required if a spot fire that exceeds the capabilities of the onsite holding forces were to develop outside the burn unit. |
| Spot fire-<br>Potential fire escape | Use of chainsaws by firefighters to establish access to spot fire and to clear control line around spot fire area after knockdown by aircraft. Firefighters must have safe access and escape routes when attacking spot fire in case it flares up. In most cases, crosscut saws would not allow quick response and could therefore put firefighters at risk if the fire flared up. |

**Economic and Timing Concerns of Lighting and Holding**

***Primitive transportation for equipment would be much more labor-intensive and require considerably more time than mechanized transportation***

In the past, the Forest has paddled in equipment to suppress small wildfires when it is not crucial to get to the wildfire quickly in order to put them out (when fire danger is low). Suppression actions on a small wildfire require much less equipment than would be needed for a large prescribed burn. It is estimated that some of the large prescribed burns would require 60 to 90 people just for hauling in equipment if only canoes were used. Additional people would be required to set up the equipment along the control lines once it got to the treatment unit.

The average allowable load for a small-sized helicopter is approximately 750 lbs., and the average allowable load for a medium-sized helicopter is approximately 1,500 lbs. Under Alternative B, the number of trips into the Wilderness to just transport water delivery equipment for one burn with sling-loads would range from 2 trips with moderate-sized helicopters to 20 trips with small-sized helicopters (Table 13). (It is likely that a combination of small or medium-sized helicopters would be used. The combination would depend on helicopter availability.)

By canoe, the number of trips it would take to carry in water delivery equipment would vary from 7 to 42 trips. A canoe with 2 paddlers and their food, camping gear, and personal gear would be able to transport 350 lbs. of equipment.

**Table 13. The number of trips into the BWCAW required to transport only the water delivery equipment required for one burn.**

| Transport | Approximate Load (lbs.) | Number of Trips into BWCAW | | |
|---|---|---|---|---|
| | | Average Burn | Burn with the Least Equipment | Burn with the Most Equipment |
| Medium-sized Helicopter | 1,500 | 4 | 2 | 10 |
| Small-sized Helicopter | 750 | 7 | 3 | 20 |
| Canoe | 350 | 16 | 7 | 42 |

Option 1 – Aircraft would be allowed for transporting equipment.

Option 2 – Aircraft would not be allowed for transporting equipment.

Option 3 – Sling-loading equipment would be pre-approved on a case-by-case basis in burn plans. Burn plans will consider safety, logistics, and wilderness values.

***The cost of lighting and holding would vary by equipment option***

Table 14 lists the costs of setting up equipment for lighting and holding one burn and the cost of implementing lighting and holding. Under Option 2, sprinkler lines would not be allowed. Clearing mineral soil lines would be done by hand because helicopter use for transporting explosives would not be approved. Lighting and holding would not be feasible under Option 2 because of the safety concerns previously discussed.

**Table 14. Estimated average costs of lighting and holding one burn**

| | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Clearing Mineral Soil Line | $40,235 | $31,920 | $41,585 |
| Sprinkler Line Installation | $7,882 | Not Applicable | $14,311 |
| Ignition and Holding Control Lines | $37,276 | Not Feasible | $43,290 |
| Total | $85,393 | ------- | $99,186 |

Option 1 – Mechanized transportation would reduce the personnel time that would be required to get equipment into place. Using helitorch and PSD would expedite and ensure proper ignition. Explosives are the primary expense in clearing mineral soil line. This is why Option 1 is more expensive than Option 2 even though Option 2 would require more personnel.

Option 2 – Motorized pumps and sprinkler systems would not be allowed under Option 2. In terms of timing, hand-held drip torches would be the only ignition method allowed under Option 2 and the risk would be substantial to ground crews from manual ignition. This could result in serious injury or loss of life, and the associated costs could be exorbitant. Because of these safety issues, ignition could not be implemented under Option 2. In addition, sling-loads could not be used to deploy control line explosives and it would be unsafe to transport explosives by canoe. Therefore, mineral soil lines would be cleared using hand tools and would require more personnel than the other Options.

Option 3 – Mechanized transportation would be used less than in Option 1 for moving equipment into place, so the cost would be higher than Option 1 because more personnel would be required. Using helitorch and PSD would expedite and ensure proper ignition. Explosives are the primary expense in clearing mineral soil line, which is why Option 3 is more expensive than Option 2.

***Being able to take advantage of narrow burn windows could mean the difference between reaching the goal of reducing the risk of wildfire exiting the BWCAW in 5 to 7 years and not reaching this goal***

The primary need for mechanized transportation for equipment is to be able to implement the burns and meet management objectives. Fire management personnel cannot take advantage of burn windows, some of which there is only a one-day advance warning or less, without being able to move equipment quickly and deploy quickly using helicopters and sling-loads.

As listed the table below, 79 prescribed burns are proposed for implementation within 5 to 7 years. In the third year of treatment, 2003, the Forest anticipates that it will burn 19 treatment units, encompassing an estimated area of 22,749 acres. Meeting these prescribed burning objectives is largely dependant on how many days there are with ideal burning conditions. Local climate varies each year; therefore, it is not possible to accurately predict how many burn windows will be available that year. It is for these reasons that using aircraft to get equipment into place to take advantage of burn windows that are forecasted only one or two days in advance is so important to reaching the management objectives of reducing the risk of wildfire exiting the BWCAW. The alternative to using mechanized transportation would be to pre-place large amounts of equipment and fuel in the Wilderness for a long period of time.

Not every burn window that is predicted with just a couple of days warning would require aircraft. For instance, some treatment units that are on motorized routes in the Wilderness would be easily reached with motorboats. However, aircraft would be crucial for remote units.

**Table 15. Estimated number of acres and units to be burned each year**

| Year of Treatment | Acres | No. of Units |
|---|---|---|
| 2001 | 4,105 | 6 |
| 2002 | 11,215 | 16 |
| 2003 | 22,749 | 19 |
| 2004 | 18,168 | 17 |
| 2005 | 6,494 | 9 |
| 2006 | 8,996 | 7 |
| 2007 | 3,879 | 5 |
| **Total** | **75,605** | **79** |

Option 1 - If there were a narrow burn window, management would be able to get crews and equipment into position in a short amount of time.

Option 2 - Under Option 2, it would be difficult to get crews and equipment into place, especially to remote units, when there is little advance notice of burn window.

Option 3 - The decision could be made to use mechanized transportation to get equipment and personnel into position on a case-by-case basis while each burn plan is developed. Every burn plan would be developed by an interdisciplinary team that would consider safety, logistics, and wilderness values. Allowing mechanized transportation when a good burn window is predicted only 1 day in advance could mean that the goal of completing all the 79 prescribed burns in 5 to 7 years could be met.

**Summary of Lighting and Holding**

Table 16 summarizes the potential negative effects of lighting and holding. Lighting and holding would not be feasible under Option 2 because of the safety risk of using manual ignition in units with moderate to heavy blowdown.

**Table 16. Summary of the Potential Negative Effects of Lighting and Holding***

| | **Option 1** Motor/ Mech. | **Option 2** Non-motor/ Non-mech. | **Option 3** Combina. | **Key Issues** |
|---|---|---|---|---|
| **Biophysical Effects** | Moderate | Not Feasible | Moderate | Risk of Fuel Spills: The risk of impacts from accidental fuel spills would be present under all options.<br>Retardant Use: Fire retardants and foams would be used under Options 1 and 3, but under Option 3, water use would be preferred to foam use and retardants would only be used if a burn threatened to escape. There would only be negative impacts if they were accidentally applied directly to water bodies, riparian areas, and wetlands. |
| **Social/ Recreational/ Experiential Effects** | High | Not Feasible | High | During lighting and holding under any option, visitors' experience and opportunities would be affected (e.g., campsite displacement).<br>Sense of Solitude: Aircraft use in Option 1 would result in the most impact on visitors' sense of solitude. Option 3 would use less aircraft for transportation of crews and equipment than Option 1. Aircraft use would be the least disturbing under Option 2.<br>Audible Impacts: The motorized equipment and mechanized transportation in Option 1 would result in the most audible impacts. Option 3 would use less of this equipment than Option 1, while Option 2 would use almost none.<br>Apparent Naturalness: Aircraft use in Option 1 would have the most impact on apparent naturalness, but it would affect apparent naturalness for the shortest amount of time. Conversely, Option 2 would have the least impact on apparent naturalness but impacts would last longer. Option 3's impacts would be intermediate.<br>Pre-placement: Under Options 1 and 3, pre-placement would reduce impacts to visitors because fewer aircraft trips would be required. Under Option 2, pre-placement would be necessary because of the large number of trips required to transport equipment in with primitive means. |

| **Table 16. Summary of the Potential Negative Effects of Lighting and Holding*** | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Social/ Political Effects** | High | Not Feasible | Moderate | Safe Implementation: Some segments of the public would be opposed to using mechanized transportation and motorized equipment (Options 1 and 3), however this equipment would allow the burns to be safely implemented. On the other hand, there would also be opposition to not using the equipment that would allow the project to be implemented safely (Option 2).<br>Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| **Health/Safety Concerns** | Low | Not Feasible | Low | Ignition: In areas with moderate to heavy blowdown, aerial ignition would be the safest ignition method. Options 1 and 3 would allow aerial ignition, but Option 2 would not. Under Option 2, burns would have to be lit manually, with hand-held drip torches for example. This would require ground crews to be in the treatment unit during ignition, which would put those crews at considerable risk of being overtaken by fire.<br>Control Line Reinforcements: Motorized water pumps and aircraft water drops, which are allowed in Options 1 and 3, would make control lines more secure. Under Option 2, ground crews would have to hold control lines with backpack pumps that can only hold fire with flame lengths of 4 ft. or less. Heavy fuel loads will generate flame lengths greater than 4 ft., making Option 2 unable to hold the fire in treatment units with moderate to heavy fuel loads.<br>Feasibility: The equipment in Options 1 and 3 would allow the burns to be safely implemented. However, Option 2 could not be safely executed and is therefore not feasible. |

| Table 16. Summary of the Potential Negative Effects of Lighting and Holding* | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Economic/ Timing Concerns** | Low | Not Feasible | Low | Narrow Burn Windows: Burn windows are predicted with little advance warning. The mechanized transportation in Options 1 and 3 would allow the Forest to take advantage of narrow burn windows and ensure that the fuel treatment objectives could be reached in 5 to 7 years. It is doubtful that the fuel treatment objectives could be reached within 5 to 7 years under Option 2 because primitive transportation could not move personnel and equipment in place fast enough to take advantage of narrow burn windows. |

*Low, medium, and high are summaries of each effect or concern. The importance of each effect or concern varies by implementation phase.

## Effects of Mopup and Rehabilitation

### Mopup

Mopup could be a lengthy or short process depending on how long burn crews have to wait for a fire-ending weather event, such as two or more inches of rain in a five-day period. There are two major activities during mopup: “active mopup” and “patrol.”

Active mop-up begins immediately upon completion of holding, after a cold line has been established, and could continue for days or possibly weeks after ignition. During mopup, hot spots are cooled with hand tools and water. It would not be possible to completely mopup large burns, so only areas that are the main threat to fire escaping would be actively mopped up. These critical areas would be outlined in burn plans. During active mopup, the standards established in the burn plan are met using most of the same tools as the lighting and holding phase.

During patrol, ground crews sweep through a unit looking for hot spots that still need to be cooled down. Aerial patrol also searches for hot spots by looking for smoke and using heat location equipment. Previously mopped up areas are patrolled to make sure no hot spots flare up and threaten to escape. Both aerial and ground patrol continue until the burn is declared out.

In some cases, patrol may return to active mopup if rain is not forthcoming and fire danger begins to increase. Mopup may also be reactivated if a major wind event is forecasted that could cause the burn to become active again.

**Assumption - Response to urgent, contingency situations could require chainsaws and aircraft in order to keep a flare-up under control**

Contingency planning is necessary for mopup. It is possible that the fire could flare up a week or two after ignition and action would be required to keep the fire from moving outside control lines. Crews would take action as needed to prevent a flare-up from spreading outside the unit, which could require chainsaws or aircraft, for instance. For spot fires, ground crews would be used only if a spot fire was not spreading and it was determined that ground personnel could safely get to the spot fire. Otherwise, aerial support would be used for spot fires. Table 17 lists a couple of examples of possible contingency situations during mopup.

| Table 17. Possible contingencies and response to contingencies during mopup | |
|---|---|
| **Possible Contingency** | **Contingency Response Action** |
| Flare-up-<br>Potential fire escape | Use of chainsaws, airdrops, portable pumps, and aerial transport of contingency firefighters and equipment. |
| Increasing fire danger-<br>Expected wind event | Use of chainsaws, airdrops, portable pumps, and aerial transport of contingency firefighters and equipment. |

**Rehabilitation**

Rehabilitation involves repairing areas that have resource damage. Rehabilitation efforts, such as waterbarring and other mitigation efforts, are listed in Appendix B of this document and in the BWCAW Fuel Treatment Final EIS. Rehabilitation in some cases begins during control line construction (in the case of erosion control), but it primarily begins upon completion of the burn and could continue for a few days to a few weeks following the burn.

| Table 18. Tools for each Equipment Option during Mopup and Rehabilitation | | | | |
|---|---|---|---|---|
| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized & Non-mechanized | **Option 3** Combination | **Approval Required?** |
| **Transportation** | | | | |
| Motorboats everywhere accessible by motorboats (including non-motorized routes) | | | | Yes |
| Motorboats on established motorized routes only | | | | No |
| Canoes | | | | No |
| Helicopters and airplanes* | | | | Yes |
| Helicopters and airplanes in case contingency response actions are required | | | | Yes |
| **Tools** | | | | |
| Pulaskis, axes, shovels, flapper, rake, hand winch, log carrier | | | | No |
| Chainsaws* and brushsaws as primary cutting tools | | | | Yes |

**Table 18. Tools for each Equipment Option during Mopup and Rehabilitation**

| | **Option 1** Motorized & Mechanized | **Option 2** Non-motorized & Non-mechanized | **Option 3** Combination | **Approval Required?** |
|---|---|---|---|---|
| Chainsaw* for active mopup | | | | Yes |
| Crosscut saws as primary cutting tool | | | | No |
| Chainsaw* for contingency response | | | | Yes |
| Aircraft for surveillance (below 4,000 ft. ASL) and aerial heat location equipment | | | | Yes |
| Fixed-wing aircraft for surveillance (above 4,000 ft. ASL) | | | | No |
| Drip torch and fusees | | | | No |
| Portable motorized water pumps* for active mopup | | | | Yes |
| Backpack pumps | | | | No |
| Aircraft* for water drops for active mopup | | | | Yes |
| Hand-held heat location equipment | | | | No |

*Mitigation measure would be in place

**Biophysical Effects of Mopup and Rehabilitation**

***More motorized equipment and mechanized transportation would result in greater risk of accidental fuel spills***

During refueling motorized equipment or pre-placement and while refueling motorboats, accidental fuel spills could affect soil resources, aquatic resources, wetlands, and riparian areas.

Option 1 - The risk of negative effects from accidental spills while refueling chainsaws, brushsaws, and motorboats would be greater than under the other options because more of this motorized equipment would be used under Option 1 than the other options.

Option 2 – Motorized equipment would rarely be used under Option 2, so less chainsaw fuel would be required, reducing the risk of accidental spills.

Option 3 - Chainsaws use would be less under Option 3 than Option 1, so less chainsaw fuel would be required, reducing the risk of accidental spills.

***Risk of negative impacts to wildlife***

Potential effects from mopup and rehabilitation to wildlife include disturbance or displacement. Nesting or breeding individuals could be disturbed by crews and equipment (e.g., aircraft and chainsaws). These effects are described in detail in the BWCAW Fuel Treatment Final EIS.

Option 1 – This option would use the most mechanized transportation and could result in the most impacts to wildlife.

Option 2 – This option would be the least disruptive because it would use the smallest amount of motorized equipment and mechanized transportation.

Option 3 – This option would result in more disturbance than Option 2 but less than Option 1.

**Mitigation Relative to Minimum Tool Use and Wilderness Values during Rehabilitation**

- Rehabilitate control lines, where visible (where they intersect portages, hiking trails, lakes, and boundaries), helispots, and campsites to leave the areas in a state that is as natural appearing possible.
  - Scatter obvious large accumulations of cut limbs, seedlings, and saplings.
  - Scatter some cut brush and limbs onto control lines and helispots.
  - Cut stumps as close to the ground as possible in campsites and along portages and trails.
  - Remove all plastic flagging and trash along control lines and helispots.
  - Return helispot landing pads to a condition that is as natural as possible.

**Social, Experiential, and Recreational Effects of Mopup and Rehabilitation**

Control lines would be rehabilitated where they are visible, where they intersect portages, hiking trails, lakes, and boundaries. Helispots and campsites would also be rehabilitated to leave the area in a state that is as natural appearing as possible.

Option 1 - The least labor-intensive of the options because motorized tools and mechanized transport would be used for mopup and rehabilitation. There would be fewer personnel present under Option 1 than the other options, which would result in less contact with visitors. However, visitors would hear motorized equipment and aircraft use would be more apparent than under Option 2.

Option 2 – The most labor-intensive of the options because almost no motorized tools and mechanized transport would be used for mopup and rehabilitation. There would be more personnel present under Option 2 than the other options, which would result in more contact with visitors. However, visitors motorized equipment and aircraft use would be less apparent than under Option 1.

Option 3 - Personnel presence and contact with visitors would be in between Options 1 and 2. Visitors would hear motorized equipment and aircraft use would be more apparent than under Option 2 but less than Option 1.

**Social and Political Effects of Mopup and Rehabilitation**

Some segments of the public would like the project to be implemented with primitive tools only. Others would oppose limiting a crew's ability to respond to flare-ups.

Mitigation measures would be in place to rehabilitate, among other things, portages, campsites, and trails.

Option 1 - The mechanized and motorized equipment in Option 1 would allow burn crews to respond to flare-ups. It would also result in the quickest rehabilitation. There would be much public opposition to motorboat use on non-motorized routes.

Option 2 – Rehabilitation would be the slowest under Option 2. However, this option could satisfy advocates of primitive tool use. Because the risk period would be longest for Option 2, the potential for flare-ups are greatest. Motorboats would not be allowed on non-motorized routes.

Option 3 – Option 3 would use a combination of primitive and non-primitive tools to complete mopup, patrol, and rehabilitation. The mechanized and motorized equipment allowed for active mopup in Option 3 would allow burn crews to respond to flare-ups. Motorboats would not be allowed on non-motorized routes.

**Health and Safety Concerns of Mopup and Rehabilitation**

***Heat sensors would be necessary to aid in detecting flare-ups***

After the burning is done but not all of the fire is out, flare-ups can be dangerous if suppression resources have been dispatched to other areas. During mop-up, it is important to know where areas that are still hot are and how hot those areas are so that flare-ups after the burn can be prevented.

Options 1 and 3 - Burn crews would be allowed to use both aerial heat sensors (used in aircraft) and hand-held heat sensors, increasing crews' ability to prevent flare-ups.

Option 2 – Burn crews would only be allowed to use hand-held heat sensors.

***Aircraft would be needed to patrol for spot fires***

During mopup, spot fires can flare up and the best way to detect them is with aircraft.

Options 1 and 3 - Planes would be allowed to fly below 4,000 ft. to patrol the area for spot fires with aerial heat location equipment.

Option 2 - Surveillance above 4,000 ft. would be allowed and would help locate large spot fires, however locating spot fires would be hindered if aircraft flew above 4,000 ft. because it would be difficult to see smoke at that height.

**Economic and Timing Considerations of Mopup and Rehabilitation**

Table 19 lists the estimated cost of mopup for one burn.

| **Table 19. Estimated average costs of mopup for one burn** | | |
|---|---|---|
| **Option 1** | **Option 2** | **Option 3** |
| $9,760 | Not Feasible | $16,755 |

Option 1 - Motorized pumps, helicopter drops, chainsaws, and aerial heat location equipment during mopup would expedite mopup and rehabilitation because fewer personnel would be required.

Option 2 - Mopup could not be safely implemented without the use of motorized equipment and mechanized transportation if there were a flare-up. Rehabilitation would take longer using crosscut saws.

Option 3 – Aerial heat location equipment during mopup would expedite mopup. Rehabilitation would take longer using crosscut saws.

**Summary of Mopup and Rehabilitation**

Table 20 summarizes the potential negative effects of mopup and rehabilitation. Mopup could not be implemented without the use of motorized pumps and the use of mechanized transportation in the event of a flare-up. Rehabilitation, however, could be done under Option 2.

| **Table 20. Summary of the Potential Negative Effects of Mopup and Rehabilitation*** | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Biophysical Effects** | Moderate | Low | Moderate | Risk of Fuel Spills: The risk of impacts from accidental fuel spills would be greatest under Option 1 and smallest under Option 2. The risk would be moderate under Option 3. |
| **Social/ Recreational/ Experiential Effects** | Moderate | Moderate | Moderate | Audible Impacts: Audible impacts would be greatest under Option 1. Audible impacts would be smaller under Option 3 and smallest under Option 2 because noise chainsaws and aircraft would not bother visitors. Personnel Presence: Option 2 would require more personnel than the other two options, which could mean more contact with visitors and potentially more displacement from campsites. |

**Table 20. Summary of the Potential Negative Effects of Mopup and Rehabilitation***

| | Option 1 Motor/ Mech. | Option 2 Non-motor/ Non-mech. | Option 3 Combina. | Key Issues |
|---|---|---|---|---|
| **Social/ Political Effects** | High | Moderate | Moderate | Response to Flare-ups: Some people would be opposed to using motorized pumps and aircraft in the Wilderness as in Options 1 and 3, while others would be opposed to crews not being able to quickly respond to flare-ups as in Option 2. Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| **Health/Safety Concerns** | Low | High | Low | Aircraft Use: In Options 1 and 3, aircraft under 4,000 ft. would allow for effective patrol, while patrol in Option 2 would not be as effective. Motorized Pumps/Chainsaws: High-pressure pumps and chainsaws, in Options 1 and 3, would be used to respond to flare-ups. Under Option 2, crews' ability to respond to flare-ups would be limited. |
| **Economic/ Timing Concerns** | Low | Moderate | Low | Personnel Required: Using chainsaws in rehabilitation (Option 1) would require fewer crews than using crosscut saws (Options 2 and 3). |

*Low, medium, and high are summaries of each effect or concern. The importance of each effect or concern varies by implementation phase.

# 4. Minimum Tool Determination

## 4.1 Preferred Equipment Option – Option 3

**Can the equipment option allow the Forest to meet the goal of reducing the risk of wildfire exiting the BWCAW and threatening life and property outside the Wilderness and do it in a manner that is sensitive to wilderness values and in a manner that protects fire personnel and BWCAW visitor safety during implementation?**

**Option 1**: **No**, impacts to wilderness values would be unacceptable because the prescribed burns could be safely implemented with less motorized equipment and less mechanized transportation.

**Option 2**: **No**, safe implementation and effectiveness are questionable.

**Option 3**: **Yes**, there would be short-term use of equipment that would affect wilderness values, however this option could be implemented safely.

Of the three equipment options, Option 1 would be the most inconsistent with wilderness values. The project could be safely implemented with less motorized equipment and less mechanized transportation than is proposed in Option 1. The suite of tools in Option 1 would therefore have an unnecessary negative impact on wilderness values.

It would be unsafe to ignite the burns with crews on the ground in most treatment units because of high fuel concentrations. Under Option 2, aerial ignition would not be allowed. Option 2 would also not allow for equipment critical to holding control lines in moderate to heavy blowdown, such as aircraft, motorized pumps, and foam. Therefore, Option 2 would be unsafe. Options 1 and 3 would allow aerial ignition and crucial control lines reinforcements. In addition to crew safety, aerial ignition would be required in treatment units with moderate to heavy blowdown to ensure greater control of the direction of the burn. These safety issues are the primary reason that the Forest cannot implement the prescribed burn project with the equipment allowed in Option 2.

Option 3 balances the protection of wilderness values and safe implementation. The Forest will use a mixture of tools and the use of motorized tools or mechanized transportation would only be for safety reasons or to ensure that the Forest meets management objectives, which is to reduce the public safety risk. It should be kept in mind that the motorized equipment and mechanized transportation that is approved might not be used to implement every burn because it may not be necessary for every burn.

Approval is for a range of appropriate uses that minimize impacts to wilderness values and protect the safety of the public and Forest personnel.

Table 21 summarizes the potential negative effects of each option during each phase of implementation.

**Table 21. Summary of the Potential Negative Effects of each phase of implementation**

| | **Option 1** Motor/ Mech. | **Option 2** Non-motor/ Non-mech. | **Option 3** Combina. | **Key Issues** |
|---|---|---|---|---|
| **Reconnaissance** | | | | |
| Biophysical Effects | Low | High | Low | Bald Eagle Surveys: Under Option 2, surveys would not be effective because flights below 4,000 ft. would not be allowed, which could result in bald eagle nests being destroyed during implementation. Under Options 1 and 3, surveys would be below 4,000 ft. |
| Social/ Recreational/ Experiential Effects | High | Low | Moderate | Sense of Solitude: Under Options 1 and 3, aircraft below 4,000 ft. would decrease visitors' sense of solitude and would result in more audible impacts than Option 2. However, there would be less aircraft use in Option 3 than 1. |
| Social/ Political Effects | High | Moderate | Moderate | Bald Eagle Surveys: There would be some public opposition to flying below 4,000 ft. for bald eagle surveys (Options 1 and 3). If flights below 4,000 ft. were not allowed (Option 2), there would be opposition to surveying for bald eagle nests with ineffective methods.<br>Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| Health/Safety Concerns | Low | Low | Low | Helispot Verification: Helispot verification would be required and allowed in Options 1 and 3 to ensure safe helicopter operation. There would be no helicopter use in Option 2. |
| Economic/ Timing Concerns | Low | Moderate | Moderate | Personnel Required: Primitive transportation in Options 2 and 3 would require more personnel to accomplish reconnaissance goals than the mechanized transportation under Option 1, so Options 2 and 3 would be more expensive than Option 1. |
| **Preparation** | | | | |
| Biophysical Effects | Low | Moderate | Low | Vegetation Cut: Option 2 would require wide control lines to be cleared, which would result in more vegetation being cut than the other options. |

| **Table 21. Summary of the Potential Negative Effects of each phase of implementation** | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| Social/ Recreational/ Experiential Effects | Moderate | Moderate | Low | Audible Impacts: Audible impacts would be greatest under Option 1. Audible impacts would be the smaller under Options 2 and 3 because noise from chainsaws would not bother visitors. Personnel Presence: Option 2 would require more personnel then the other two options, which could mean more contact with visitors and more displacement from campsites. Apparent Naturalness: Option 2 would require wider control lines to be cut than the other two options, which would be more noticeable along the portages hiking trails used in control lines. |
| Social/ Political Effects | High | Moderate | Low | Chainsaw Use: Under Option 1, there would be public opposition to using only chainsaws to clear control lines when crosscut saws could be used. However, under Option 2, there would also be opposition to not being able to use chainsaws in unsafe sawing situations, putting crew safety at risk. Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| Health/Safety Concerns | Low | High | Low | Chainsaw Use: Under Option 2, the safety risk of using crosscut saws on lodged trees under tension would be considerable. Option 1 would allow for chainsaw use all the time. Option 3 would only allow chainsaw use for unsafe sawing situations if an alternative method (e.g. explosives) would not be effective. |
| Economic/ Timing Concerns | Low | High | Moderate | Personnel Required: Using chainsaws to clear control lines (Option 1) would require fewer crews than using crosscut saws (Options 2 and 3). However, under Option 3, control lines could be cleared with a moderate amount of crews even though crosscut saws would be the primary cutting tool because control lines would be narrower than they would be under Option 2. |

| **Table 21. Summary of the Potential Negative Effects of each phase of implementation** | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Lighting and Holding** (Lighting and Holding under Option 2 **could not be safely executed** so it is not feasible.) | | | | |
| Biophysical Effects | Moderate | Not Feasible | Moderate | Risk of Fuel Spills: The risk of impacts from accidental fuel spills would be present under all options.<br>Retardant Use: Fire retardants and foams would be used under Options 1 and 3, but under Option 3, water use would be preferred to foam use and retardants would only be used if a burn threatened to escape. There would only be negative impacts if they were accidentally applied directly to water bodies, riparian areas, and wetlands. |
| Social/ Recreational/ Experiential Effects | High | Not Feasible | High | During lighting and holding under any option, visitors' experience and opportunities would be affected (e.g., campsite displacement).<br>Sense of Solitude: Aircraft use in Option 1 would result in the most impact on visitors' sense of solitude. Option 3 would use less aircraft for transportation of crews and equipment than Option 1. Aircraft use would be the least disturbing under Option 2.<br>Audible Impacts: The motorized equipment and mechanized transportation in Option 1 would result in the most audible impacts. Option 3 would use less of this equipment than Option 1, while Option 2 would use almost none.<br>Apparent Naturalness: Aircraft use in Option 1 would have the most impact on apparent naturalness, but it would affect apparent naturalness for the shortest amount of time. Conversely, Option 2 would have the least impact on apparent naturalness but impacts would last longer. Option 3's impacts would be intermediate.<br>Pre-placement: Under Options 1 and 3, pre-placement would reduce impacts to visitors because fewer aircraft trips would be required. Under Option 2, pre-placement would be necessary because of the large number of trips required to transport equipment in with primitive means. |

**Table 21. Summary of the Potential Negative Effects of each phase of implementation**

| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
|---|---|---|---|---|
| Social/ Political Effects | High | Not Feasible | Moderate | Safe Implementation: Some segments of the public would be opposed to using mechanized transportation and motorized equipment (Options 1 and 3), however this equipment would allow the burns to be safely implemented. On the other hand, there would also be opposition to not using the equipment that would allow the project to be implemented safely (Option 2). Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| Health/Safety Concerns | Low | Not Feasible | Low | Ignition: In areas with moderate to heavy blowdown, aerial ignition would be the safest ignition method. Options 1 and 3 would allow aerial ignition, but Option 2 would not. Under Option 2, burns would have to be lit manually, with hand-held drip torches for example. This would require ground crews to be in the treatment unit during ignition, which would put those crews at considerable risk of being overtaken by fire. Control Line Reinforcements: Motorized water pumps and aircraft water drops, which are allowed in Options 1 and 3, would make control lines more secure. Under Option 2, ground crews would have to hold control lines with backpack pumps that can only hold fire with flame lengths of 4 ft. or less. Heavy fuel loads will generate flame lengths greater than 4 ft., making Option 2 unable to hold the fire in treatment units with moderate to heavy fuel loads. Feasibility: The equipment in Options 1 and 3 would allow the burns to be safely implemented. However, Option 2 could not be safely executed and is therefore not feasible. |
| Economic/ Timing Concerns | Low | Not Feasible | Low | Narrow Burn Windows: Burn windows are predicted with little advance warning. The mechanized transportation in Options 1 and 3 would allow the Forest to take advantage of narrow burn windows and ensure that the fuel treatment objectives could be reached in 5 to 7 years. It is doubtful that the fuel treatment objectives could be reached within 5 to 7 years under Option 2 because primitive transportation could not move personnel and equipment in place fast enough to take advantage of narrow burn windows. |

| Table 21. Summary of the Potential Negative Effects of each phase of implementation | | | | |
|---|---|---|---|---|
| | **Option 1** **Motor/ Mech.** | **Option 2** **Non-motor/ Non-mech.** | **Option 3** **Combina.** | **Key Issues** |
| **Mopup and Rehabilitation** (Mopup would **not** be feasible under Option 2. Rehabilitation would be feasible under Option 2) | | | | |
| Biophysical Effects | Moderate | Low | Moderate | Risk of Fuel Spills: The risk of impacts from accidental fuel spills would be greatest under Option 1 and smallest under Option 2. The risk would be moderate under Option 3. |
| Social/ Recreational/ Experiential Effects | Moderate | Moderate | Moderate | Audible Impacts: Audible impacts would be greatest under Option 1. Audible impacts would be smaller under Option 3 and smallest under Option 2 because noise chainsaws and aircraft would not bother visitors.<br>Personnel Presence: Option 2 would require more personnel than the other two options, which could mean more contact with visitors and potentially more displacement from campsites. |
| Social/ Political Effects | High | Moderate | Moderate | Response to Flare-ups: Some people would be opposed to using motorized pumps and aircraft in the Wilderness as in Options 1 and 3, while others would be opposed to crews not being able to quickly respond to flare-ups as in Option 2.<br>Motorboats on Non-motorized Routes: Under Option 1, there would be a great deal of public opposition to using motorboats on non-motorized routes. Options 2 and 3 would not allow motorboats on non-motorized routes. |
| Health/Safety Concerns | Low | High | Low | Aircraft Use: In Options 1 and 3, aircraft under 4,000 ft. would allow for effective patrol, while patrol in Option 2 would not be as effective.<br>Motorized Pumps/Chainsaws: High-pressure pumps and chainsaws, in Options 1 and 3, would be used to respond to flare-ups. Under Option 2, crews' ability to respond to flare-ups would be limited. |
| Economic/ Timing Concerns | Low | Moderate | Low | Personnel Required: Using chainsaws in rehabilitation (Option 1) would require fewer crews than using crosscut saws (Options 2 and 3). |

## 4.2 Minimum Tool Determination

The purpose and need for this project is to improve public safety by reducing the potential for high-intensity wildland fires to spread from the BWCAW into areas of intermingled ownership, which include homes, cabins, resorts, and other improvements, and areas across the international border into Canada. This needs to be accomplished in a manner that is sensitive to ecological and wilderness values and in a manner that protects fire personnel and BWCAW visitor safety during implementation. **Option 3 would allow the Forest to reduce the risk of wildfire exiting the Wilderness while implementing the project in a manner that is sensitive to ecological and wilderness values; therefore, the Forest will implement the prescribed burns with the equipment and transportation in Option 3.**

The minimum tool analysis assists the decision maker in determining the minimum tool necessary to implement this project. This Minimum Tool Determination documents the Forest Supervisor's analysis of the appropriate tools needed to implement prescribed burning in the BWCAW with the least overall impact to the wilderness resource. The equipment and transportation in Option 3 meets the conditions under which use may be approved (FSM 2326.1), while to the extent practicable, minimizing the use of motorized equipment necessary to implement actions deemed necessary to protect public health and safety.

Tool use in wilderness is an administrative decision and the authority to approve the minimum tool analysis for the Boundary Waters Canoe Area Wilderness Fuel Treatment project has been delegated from the Regional Forester to the Forest Supervisor of the Superior National Forest. This delegation of authority was granted with the understanding that it is limited to decisions directly related to fuel reduction projects. The authority will terminate upon the completion of the project or at the discretion of the Regional Forester.

Non-motorized equipment and non-mechanized transportation are part of the suite of primitive tools available to managers in wilderness and do not require approval for use. These types of tools and transportation were included in the equipment options to illustrate the suite of tools that would be required to implement the prescribed burns and to analyze the trade offs between different tool uses. Approval is not needed for use of non-motorized equipment such as crosscut saws and backpack pump sprayers. It also does not need approval for non-mechanized transportation such as transportation by canoe or dogsled.

## Equipment and Transportation in Option 3

### Reconnaissance Phase

***Transportation:*** For gathering site-specific information on the ground, canoes, dogsleds, and motorboats (only on motorized routes) would be used. Helicopters would be used for helispot verification. Airplanes would fly above 4,000 ft. to survey control lines, but they would fly below 4,000 ft. at sea level (ASL) for bald eagle surveys. Approval is not required for flights above 4,000 ft. ASL.

**Preparation Phase**

***Transportation***: Canoes and motorboats (only on motorized routes) would be used to get crews and equipment into place to clear control lines.

***Tools***: Crews would use hand tools (e.g., shovels and axes), drip torches, fusees, and crosscut saws to clear vegetation for control lines. Crosscut saws would be the primary cutting tools, however chainsaws would be used in unsafe sawing situations such as lodged trees that are under tension. In unsafe sawing situations, an alternative tool to chainsaws, such as explosives, would be used instead of chainsaws if it were effective.

**Lighting and Holding Phase**

***Personnel Transportation***: Crews would be transported to treatment units by canoes and motorboats (only on motorized routes). During burn plan development, an Interdisciplinary Team would decide if aircraft below 4,000 ft. would be used to move crews into place. The Team would consider safety, logistics, and wilderness values. It is anticipated that most of the burns would require at least some personnel to be transported by aircraft for safety sweeps. Egress under Option 3 would use as much primitive transportation as possible and would be pre-determined in burn plans.

***Equipment Transportation***: Equipment would be transported to treatment units by canoes and motorboats (only on motorized routes). During burn plan development, an Interdisciplinary Team would decide if helicopter sling-loads would be necessary to move some equipment into place. The Team would consider safety, logistics, and wilderness values. It is anticipated that most of the burns would require some equipment to be sling-loaded to the treatment unit for either safety or timing reasons. In contingency situations, equipment would be transported by aircraft. Egress under Option 3 would use as much primitive transportation as possible and would be pre-determined in burn plans.

***Lighting Tools***: Depending on fuel loads and burning conditions the following could be used to ignite burns: drip torches, fusees, flare pistols, helitorches, plastic sphere dispensers, and ignition explosives. In order to safely manage the burn, crews would also use fuel and air moisture meters, portable radio repeaters, and portable weather equipment.

***Holding Tools***: Helicopters and other aircraft below 4,000 ft. would drop water or foam in order to secure control lines or put out spot fires. Fire retardants would only be used if fire threatens to escape. Aircraft would also be used below 4,000 ft. for surveillance. Crosscut saws would be the primary cutting tool during holding. However, during holding chainsaws would be used as needed to ensure the safety of the burn. Motorized water pumps, sprinkler systems, and backpack pumps would also be used to secure the control lines.

**Mopup and Rehabilitation Phase**

***Transportation***:  Crews and equipment would be transported by canoes and motorboats (only on motorized routes).  Aircraft would only be used in case contingency response is required.

***Tools***:  Crews would use hand tools (e.g., pulaskis), drip torches, fusees, motorized water pumps, backpack pumps, hand-held heat location equipment, and crosscut saws to mopup and rehabilitate treatment units.  During active mopup, motorized water pumps, aircraft water drops, and chainsaws, may be needed.  Chainsaws could also be used in unsafe sawing situations and contingency response.  Aircraft and aerial heat location equipment would be used below 4,000 ft. for patrol.

# 4.3 Implementation

The implementation of the Selected Alternative is described above in this document and in the BWCAW Fuel Treatment Final EIS. Planning and pre-work leading up to implementation will minimize some of the impacts to wilderness values.

As the project is implemented, the Forest may learn from experience that the minimum tool is not accomplishing the project's objectives. If so, the Forest will revisit this analysis to make a subsequent decision.

## Interdisciplinary Team for Prescribed Burns in Wilderness

An interdisciplinary team with both fire and wilderness staff will develop each burn plan for prescribed burning the BWCAW. The Team will ensure that fuel treatment objectives are met while minimizing negative effects on wilderness values. During the planning stage, the Team will determine how to deal with safety and logistical issues using the minimum tool. The Team will also be involved with implementation and monitoring.

## Logistics Analysis

Because the transportation needs for each treatment unit will be different, the Interdisciplinary Prescribed Burn Team would consider safety, logistics, and wilderness values to determine transportation for each burn.

It is anticipated that most of the burns would require some equipment to be sling-loaded to the treatment unit for either safety or timing reasons. Egress would use as much primitive transportation as possible.

Burn plans will have flexibility to use mechanized transportation in certain situations if it is the minimum tool. However, there would be limitations on mechanized transportation. Where possible, the Forest would limit the amount of mechanized transportation with careful planning.

The rationale for any mechanized transportation use would have to be explained in a burn plan with the following questions.

1. What are the equipment and personnel needs?
2. Does the burn require any equipment that would be unsafe to transport by canoe, e.g., explosives?
3. If airplanes or helicopters are used, what are the anticipated impacts on wilderness values (for instance natural integrity, apparent naturalness, outstanding opportunities for solitude, and outstanding opportunities for primitive recreation)?
4. Would equipment have to be pre-placed if it were transported into the Wilderness with primitive means? If so, how much equipment would have to be pre-placed and for how long?
5. What are the logical transportation routes to get crews and equipment into place?
6. What is the relationship between the equipment in this burn and other burns, e.g., is there another burn that is planned to be lit shortly after this burn and would it make sense to move the equipment to that treatment unit immediately after this burn is completed?
7. Because the urgency of meeting a burn window would no longer be present, are the transportation needs for egress different from the needs for getting things into place?
8. What are the transportation needs for the few days before ignition, i.e., deploying control line explosives, and the day of ignition?
9. What equipment must be removed by mechanized transportation and why?

In addition, there will be an annual logistic analysis that will examine the transportation needs for all burns each year. This will allow for transportation planning to consider all of the logistical issues of moving equipment into the Wilderness and to coordinate movements between treatment units if timing is a concern.

## Mitigation

See Appendix B for the mitigations that were developed in the BWCAW Fuel Treatment Final EIS that relate to tool use.

## Monitoring and Feedback

Monitoring will be done to document that Option 3 is implemented as designed, and on selected sites, to verify the effectiveness of a specific action and mitigation. The objective of monitoring is to obtain feedback on implementation so that actions can be modified, if necessary, to improve implementation success and effectiveness in the future. For this reason, monitoring represents a critical part of adaptive management. Monitoring will be emphasized during the first through third year of implementation so that information gained can have the greatest impact on future implementation. The following monitoring is specific to tool use. Additional monitoring that will be done on the BWCAW fuel project is included in the EIS.

**Burn Plan Implementation Monitoring**

Objective: Verify that mitigation measures are implemented.
Desired Results: Mitigation measures are implemented as planned.
Methods: Visual observation immediately after or during each burn for all units, documenting the degree of implementation of all mitigation measures using a checklist of mitigation measures.
Responsibility: Burn Boss

**Interdisciplinary Implementation Team Monitoring**

Objective: Verify that mitigation measures are implemented and document the degree of disturbance.
Desired Results: Mitigation measures are implemented as planned.
Methods: Visual observation by Interdisciplinary Implementation Team members within 30 days following burn on at least 20 percent of units. Use photography for documentation, as well as written descriptions, and the checklist of mitigation measures.
Responsibility: Interdisciplinary Implementation Team

**Minimum Tool Monitoring**

Objective: Verify that the minimum tools are used.
Desired Results: Minimum tools are used in a manner consistent with the Minimum Requirement and Minimum Tool Determination.
Methods: Interdisciplinary implementation team will be involved in all phases of prescribed burning. They will monitor implementation activities, such as control line construction, transportation of equipment, and mop-up, by visual observation and use photography, written descriptions, and the checklist of mitigation measures as documentation.
Responsibility: Interdisciplinary Implementation Team

**Protection of Heritage Resources**

Objective: Verify that mitigation measures for protecting heritage resources are implemented.

Desired Results: Protect prehistoric and historic archaeological sites from ground disturbance during control line construction and other ground-disturbing activities.
Methods: Monitor ground-disturbing activities in the vicinity of archaeological sites during control line and helispot construction and mop-up. If new finds are encountered during implementation, halt the activity, identify and map the boundaries of site and a suitable buffer, and prevent people and equipment from entering new site buffer.
Responsibility: Forest Heritage Resources Program Manager

**Protection of TES Plants and Wildlife**

Objective: Verify that mitigation measures for TES plants and wildlife are implemented.
Desired Results: Protection of TES plants and wildlife from the effects of ground disturbance during control line construction and other ground-disturbing activities.
Methods: Visual observation and photography of known TES sites within 30 days after burn implementation to document effects.
Responsibility: Forest Wildlife Biologist/Botanist

**Soils**

Objective: Determine the degree to which mitigation measures protected soils from impacts, especially for ELT 9 and 18 soils.
Desired Results: Duff reduction and mineral soil exposure are within the National Soil Quality Standards (FSH 2509.18 Soil Management Handbook) where 85 percent of the area demonstrates soil property or soil conditions reflecting no changes in soil properties.
Methods: Measure the depth of the organic layer, and other physical changes of soils, such as wettability of the soil, changes in color, and thickness of the ash layer before and after implementation in a representative sampling of units in readily accessible areas. Ensure that ELT 9 and 18 areas are covered by sampling, where practical. Documentation can also be from Prescribed Fire Burn Plan Monitoring (fuel reduction surveys) - the duff reduction measurement and soil moisture content.
Responsibility: Forest Soil Scientist

**Water Quality**

Objective: Monitor the effectiveness of water quality mitigation measures.
Desired Results: Water quality changes resulting from treatments are insignificant.
Methods: Measure Sechi depths and depth-temperature-dissolved oxygen profiles before and after treatment at selected locations in selected lakes within or adjacent to treatment units in the spring and fall. Measure pH, total phosphorus, orthophosphate, dissolved oxygen, nitrate, total Kjeldahl nitrogen, Chlorophyll A, total organic carbon, temperature, mercury, and

other constituents of interest before and after prescribed burns in selected water bodies in spring, summer, and fall. Monitoring after treatment is to be conducted three times annually for five years (to be extended depending on trend). Further details on the water quality monitoring plan can be found on the Superior National Forest website at www.fs.fed.us/r9/superior/ or at the Supervisor's Office. This monitoring will be done through continued cooperative efforts with the Minnesota Pollution Control Agency.
Responsibility: Forest Aquatic Ecologist

**Monitoring of Noxious Weed Invasion**

Objective: Determine if fire resulted in increased infestation of noxious weeds, and identify areas for control or conduct control on isolated, small occurrences,
Desired Results: Prevent large-scale noxious weed infestation.
Methods: One site visit to selected sites, one year after the burn; and a follow-up visit in years 2 and 3.
Responsibility: Forest Wildlife Biologist/Botanist

**TES Plants**

Objective: Determine the effects of fire on known TES plant populations.
Desired Results: Prevent negative impacts on known TES plant populations.
Methods: Monitor and record impacts, positive or negative, on TES plant populations and provide information to the national Fire Effects Database. One site visit to selected known populations one year after the burn; and a follow-up visit in Years 2 and 5.
Responsibility: Forest Wildlife Biologist/Botanist

**Minimum Tool Monitoring**

Objective: Determine if the minimum tools identified in the Minimum Requirement and Minimum Tool Determination are effective at meeting the objectives of the project.
Desired Results: Objectives of the project are met while using the minimum tools.
Method: The tools used to implement the prescribed burns would be evaluated annually to determine if fewer motorized tools could be used or whether the tools are a constraint in meeting the objectives of the project. If it is determined that a significant constraint is occurring, then the Minimum Requirement and Minimum Tool Determination will be revisited.
Responsibility: Interdisciplinary Implementation Team

## Evaluation and Reporting

Results of all monitoring activities associated with the BWCAW fuel treatment project will be gathered and summarized by the Interdisciplinary Implementation Team. This summary, which will include a synthesis of all monitoring results to date, will be added as a separate section in the Annual Monitoring Report for the Superior National Forest.

### Adaptive Management

Adaptive management is a process of learning from our management actions. It involves trying an approach and then monitoring and analyzing the results so the findings can be incorporated into the next round of prescribed burns. There are several facets of adaptive management incorporated into implementation of the fuel treatment project for the BWCAW.

After each burn the following questions will be asked:

- Were the mitigation measures implemented as planned?
- What went right and what went wrong?
- Are there opportunities for improvement?

The answers to these questions will be used along with implementation monitoring results to adjust how future prescribed burns are conducted.

Effectiveness monitoring examines the effectiveness of mitigation measures at reducing environmental impacts. Some mitigation measures limit weather conditions under which burns can be conducted in order to protect resources. Others put constraints on the prescribed burning operations. During analysis of the effectiveness monitoring results, the following questions will be asked:

- Are the mitigation measures effective at protecting the resources?
- If the mitigation measures are effective at resource protection, are they overprotective and do they place unnecessary constraints on the ability to accomplish project objectives?

The implementation of each of the action alternatives is expected to take place over a six to seven-year period. As a result, a number of wildland fires could occur within or adjacent to treatment areas during this period. Therefore, the scheduling of treatments may need to be modified accordingly. Further, unit boundaries may need to be modified to take into account nearby areas that have already burned. An evaluation will be conducted as to the degree to which the fuel reduction objectives of the prescribed burn program have been met and if prescribed burn units can be dropped or adjusted in response.

Any changes to the authorized project will be subject to the requirements of NEPA. In determining whether and what type of NEPA documentation is required, the Forest Supervisor will consider the criteria for whether to supplement the EIS, as described in 40 CFR 1502.9(c) and Forest Service Handbook (FSH) 1909.15, sec. 18, and, in particular, whether the proposed change is relevant to environmental concerns and is a substantial change to the Selected Alternative as approved. Connected or interrelated proposed changes regarding particular areas of specific activities will be considered together in making this determination. The cumulative impacts of these changes will also be considered.

Minor changes to the treatment units are expected during implementation to better meet on-site resource management and protection objectives. Adjustments to unit boundaries are also likely during layout for improving effectiveness. Many of these minor changes will not present sufficient potential impacts to require any specific documentation or other action in order to comply with applicable laws. However, some minor changes may still require appropriate analysis and documentation to comply with FSH 1909.15, Sec. 18.

Future decisions may be made regarding activities in the project area. Decisions may be made to allow new activities or change existing ones. Any changes will follow the appropriate NEPA regulations.

# 5. Approval

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Writer/Editor

## Recommended by

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## Approved by

/s/ JAMES SANDERS June 27, 2001
Forest Supervisor, Superior National Forest

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# Appendix A. Definitions

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| **Backpack Pumps** | A complete unit consisting of a 5-gallon tank, a flexible hose, a "trombone" pumping device, and shoulder straps. It is worn as a backpack and has a manual pump and sprayer attached. The backpack pump is particularly useful in hot spots and mopup. |
| **Bowsaw** | Used for clearing small downfall, cutting firewood, and limbing trees. Bowsaws have a thin, narrow, needle-sharp blade held rigid by the tension provided by the bow frame. The blade length can vary from 16 to 36 inches long. Saws weigh from 1 to 4 pounds. |
| **Brushsaw** | Gas powered cutting tool that allows the operator to cut ground level material while maintaining an upright position. Brushsaws generally are held by a harness and manipulated by one or two handles. Cutting is done by a circular cutting blade on the lower end of the unit. |
| **Burn Window** | The period in which weather conditions are expected to fall within the parameters specified in the burn prescription for a prescribed burn. |
| **Contingency Response Actions** | Contingency response actions are actions required by unexpected circumstances encountered during the burn phases of project implementation. Actions may be necessary to meet the objectives of the project, to keep the burn in prescription, to ensure firefighter and public safety, but they are potentially hazardous situations possible during actions with inherent risk. |
| **Control Line Explosives** | In areas where it is ineffective to construct control line due to the presence of rock with organic material, explosives may be used to construct a control line. Control line explosive is made of a nitrate material that is configured in long rope-like manner. The force of the explosion creates a mineral soil control line about 3 feet wide and can spray soil (if available) up to 15 feet on each side of the blast. Fireline explosives are sometimes used to fall snags and during wilderness rehab are used to make cut stumps or log ends appear to be the result of natural breakage rather than cutting. |
| **Control Lines** | A strategically located strip where fuel has been reduced or modified; used to segregate, stop, or control the spread of fire. Sometimes all flammable material is removed from the control line by scraping or digging down to mineral soil. 'Control line" is comprehensive term used for all the constructed or natural fire barriers and treated fire edges used to control fire. |
| **Crosscut Saw** | Used for tree falling and log bucking. Crosscuts come in two basic sizes: one- and two-person saws. They also come in two designs: the felling saw and the bucking saw. The felling saw has a concave back and is relatively light and flexible. The bucking saw has a straight back and is much heavier, thicker and stiffer than the felling saw, the weight being an advantage in applying tooth pressure in the bucking process. Crosscuts range from 3 feet in length up to 6 feet and longer, depending on the material to be cut. |
| **Drip Torch** | A drip torch is a handheld fuel ignition device. It uses a mixture of diesel and gasoline administered via a lighted wick to wildland fuel. The gas mixture flows through a spout to a wick, which becomes saturated with gas and burns continuously, permitting the person using the torch to cast burning liquid to ignite the fuel. Used by ground-based personnel. |
| **Fire Management** | A strategic plan that defines a program to manage wildland and prescribed fires and documents the fire management program in the approved land use |

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| **Plan** | plan. The plan is supplemented by operational plans, such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans. |
| **Fire Retardant** | Liquid fire retardants are ammonium-based solutions that are applied to fuel to reduce their flammability. Liquid fire retardants will most likely be applied predominantly by airtankers, to increase the effectiveness of control line in areas with moderate to heavy blowdown and to assist in holding the prescribed fires within treatment units. When using retardant precautions will always be taken to reduce the probability of fire retardant from entering water bodies and riparian areas. |
| **Flappers (Swatters)** | Flappers are a rectangular piece of rubberized fabric attached to a wooden, rake-like handle. Used primarily for suppressing fires in light fuels, such as pine needle litter and light grasses. Flappers are very effective when used in conjunction with backpack pumps or fire rake. |
| **Flare-ups** | After an area is burned and the fire is out, material that is still hot catches on fire again. |
| **Foam** | Foam fire retardants are a detergent that increases the wetness of water. Foam applied aerially or with motorized or backpack pumps can increase the effectiveness of a control line and reduce the needed width of the line. Foam may also be dropped from the air by helicopters and airtankers to assist in the containment of prescribed fires. At all times, precautions will be taken to reduce the probability of the retardant foam from entering water bodies. |
| **Fuel** | All dead and living material that will burn. |
| **Fuel Treatment** | The manipulation of wildland fuel, such as lopping, chipping, crushing, piling, and burning, or removal, to reduce its flammability. |
| **Fusee** | Fusees are sometimes called flares and are used to ignite forest fuel. Used by ground-based personnel. The fusee is in effective device for burning out control lines. It provides a method of burning grass, pine needles, leaves, brush, and similar types of fine fuels that will ignite freely and radiate sufficient heat to sustain combustion. |
| **Helispot** | Landing pads for helicopters. A helispot is an open area that is dry enough to support a helicopter and clear of trees and brush. Generally, construction would involve clearing the area to allow safe access for the helicopter and providing a hard surface for landing by laying down logs. Forest Service aviation regulations require helispots to have a minimum 90-foot diameter cleared area for one medium helicopter. Helispots must have at least one safe approach and take off lane, which may result in vegetation being cleared in addition to the 90-or 180-foot diameter. |
| **Helitorch** | A method of aerial ignition. A fuel ignition device that is suspended beneath a helicopter and drops ignited jellied gasoline onto fuel. |
| **Hose And Fittings** | In areas where portable water pumps are used, transferring the water or foam to the treatment unit boundary is done using hose and a distribution system of lateral hose lays using fittings and nozzles. |
| **Hand Winch (Come-along)** | Hand operated, geared, block-and-tackle cable tool for moving heavy objects such as logs, rocks, or stuck vehicles. |
| **Hose Lay** | Hose lay includes hose lengths and the connecting nozzles. |
| **Ignition Explosives** | Explosives with alumajell are sometimes used to ignite small areas. Used by ground-based personnel. |
| **Log Carrier** | Tool for allowing two people to lift and drag a log. The carrier consists of an approximately 4 foot cross bar that acts as a double handle for the steel tongs mounted in the center. Can be used for logs up to 16 inches in diameter. |

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| **Mitigation** | Measures designed to counteract environmental impacts or to make impacts less severe. These may include: avoiding an impact by not taking a certain action or part of an action; minimizing an impact by limiting the degree or magnitude of an action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the effected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or proving substitute resources or environments. |
| **Monitoring** | Monitoring is done to document that the selected alternative (in the BWCAW Fuel Treatment Final EIS) is implemented as designed and, on selected sites, to verify the effectiveness of a specific action and mitigation. The objective of monitoring is to obtain feedback on implementation and effectiveness so that actions and measures can be modified, if necessary, to improve their implementation success and effectiveness in the future. As such, monitoring represents a critical part of adaptive management. Monitoring will be emphasized during the first through third years of implementation in order that the information gained can have the greatest impact on the future implementation. |
| **Mopup Kit** | A kit consisting of small diameter hose, nozzles and fittings specifically designed to use a minimum amount of water to "mopup" or extinguish all smoldering material, in an area. |
| **National Environmental Policy Act (NEPA)** | The National Environmental Policy Act requires federal agencies to follow a systematic, interdisciplinary approach to determine potentially significant effects on the quality of the human environment that could result from proposed management actions. The objective is to provide a basis for a well-informed management decision. According to NEPA, the analysis process includes public involvement. NEPA also requires documentation of the analysis process in a detailed statement (in and Environmental Impact Statement, for example). |
| **Natural Ignition** | An ignition resulting form any natural cause, generally lightning. |
| **Nippers (Lopping Shears)** | Long handled (22-30 in.) shears with relatively short blade or jaws (3-4 in.) used for cutting or pruning wood up to 2.5 in. in diameter. |
| **Plastic Sphere Dispenser (PSD)** | Dispenses ping-pong ball sized plastic spheres that contain potassium permanganate. A machine that is mounted inside the door of a helicopter uses a needle to inject ethylene glycol into the spheres just prior to their being dropped from the helicopter. The ethylene glycol causes a chemical reaction in 10-15 seconds, igniting the spheres. The ignited spheres then ignite fuel. The effective use of the Plastic Spherical dispenser requires relatively dry fuel, whereas the helitorch can produce enough heat to ignite wetter wildland fuel. |
| **Portable Water Pumps** | Portable water pumps facilitate the movement of water from lakes and ponds through a light weight rubber lined hose to sprinklers and nozzles staffed by personnel. The use of water to contain prescribed fires within treatment units boundaries will reduce amount of control line needed. These pumps are light enough to be carried by one or two people to the site (sometimes over rough terrain) where they are to be used. |
| **Pre-placement** | Putting equipment into place on a short-term bases shortly before prescribed burn. |

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| **Prescribed Fire** | Any fire ignited by management actions (e.g., management-ignited fire) to meet specific objectives. Before ignition, a burn must have a written, approved prescribed fire plan (burn plan) and the requirements of the National Environmental Policy Act must be met. |
| **Primitive Tool** | Non-motorized devices such as hand saws, axes, shovels, and certain tools that give a mechanical advantage such as wedges, block and tackles, and winches. The defining characteristic of traditional or primitive tools is the reliance on human or animal power. |
| **Pulaski** | A scraping tool that is used primarily for control line construction and mop up. On one side of the head of the tool a Pulaski has a wide, flat blade like a hoe and on the other side there is a pick-like blade. |
| **Pump Kit** | A kit consisting of a motorized portable pump, suction hose, fittings and tools which are used to pump water for hoselays and /or sprinkler systems. |
| **Radio Repeaters** | Radio equipment designed to receive and re-transmit signals farther than the originating radio can normally transmit. Typically mounted on a hilltop or other high spot in order to relay radio signals over rough terrain which would otherwise prevent communications between fire personnel. |
| **Relay Tanks** | A waterproof fabric collapsible tank holding 50-1500 gallons that is used with multiple portable pumps to relay water over distances much longer than could be reached with one pump alone. |
| **Sling-Loading** | Using a net suspended from a helicopter to transport equipment. |
| **Spot Fires/ Spotting** | During a prescribed burn, fire that starts outside of the treatment unit is a spot fire. Spot fires can start from flying embers. |
| **Suppression** | See wildland fire suppression. |
| **Wildfire** | An unwanted wildland fire. |
| **Wildland Fire** | Any non-structure fire, other than prescribed fire, that occurs in the wildland. |
| **Wildland Fire Suppression** | An appropriate management response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration but minimizes loss of resource values, economic expenditures, and/or the use of critical firefighting resources. |
| **Wildland Fire Use (WFU)** | The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outline in fire management plans. Operational management is described in the wildland fire implementation plan. |

# Appendix B.  Mitigation Relative to Tool Use

The following measures were developed in the BWCAW Fuel Treatment Final EIS and represent mitigation proposed to limit the effects of tool use.  Development of the mitigation measures has been and is intended to be an iterative process; new mitigation measures may be identified or current ones modified based on the Final EIS analysis.  The mitigation measures listed herein were developed based on interactions among Interdisciplinary Team members and through review of a variety of sources including but not limited to the following:

1. The Superior National Forest Land and Resource Management Plan;
2. The BWCA Wilderness Management Plan;
3. The Superior National Forest Fire Management Plan;
4. Sustaining Minnesota Forests: Voluntary Site-Level Forest Management Guidelines (referred to as "Voluntary Site-Level Forest Management Guidelines"); and
5. USFS Soil and Water Conservation Handbook.

The following mitigation measures are general and apply to all treatment units. Mitigation measures that apply only to specific treatment units are identified in the treatment unit cards provided in Appendix A of the BWCAW Fuel Treatment Final EIS.

The following are the mitigation measures that deal with tool use.  All of the mitigation measures for the project can be found in Chapter 2 of the Final EIS.  (Each mitigation measure has been assigned a reference number and this appendix only lists the mitigation that deal with tool use, the numbering may not be consecutive.)

## Soils

1. If site preparation of helispots is necessary, then soil disturbance will be minimized and rehabilitated if necessary to reduce potential impacts to soils.
2. To minimize soil loss and indirect deterioration of water quality due to sedimentation along control lines, the following measures will be implemented:
   a. If the slope gradient is 18 percent or greater, waterbars will be constructed during construction of control lines.  Waterbars will be installed at a 30- to 45-degree angle along control lines or other disturbed areas using the following spacing guidelines (from Forest Service Handbook):

**Waterbar Spacing**

| Slope Grade (%) | Approximate Distance (ft.) |
|---|---|
| 2 | 230-250 |
| 5 | 120-150 |
| 10 | 60-90 |
| 15 | 45-70 |
| 20 | 35-50 |
| 25 | 30-45 |

| Slope Grade (%) | Approximate Distance (ft.) |
|---|---|
| 30 | 20-40 |

b. In highly erodible areas, spread slash on the control line after burning to protect bare soil (generally these areas will reseed naturally).

# Aquatic Resources, Wetlands, and Riparian Areas

1. Favor the use of water, rather than foam, for pretreatment of control lines. Liquid fire retardant will not be used for pretreatment.
2. When liquid fire retardant is used to suppress a wildfire or a prescribed fire that is threatening to escape, avoid its use within 400 feet of a waterbody or stream.
3. Minimize foam and liquid fire retardants in bogs and marshes.
4. Where foam retardant is necessary and approved by the Forest Supervisor, the following guidelines will be used.
   a. For Aerial Delivery -- Avoid foam use within 300 feet of open water when using Beaver aircraft, and T2 and T3 helicopters and 400 feet when using CL-215 heavy air tanker or heavy helicopters. Foam will be injected into the holding tank only after the water pick-up operation has been completed.
   b. For Ground Delivery with Motorized Pumps --Avoid application of foam within 25 feet of open water when using small pumps and within 50 feet of open water when using MKIII or equivalent pumps. All foam concentrate will be located in impermeable containment basins (i.e., a plastic sheet spread over rocks or logs to form a catch basin).
   c. For Ground Delivery with Backpack Pumps --Avoid application within 10 feet of open water. All backpack pumps will be filled a minimum of 10 feet or more from water. A separate, uncontaminated container will be used to transport water from the foam source to the backpack pump. This container will be kept uncontaminated by foam.
5. If an unintentional drop of retardant occurs in a water body, then the appropriate agencies will be notified and water quality will be monitored. If a spill occurs in a lake used as a drinking water source by local residents, then potentially affected residents will be notified along with the appropriate agencies.
6. Minimize cutting and removal of trees and ground disturbance during control line construction in flood prone zones to the extent possible. This mitigation will be applied to specific units where applicable.
7. Locate camps, equipment maintenance areas, etc., away from sensitive areas, such as wetlands or riparian zones where possible in order to minimize impacts on these areas.
8. To minimize potential impacts to wetlands and water quality due to fuel spills:
   a. If refueling or maintenance of equipment must occur within “filter strips,” riparian management zones, or wetlands, use catch basins to prevent potential spills from contaminating soils or entering riparian areas, wetlands or waterways.

b. Spill kits will be available whenever 5 or more gallons of petroleum fuels are being used. The spill kit contains absorbant pads for petroleum products, absorbant powder, bag for disposal, rubber gloves and rags.

# Vegetation and TES Plants

1. Reduce impacts to standing forest in riparian areas and lakeshores that do not have extensive blowdown by mimicking natural fire burn patterns in order to provide seed sources for future forest. Identify standing forest in accessible lakeshores and riparian areas prior to burning, through aerial photo mapping or ground reconnaissance. Older white cedar and red and white pine stands often occur in areas where historical wildfire frequency and intensity was lower, such as on lakeshores and in riparian areas. Methods that could be used, given firefighter safety and management objectives of the burn, include but are not limited to:
   - Altering the season of the burn or the prescription, so that the unit is burned under higher fuel and soil moisture conditions in order to further reduce the intensity and severity of the burn while still achieving fuel reduction objectives;
   - Adjusting control line locations to exclude areas of standing forest;
   - Adjusting prescribed fire ignition patterns so the fire burns cooler and moves in a specific direction;
   - Applying water on selected old-growth trees to minimize mortality; and
   - Taking further advantage of natural firebreaks to reduce or exclude fire from stands of live trees.
2. In upland areas, larger patches of older standing forest will be protected where practical, with the following outcomes in each treatment type:
   a. In patch burns, only the patches of blowdown will be ignited; however, some of the surrounding standing trees may also be burned because of the heat generated within the patches and because some of the fire may carry through fine fuels in adjacent stands. Generally, this mortality will be limited to the area directly surrounding the patch.
   b. In patch/understory burns, the patches of blowdown are distributed among standing red and white pine forest. The patches of blowdown will be burned along with the fine fuels beneath the pines, which will also be burned with a lower intensity fire. The majority of the overstory red and white pine trees will survive this treatment, but there will be some mortality to isolated trees and clumps of trees where surface and ladder fuels are in heavier concentrations. This is what occurs under the natural fire regime for these areas.
   c. In broadcast burns, known stands of old trees in the interior of units will be evaluated with regards to mitigation options to reduce mortality. However, fuel loads are generally so high around these areas that these patches of standing forest cannot be protected because of safety and operational considerations. These patches will have a higher likelihood of surviving a broadcast prescribed fire than a wildfire.
3. To minimize potential impacts to threatened, endangered, and sensitive (TES) plants:

   a. Minimize impacts to known locations of TES plants along lakeshores, in riparian areas, and cliffs during the prescribed burns to the extent practical. Consider the natural role fire plays in the natural history and occurrence of these species and the risks associated with burning them. Methods that could be used include, but are not restricted to: altering the season of the burn, adjusting control line locations, adjusting prescribed fire ignition patterns, using water to minimize burn intensities, and using existing landscape and topographic patterns in the overall placement of treatment units.
   b. Conduct TES plant and noxious weed surveys in accessible, high-probability habitats within control lines, helispots, and treatment units prior to burning.
   c. Avoid known locations of TES plants during control line and helispot construction.
4. To minimize the potential spread of noxious weeds in the wilderness, clean and visually inspect helicopter buckets and snorkels used inside the wilderness. Also, inspect all helispots to ensure they are not located in areas containing noxious weeds.

# Wildlife

1. Protect any TES wildlife species that are known or found during project implementation, along with any specific habitat (dens, nests, perch trees, etc.) currently or recently used.
2. Conduct bald eagle nest surveys in and adjacent to treatment units and helispot locations during standard survey times prior to control line construction and burning.
3. Avoid disturbance within 1,320 feet of any active bald eagle nests between February 15 and August 15. Coordinate with the U.S. Fish and Wildlife Service if any potential disturbance or activity (e.g., control line construction nest site protection, prescribed burning) is planned within 1,320 feet of an active bald eagle nest site between February 15 and August 15.
4. Avoid or limit habitat altering activities within 660 feet of any bald eagle nest site, whether occupied or not.
   a. 0 to 330-foot Zone--No habitat altering activities are permitted except for actions necessary to protect nest sites.
   b. 330 to 660-foot Zone--Habitat altering activities are prohibited except for those not making significant changes in the landscape.
   c. Coordinate with the U.S. Fish and Wildlife Service if any habitat altering activities (e.g., control line construction, nest site protection, prescribed burning) are planned within 660 feet of any nest site.
6. To avoid disturbance to Canada lynx and gray wolves, prevent potential illegal use of constructed control lines by snowmobiles. Where constructed control lines intersect the BWCAW boundary, this will be accomplished by screening and blocking access to the control lines by placing down trees and brush across control lines following treatment.

# Wilderness Values

1. Use the minimum actions and tools necessary within the wilderness to meet the purpose and need based upon the Minimum Requirement and Minimum Tool Determination.
2. Review the minimum tool concept during preparation of each burn plan to assure that the minimum tools are being used.
3. Locate portable weather equipment and radio repeaters outside of the wilderness where possible.
4. Conduct reconnaissance flights at or above 4,000 feet above mean sea level. One flight below 4,000 feet will be needed to identify bald eagle nests prior to burning. Also, helicopters will fly below 4,000 feet to test potential helispots in order to assure the helispots meet standards.
5. Use hiking, canoeing, or dogsledding for ground reconnaissance and line and helispot construction, with the exception that motorboat access is permitted in areas with established motorized routes.
6. Follow the control line construction guidelines identified below to minimize the impact on wilderness values *where possible*:
   a. Use water as a control line tactic.
   b. Use natural firebreaks instead of artificial ones.
   c. Consider explosives as a tactic for control line building and removal of necessary trees and snags.
   d. Roll logs out of the control line instead of bucking.
   e. Minimize cutting trees (especially live trees) and limbs unless necessary to prevent the spread of fire across the control line or for worker safety.
   f. Where tree cutting occurs along portages or trails, cut stumps as close to the ground as possible.
   g. Construct control line to the minimum width and depth necessary to control the prescribed fire; widen minimal control lines by carefully burning fuel on the inside of the line and by soaking the area adjacent to the line with water or foam. Liquid fire retardant will not be used for pretreatment.
   h. Locate constructed control lines in areas requiring a minimum of scraping and cutting and design them to follow irregular lines.
   i. Use chainsaws only where safety precludes the use of handtools.
   j. Follow Minimum Impact Management Tactics (MIMT) mop-up guidelines to minimize the impact on wilderness values.
   k. Avoid tool scars where possible by using water or wetting agents (foam) to extinguish fire when necessary.
7. If helispots are necessary, use the following helispot construction guidelines:
   a. Construct helispots only for units that are 5 miles or more from an improved helispot location outside the wilderness boundary. For units that are within 5 miles from the boundary, helispots outside of the wilderness will be used.
   b. Use natural openings (e.g., open sedge- or grass-dominated areas), units that have been already burned, or areas in units that will be burned in the future, wherever possible. Cut only the trees necessary to permit safe operation.

   c. Avoid construction of helispots in high visitor-use areas or sites with sensitive plants or heritage sites.
   d. Transport helitorch fuel into the wilderness immediately prior to igniting the burn and remove the fuel from the site within 72 hours after the fuel is no longer needed for treating the unit.
   e. Refuel helicopters directly from fuel trucks outside of the BWCAW. Helicopter fuels will not be cached within the BWCAW.
8. Use the following camp construction guidelines:
   a. Identify camps in the Burn Plan.
   b. Locate camps outside of the wilderness, wherever possible.
   c. Locate camps at existing campsites or where they would have the least impact on wilderness values.
   d. Avoid cutting trees or brush to construct campsites unless absolutely necessary.
9. To reduce the visibility of control lines, leave a screen of vegetation between the ends of control lines and lakeshores or consider angling the control line so it is not visible from the water, as long as control line effectiveness is not compromised. This will be determined by the topography, fuel levels near the control line, and the potential for an escaped prescribed burn.
10. Rehabilitate control lines, where visible (e.g., where they intersect portages, hiking trails, lakes, and boundaries), helispots, and campsites to leave the areas in a state that is as natural appearing as possible.
    a. Scatter obvious large accumulations of cut limbs, seedlings, and saplings.
    b. Scatter some cut brush and limbs onto control lines and helispots.
    c. Cut stumps as close to the ground as possible in campsites and along portages and trails.
    d. Remove all plastic flagging and trash along control lines and helispots.
    e. Return helispot landing pads to a condition that is as natural as possible.
11. Rehabilitate campsites to standards following the prescribed burns. Tree cutting will only be done at campsites to remove “hazard” trees that pose a threat to public safety. When tree cutting occurs in campsites, stumps will be cut as close to the ground as possible.
12. Develop and distribute materials to the wilderness visitor on what to expect during prescribed burning activities, including potential noise from chainsaws during line construction, smoke dispersion, safety, helicopter and airplane use, and where and when these activities would occur. This information will be provided in pamphlets to wilderness visitors and placed on the Superior National Forest internet website.
13. To the extent possible, burn treatment units in areas of high recreation use during low recreation use times (early spring and late fall) and schedule (year to be burned) in relation to other treatment areas to have the least impact on recreation use.
14. Provide notice to wilderness visitors when they get their permit about potential burn activities and area closures.
15. When campsites or travel routes are closed during operations, reroute visitors to alternative travel routes served by the same entry point if the carrying capacity is not exceeded.
16. If entry points are closed during burn operations, accommodate visitors with confirmed reservations at other entry points to the extent that quotas are not exceeded. If alternatives are not available that the party leader finds acceptable, the reservation and use fees will be refunded.

17. Where burn operations would result in quota reductions at major entry points, delay burning until after September 15 or prior to the spring walleye fishing opener. This will be the case for Units 4, 244, 268, 278, 324, 342, and 365.
18. Protect individual sites where possible (e.g., administrative structures, bridges, stairway portage) from the effects of prescribed burning and control line and helispot construction.

# Heritage Resources

1. Avoid ground-disturbing activities, including control line construction and helispot construction, within specified buffers of the boundaries of heritage sites. Burn plans will identify appropriate buffers for each site.
2. Conduct heritage resource surveys in accessible, high-probability lakeshore areas within treatment units and helispots prior to burning.
3. Protect historic structures that can be damaged by prescribed fire using sprinklers, fuel reduction, or other methods, as determined in the Burn Plan.