U.S. Department of the Interior
Bureau of Land Management

Alphabet Hill Prescribed Burn

Environmental Assessment,

May 2021

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Applicant: State of Alaska

Case Number: AA-095323, AA-095347, AA-095381

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Alphabet Hill Prescribed Burn

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1.0 Introduction

1.1 Summary of Proposed Project

In cooperation with the Alaska Department of Natural Resources (DNR) Division of Forestry and Alaska Bureau of Land Management (BLM) foresters, the Alaska Department of Fish & Game (ADF&G) proposes to burn approximately 53,000 acres of wildland in the vicinity of the Alphabet Hills in order to enhance wildlife habitat. The project is expected to take place in the 2021 summer season; 2021 will be the first year of project implementation, recognizing that completion may take several years.

The Alphabet Hills Prescribed Burn Plan project area is in South-Central Alaska, in a wildland area approximately 45 miles north of Glennallen along the Richardson Highway. The project area is situated at the headwaters of the Gulkana Wild and Scenic River -- along the North and South branches of the West Fork (See: Figure 3.1.1)

Fire suppression and limited fire occurrence across portions of Alaska has resulted in late successional forests that provide limited forage opportunities for moose. Fire returns the landscape to an early successional stage and encourages the regrowth of browse species such as willow, aspen, and birch, which are important to moose. The project's objective burn conditions imitate a natural fire's ecological role. An uneven burn is most like a natural burn, including severe and moderate burn intensities across each burn unit. Severe and moderate burn intensities are necessary in order to regenerate seeds and spruce cones and thus sprout shrubs and trees. The final objective is to enhance forage vegetation species. Low and moderate burn intensities will ensure vegetation age diversity. Further, discontinuity in the fuels after burning the proposed units will reduce the potential for large scale wildfires in the near future.

Prescribed fire has become an important management tool for increasing the capacity of landscapes to support more moose and increase harvest opportunity. Moose browse availability and removal has been shown to peak 20-30 years post-fire (Lord 2008; Spencer and Hakala 1964; Weixelman et al. 1998). Data from browse and moose twinning surveys conducted in game management units (GMUs) 13B and 13C within the last five years suggest that proportional browse removal is high and twinning rates are low, both of which may be indicative of a nutritionally limited population (Boertje et al. 2007; Seaton et al. 2011). Additionally, Collins (2002) documented lower browse quality in GMU 13A than in other parts of interior Alaska because of high levels of nitrogen binding by tannins in important moose browse species such as feltleaf () and diamondleaf (*S. pulchra*) willow. Moose in GMU 13A maintained low reproductive rates even when winter browse availability was not limited, indicating that both browse removal and browse quality information are needed to understand moose nutrition in GMU 13. ADF&G will also examine the effectiveness of applying this prescribed fire to enhance forage quality in the Nelchina Basin.

The proposed burn area is organized into three distinct burn units totaling 53,590 acres: Unit A contains 23,198 acres; Unit B contains 21,984 acres; and Unit C contains 8,408 acres (See: Figure 3-1-1). The project methodology and burn plan is outlined below in Section 1.3 Purpose and Need and likely to take place over the course of several years.

The Alphabet Hills Prescribed Burn Plan area is adjacent to the roughly 38,000 acres of wildland which was burned as part of ADF&G wildlife habitat enhancement efforts in 2004. Under State of Alaska management, ADF&G initiated a series of large-scale proscribed burn projects in this area in the 1990s. The proposed project is a natural extension of a long-term and large-scale fire reintroduction plan on State of Alaska lands. While the proposed project area is primarily on lands managed by the State of Alaska, adjacent BLM lands provide a natural fire break at the Gulkana River. Thus, BLM managed lands including sections within the Wild and Scenic River corridor are considered for the burn. More specifically, the Alphabet Hills Prescribed Burn area is located entirely within a large block of land classified as Limited Management under the Alaska Wildland Fire Management Plan of 2017.

Vegetation in the burn area is typical of the boreal forest. It consists of extensive zones of black (*Picea mariana*) and white (*P. glauca*) spruce and hardwoods. Within these zones are mosaics of shrub and herbaceous plants classed as sedges, moss-bog meadows, willow, sweetgale, and graminoid bog. Wet areas within the forest are fed by a network of small streams. Tree line occurs at about 3,500 feet above sea level. Expansive areas of shrubs such as alder (*Alnus crispa*), bog birch (*B. glandulosa*), dwarf birch (*B. nana*) and willow (*Salix spp.*) often occur in the transition zone from forest to alpine tundra.

The communities nearest to the project area are Glennallen, located about 56 miles southeast, and Lake Louise, located about 28 miles south. Seasonally populated recreational areas nearby include the Tangle Lakes Campground at the Tangle Lakes, 40 miles northeast, the Paxson Lake Campground, 45 miles northeast, and camping opportunities near the village of Chistochina, 66 miles east.

The preliminary risk assessment for this project is rated as medium. Values at risk are minimal, and any cabins and infrastructure identified lie outside of the burn area. Fire line along the respective unit perimeters mitigate the fire holding problems and allow for adjustments to the line with respect to sensitive areas. ADF&G has determined that the primary risk is smoke management for nearby communities.

The Maximum Allowable Perimeter (MAP), or maximum potential project area, for the Alphabet Hills Prescribed Burn Plan encompasses approximately 463,000 acres. It is bound on the north by the Maclaren River, running northeast to southwest. Streams and ridgelines make up the northern and eastern perimeters. The MAP extends across the West Fork of the Gulkana River, west along a series of creeks and lakes and butts against the westernmost point of the Tyone River. The MAP western most boundary parallels the Susitna River confluence with the Maclaren River.

1.2 Background

Location: This project is in a south-central interior region of Alaska south of the Alaska Range and in the location of the Gulkana Wild and Scenic River. The Project area spans an area from approximately milepost 260 on the Richardson Highway, north and west to approximately milepost 22 on the Denali Highway.

Ownership: Since the first prescribed burn in the adjacent areas was completed in 2004, a significant percentage of the ownership has changed from Federal to State ownership. The

Alphabet Hills Prescribed Burn Plan project area is predominately incorporated into State of Alaska lands managed by the DNR. However, a small portion of each burn unit includes BLM lands. The BLM land within the prescribed fire units is a part of the Gulkana Wild and Scenic River Corridor. The section of this Corridor follows the North and South Branches of the West Fork of the Gulkana River. Coordination among these partnering agencies is intended to provide for compliance as required by each agency.

Unit	State of Alaska Acres	Bureau of Land Management Acres
A	20,371	2,827
B	17,841	4,143
C	4,513	3,895

Table 1.1 Land Ownership in each Unit

Size: As shown in table 1.1 the Alphabet Hills Prescribed Burn is made up of three burn units totaling 53,590 acres; the project is comprised of Unit A with 23,198 acres (2,827 acres of which are BLM lands), Unit B with 21,984 acres (4,143 BLM acres), and Unit C with 8,408 acres (3,895 BLM acres).

Topography: The project area is incorporated in the moraine-kettle pond and broad flatlands topography characteristic of south-central Alaska (See: Figure 3.1.1) It is located near the divide of glacially derived landforms common along the Maclaren River north and the broad flatlands of the extensive Lake Louise lacustrine basin south. Moraines with intervening valleys, high ridges with long foot slopes, small outwash plains, and many lakes, streams, and scattered muskegs are major features of the landscape associated with the foothills adjoining the Alaska Range in the northern parts of the Copper River Plateau. Elevation across the burn units ranges from approximately 2300 feet to 3400 feet above sea level. A long, broken ridgeline consisting of four knobs extends across the northern perimeter of Unit A. From this northerly extent, the southerly aspect drops approximately 900 feet over 11 miles. This gradient is broken by numerous steps and terraces of various depths and size containing small lakes and ponds, including the West Fork of the Gulkana River. Finally, the project area extends along the headwaters of the West Fork of the Gulkana River, a tributary of the Copper River.

Project Area: The Project Area for the entire Alphabet Hills Prescribed Burn Plan encompasses approximately 463,000 acres, it defines the outermost boundary within which the prescribed fires may be allowed to spread naturally as determined by local weather, topography, hydrology, and fuel types except as necessary to protect private property and prevent escape from this perimeter.

The Project Area is bound on the north by the Maclaren River running northeast to southwest; then along an unnamed stream that flows south and follows a series of ridgelines north of Monsoon Lake; it continues northeast to a three lobed lake in T. 13N, R. 7W, Sections 20 and 21. From there it drops south then southeast along a series of ridgelines to a long serpentine shaped lake. It then follows a series of creeks and swamps southeast to a series of ridges that run to an unnamed creek that flows south. This eastern boundary joins an unnamed creek, then follows a series of creeks and ponds until it joins the West Fork Gulkana River. After travelling a short distance down the West Fork, it continues south and then west following a series of creeks and lakes. The southern boundary of the Project Area trends southwest along a series of small lakes and streams and crosses the Tyone River north of Tyone Lake. It trends to the northwest along the Tyone River and then a series of small streams and lakes until it meets a large oxbow of the Susitna River. The western boundary is the Susitna River north to the confluence of the Maclaren River.

The Alphabet Hills Prescribed Burn Plan project area is located almost entirely within a large block of land classified in the Limited fire management option under the Alaska Interagency Wildland Fire Management Plan - 2016. Surveillance is normally the appropriate initial response to wildfires occurring on lands afforded Limited status. A small portion (7,150 acres) of the Project Area is in the Full fire management option, located along a segment of the southern boundary. This full option area continues to the south outside of the Project Area encompassing the Lake Louise Area. These are the nearest lands outside the PA with a protection level other than limited. This area contains the Lake Louise State Recreation Area, private and native allotment parcels on both Lake Louise and adjacent lakes, and state lands. This area has numerous natural fire breaks.

1.3 Purpose and Need

The BLM action under consideration is the Alphabet Hills Prescribed Burn which would burn approximately 53,000 acres of wildland. The purpose of this action is to continue compliance with East Alaska Resource Management Plan (EARMP) natural resource management stipulations; prescribed fire is frequently used in natural resource management and in this case the purpose of "utilizing wildland or prescribed fire [is to] achieve desired conditions for moose habitat on moose winter range," (EARMP 2007). The need for this action is driven by the initial request from ADF&G to initiate proscribed burn plan in the project area including BLM managed land on the North and South Branches of the West Folk of the Gulkana Wild and Scenic River. Priority for treatment will be as follows: a) completion of Alphabet Hills prescribed burn; b) winter range on unencumbered BLM land; c) projects on State or Native-selected land where the selecting entity is a partner and contributor.

1.3.1 Decision to be Made

The Bureau of Land Management is responsible for the management of the wild and scenic river corridor. The decision to be made is the Need of BLM to complete this action in response to ADF&G request to utilize BLM managed lands to conduct prescribed fire operations while meeting BLM RMP objectives.

1.4 Land Use Plan Conformance

The Final Environmental Assessment for the 2006 revision of the 1983 Gulkana River Management Plan

> 8. FIRE MANAGEMENT
> Wildfires within the wild river corridor will be managed in accordance with the Alaska Interagency Fire Management Plan of June 1983. This plan shows the Gulkana National Wild River corridor managed under a "limited" fire suppression class, where suppression of wildfires is not necessary or desired. Prescribed fire may be used as a management tool within the corridor to maintain or improve wildlife habitat. Within individual burn plans, consideration will be given to meeting objectives described above and to leaving a buffer along the river.

The East Alaska Resource Management Plan and Record of Decision (RMP/ROD) of September 2007 provides the overall long-term management direction for lands encompassed by the proposed project. The proposed action and alternatives are consistent with the RMP/ROD. Specifically, the proposed action is consistent with the following decision in the RMP/ROD:

E. FIRE AND FUELS MANAGEMENT

EARMP Section E-3-b

1. Utilize wildland or prescribed fire to achieve desired conditions for moose habitat on moose winter range shown on Map 3, page 65. Priority for treatment will be as follows: a) Completion of Alphabet Hills prescribed burn; b) winter range on unencumbered BLM land; c) projects on State or Native-selected land where the selecting entity is a partner and contributor (resources or money).

2. Utilize prescribed fire to achieve desired conditions for caribou only if it is not being achieved through wildland fire or by prescribed burning to improve moose habitat as described under #1. This is second priority to moose habitat improvement listed above.

3. Utilize prescribed burning to improve Delta bison calving range and achieve desired conditions listed above over 15,000 acres in the area.

4. Utilize prescribed burning to improve Dall sheep habitat as described above. This would be based on on-going inventory and delineation of these ranges and encroachment of shrubs.

5. Prescribed burn plans will apply the following Required Operating Procedures, as applicable: ROP-Veg-a-4, ROP-Veg-a-2, ROP-Veg-a-1, and ROP-F&W-a-10.

6. The prescribed burn plans will address air quality and smoke management. Appropriate contacts and written approval will be obtained from ADEC.

G. FOREST AND WOODLAND VEGETATION, AND FOREST PRODUCTS

G-1: Goals

- Maintain and restore the health, productivity, and biological diversity of forest and woodland ecosystems.
- Consistent with other resource values, provide personal use wood products for local consumption and opportunities for commercial harvests.

G-2: Objectives (Desired Conditions)

- Timber stands managed for commercial production of white spruce: These stands occur on floodplains and alluvial terraces on well-drained soils. Where accessible, these stands would be managed to maintain white spruce as the dominant tree species, which may require thinning to minimize early seral competition from other species. Beetle-kill trees within these stands would be salvaged where possible as firewood or house logs. This desired condition would be an objective for a maximum of 10 percent of the approximately 144,000 acres in the area considered suitable for commercial harvest.

- Timber stands managed for improvement of wildlife habitat: In mixed white spruce-aspen/poplar/birch stands where wildlife habitat improvement is the primary objective, desired condition would be maintenance of white spruce with a component of aspen, balsam poplar, or paper birch. These stands would consist of shrub-dominated early seral stages after either harvest, wildland or prescribed fire, or mechanical treatment of mature or bark beetle-kill white spruce. This would be the desired condition for the majority of the 144,000 acres in the area considered suitable for harvest.

In addition, the following objectives were identified for the approximately 144,000 acres identified as suitable for timber harvest (see Map 4, page 66):

- Increase access for personal and commercial wood products.
- Improve forest health through salvage of bark beetle-kill spruce.
- Consider potential for commercial harvest.
- Benefit wildlife habitat.
- Manage for desired conditions described above.
- Reduce hazardous fuels.

1.5 Other Applicable Laws, Regulations, Policies, etc.

- National Historic Preservation Act as Amended 1992.
- Paleontological Resources Preservation Act of 2009.
- Alaska National Interest Lands Conservation Act of 1980 (ANILCA).
- Migratory Bird Treaty Act of 1918 (as amended).

1.6 Summary of Public Involvement

The draft environmental assessment was posted to the BLM's national NEPA register website, ePlanning on *month/day/year* for a 30-day public comment period.

1.7 Issues Identified

Issue – 1 Water Quality
How would the proposed action affect the watershed's water quality, hydrology?

Issue – 2 Vegetation
How will the proposed prescribed fire activities effect vegetation regeneration?

Issue – 3 Travel Management
How does the proposed action affect recreational experience in the Wild Scenic River Corridor?

Issue – 4 Subsistence
How does the proposed action affect subsistence users?

Issue – 5 Cultural/Historical Resources
Will the prescribed burn have an adverse effect to cultural resources on or eligible for the National Register of Historic Places?

Issue – 6 Wildlife
What are the effects of prescribed fire on migratory birds and BLM sensitive species (July 15th)
How will the prescribed fire affect caribou, moose, Dall sheep, and bison habitat?
How does the prescribed fire affect fisheries Outstanding Remarkable Values and riparian habitat?

Issue – 7 Visual Resources
How would the proposed action and alternatives affect scenic resources within the Gulkana National Wild River corridor?

Issue – 8 Air Quality
How will the proposed action affect air quality in the region?

1.7.1 Issues Eliminated from Further Analysis

Paleontological Resources-
Pleistocene epoch vertebrate remains have been located in deeply buried sediments to the northwest part of the project area near the Susitna River. However, these deeply buried sediments, and any scattered paleontological remains, will not be directly affected by the prescribed fire. There may be some increased soil erosion due to the loss of ground cover in some areas, but the potential effects are not significantly different from natural erosion already occurring.

2.0 Alternatives

2.1 Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny The Alaska Department of fish and Game's request to utilize BLM managed lands as part of the Alphabet Hills prescribed fire project.

2.2 Alternative 2 - Proposed Action Alternative

Under the Proposed Action Alternative (Alternative 2), the BLM would allow the Alaska Department of Fish and Game to utilize prescribed fire on BLM managed lands located within Unit A, B and C of the Gulkana National Wild and Scenic River corridor keeping resource concerns consistent with a Visual Resource Management Class I. In order to protect visual resources and water quality, a vegetation buffer will be provided along the river. This will be accomplished by not lighting directly along the river and by burning within a prescription that allows for a mosaic pattern of burned/unburned vegetation along the river corridor and meeting burn objectives of vegetative mortality to increase moose browse availability.

2.3 Alternative 3 – Proposed Action Alternative

Under the Proposed Action Alternative (Alternative 3), the BLM would allow the Alaska Department of Fish and Game to utilize prescribed fire on BLM managed lands located within the Gulkana National Wild and Scenic River corridor with aerial ignitions only being allowed in Unit A of the North Branch of the West Folk of the Gulkana river. The BLM would allow for lighting to take place on the outer perimeter of its managed lands in the Wild and Scenic River corridor. This would allow fire to back burn towards the river, create a mosaic burn pattern and keep resource concerns consistent with a Visual Resource Management Class I. It would also protect visual resources, water quality, and ensure a vegetation buffer along the river, while meeting burn objectives of vegetative mortality to increase moose browse availability.

3.0 Affected Environment and Environmental Consequences

3.1 Water Quality

Issue 1: How will prescribed fire affect the Gulkana River water quality, hydrology and watershed?

3.1.1 Affected Environment

The Gulkana River watershed drains approximately 2,140 square miles (5,542.6 km^2) of the eastern portion of Southcentral Alaska. The river begins in the Alaska Range southwest of Summit Lake and flows south into Paxson Lake, exiting again before converging first with the Gulkana's Middle Fork and then with the Gulkana's West Fork. Major tributaries of the Gulkana River are the Middle Fork and the West Fork. The Middle Fork drains most of the north slopes of the Alphabet Hills, flows through Dickey Lake, and joins the Gulkana River's Main Stem three miles downstream of Paxson Lake. The West Fork starts in several lakes south of the Alphabet Hills, about 50 miles northwest of Sourdough, and joins the Main Stem of the Gulkana about 8 miles above Sourdough. The river continues flowing until it empties into the Copper River near the village of Gulkana, ultimately draining into the Gulf of Alaska. Several hundred lakes and ponds are scattered throughout the spruce-dominated forests of the Gulkana River watershed (BLM 2014).

The climate of the Gulkana River watershed is subarctic continental; characterized by long, cold winters and short, warm summers. Mean January temperature reported between 1949 and 2012 -6°F (-21.1°C) at the Gulkana Airport, 30 miles south of the USGS Sourdough gage, and for the period 1975 to 2010, -1°F (-18.3°C) at Paxson at the north end of Paxson Lake (Western Regional Climate Center). Daily low temperatures of -50°F (-46°C) or less occur frequently during the winter (mid-October to April), and two-week or longer periods of severe cold weather are common within the watershed. Mean July temperature is 57°F (13.9°C) at the Gulkana Airport and 54°F (12.2°C) at Paxson. Daily high summer temperatures within the Gulkana watershed occasionally exceed 80°F (27°C). Daily minimum summer temperatures are generally between 37° to 42°F (2.8° to 5.6°C) within the Gulkana Wild and Scenic River (WSR) corridor; however, freezing temperatures have been recorded in every month (BLM 1999).

Mean annual precipitation (between 1949 and 2012) is 11.3 inches (28.7 cm) at Gulkana Airport and 21.1 inches (53.6 cm) at Paxson (between 1975 and 2010). Average annual snowfall is 51.2 inches (130 cm) at the Gulkana Airport and 100.9 inches (254.3 cm) at Paxson (Western Regional Climate Center). Most precipitation is from summer rains; July is normally the wettest month. The river generally starts to freeze in October and becomes ice-free in early to mid-May.

Unlike other rivers of the Copper River Basin, there is no runoff in the Gulkana River originating from glacier melt. Precipitation, basin physiography, lake storage, and presence of permafrost controls the hydrology of the river. Generally, the Gulkana River Main Stem flows from north to south, with the Middle Fork and West Fork generally flowing from west to east.

The maximum allowable perimeter, or the Project Area, for the entire Alphabet Hills Prescribed Burn Plan encompasses approximately 463,000 acres. It is bound on the north by the glacial fed Maclaren River running northeast to southwest. Other clear water streams and ridgelines make up the northern and eastern perimeter. The perimeter continues south and crosses the Gulkana's West Fork and then continues west along a series of clear water creeks and lakes and eventually along the clear water Tyone River. It extends further west and then parallels the glacial Susitna River North to the confluence and return with the Maclaren. (See Figure 3.1-1).

The project area contains many hydrologic features that contribute to the areas diverse water resources. There are large glacial rivers, various sized clear water rivers and creeks, lakes, ponds, and wetland areas. These all combine to create an intricate watershed that supports wildlife, vegetation, and a multitude of human activities including Subsistence, commercial use, sport, and recreational uses.

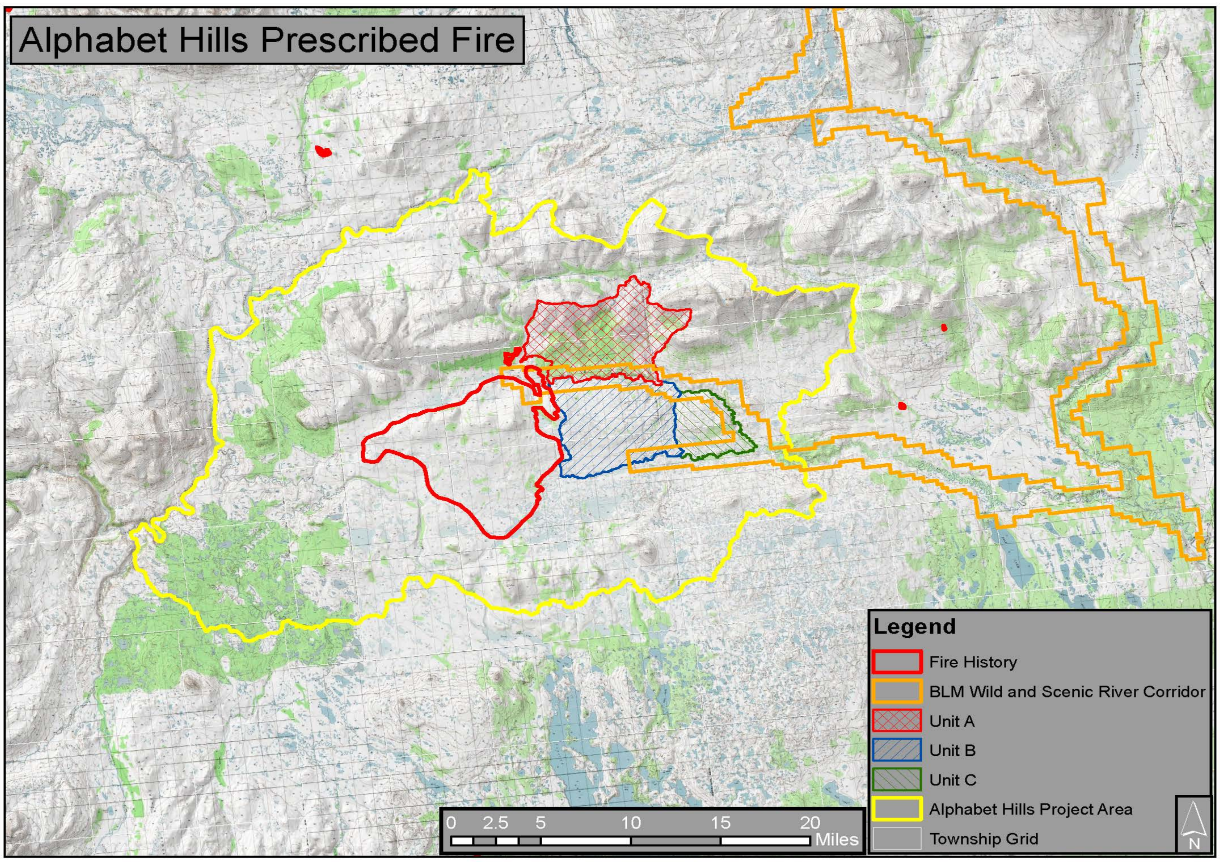

Figure 3.1.1 Alphabet Hills Prescribed Fire Location

There are three prescribed burn units (units A, B and C), within the project area, totaling 53,590 acres. These units are the primary targets for burning proposed by the Alaska Department of Fish and Game, see Figure 3.1-1 in appendix C. They are situated along the headwaters of the Gulkana's West Fork which is an important watershed providing high water quality for anadromous and resident fish species. Specifically, the North Branch of the West Fork lie within the heart of the burn units with the South Branch flanking the south side of units. They originate in the lakes and hills of the Lake Louise Plateau physiographic region (Wahrhaftig 1965) about 20 miles (32 km) north of Lake Louise at about 2,400 feet (732 m) elevation. The Gulkana's West Fork is a clear-water tributary to the Main Stem of the Gulkana and eventually the Copper River. There are many clear water tributaries to the North and South Branches, most notably Keg Creek and Moose Creek, which are also anadromous and important contributors to the Gulkana's overall water quality and quantity.

Most reaches of the Gulkana River and tributaries consist of meandering, single thread, low gradient channels. Channel width and discharge varies tremendously at different points within the Gulkana River system. For example, channel width ranges from about 10 feet (3 m) in places along the upper North Branch to as much as 225 feet (68.6 m) at Sourdough. Mean August discharge on the North Branch at the confluence with the South Branch is 140 ft3/s (3.9 m3/s); and at Sourdough, it is 1,330 ft3/s (37.2 m3/s). Shelby et al. (1990) describes channel characteristics and flow rates.

The Gulkana River exhibits considerable variation in stream flow and water temperature during the warm summer months. Water level can rise markedly and rapidly during and after intensive or long duration storms. In July 1995, a particularly intense storm resulted in an increase in the water depth along the upper North Branch of approximately 3 feet (0.9 m) in a 24-hour period. However, peak flows tend to be moderated to a large degree by the lack of integrated drainage networks and the high storage capacity of the drainage basin. Extensive bogs, lakes, and other wetlands in the drainage basin have the capacity to store water and release it to the river system at a slow, steady rate over the summer and fall. Ingram and Carrick (1983) describe, in greater detail, the influence of climate, physiography, and permafrost on the hydrology of the Gulkana River.

Water quality is generally considered very good in the project area. There are no water bodies within the project area listed as impaired on the State of Alaska's 303d list. It is important to mention that this portion of the Gulkana River is a component of the National Wild and Scenic River System. It is administered by the BLM through the River Management Plan Revision for the Gulkana River. Water quality and clarity is one of the outstandingly remarkable values listed in the Gulkana River Management Plan (BLM, 2006). The free-flowing nature of the river, adequate volume, and relatively protected watershed provides generally superior water quality. Unauthorized OHV crossings, improper human waste disposal, run-off from heavy use campsites, and release of petroleum hydrocarbons from powerboats are all factors that can negatively impact water quality. BLM water quality data taken currently meets State water quality standards (18 AAC 70) for dissolved oxygen, pH, and temperature.

Finally, ATV trails in the general area are beginning to expand and proliferate in the Alphabet Hills and into the WSR corridor. In order to access areas by ATV, it is necessary to cross streams. Stream crossings cause stream damage and sedimentation. In order to legally cross streams you must have a stream crossing permit provided by ADF&G.

3.1.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny the Alaska Department of Fish and Game's request to utilize BLM managed lands as part of the Alphabet Hills prescribed burn project. DNR could burn on State of Alaska lands however would have to protect the boundary of BLM's WSR not allowing fire to creep into BLM land. If State lands were burned, effects to the Gulkana WSR are still probable because there are many tributary creeks, including Moose and Keg Creeks, that empty into the Gulkana River. The effects are to a much lesser degree than Alternative 2 (see Alternative 2 for direct and indirect effects to water quality, hydrology and the Gulkana watershed) and a lesser degree than Alternative 3. In general, this alternative has the least potential effect to water resources on the BLM's WSR. The possibility does exist, however, that the prescribed burn could get out of control and enter the WSR, which could create impacts similar or equal to Alternatives 2 and 3. Under normal planned conditions, State water quality thresholds would not be exceeded under this alternative.

3.1.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under this alternative action, prescribed fire would be allowed to occur within the Gulkana Wild and Scenic River corridor and other BLM managed lands. In addition, firing (utilizing plastic sphere dispensers (PSD)) of the burn would be allowed within the WSR. Objectives within this burn plan are to create a highly variable mosaic of burn severity, duff consumption, and unburned area. Within the spruce vegetation classes, it is desired to achieve a minimum of 40% mortality of the spruce using moderate to high burn severity and exposing mineral soil for deciduous trees and shrubs to regenerate by seed. Within spruce & shrub vegetation classes, it is desired to achieve 50-80% top-kill of deciduous tree and shrub above ground stems with low to moderate burn severity to stimulate sprouting.

Watershed effects from this proposal depend on several variables, including fire size, fire severity, soils, watershed slope, vegetation, vegetation regrowth, precipitation, physical location on the watershed, and proportion of watershed burned (Stednick 2010). Soil heating may occur following the removal of cover (vegetation, litter and duff, and organic material) by fire (Wells and others 1979). The highest soil temperatures will be associated with areas of greatest fuel consumption and longest duration of burning. The greatest subsurface heating will likely occur where thick, dry litter layers are consumed beneath shrubs and isolated trees. Excessive soil heating can kill plants and decrease vegetative cover and influence stream temperature from loss of riparian cover to soil water heating (Stednick 2010).

If the objectives of the burn plan are met, the spatial variability in postfire surface conditions would result in spatially varying runoff and erosion rates. It can be expected that the initial infiltration rates in the high burn severity would be lower than in the unburned and undisturbed areas. In addition, when fire removes the forest canopy and the forest floor that protect the underlying mineral soil, modifications to several hydrologic properties of soil may result. One of these is an enhancement of soil water repellency that may lead to increased runoff and erosion (Neary et al. 2005). Therefore, surface runoff and erosion rates will be increased. Infiltration rates in the areas burned at lower intensities will closely resemble that of an unburned and undisturbed area (Robichaud 2010). Studies indicate that erosion after prescribed fires primarily occurred in areas where the fires were locally severe or where there is extensive disturbance (McNabb and Swanson 1990).

In areas burned at low severity or low intensity, the potential for increasing peak flows and erosion rates is relatively small. However, if the prescribed fire is conducted under dry duff moisture conditions and larger areas are burned at high severity, there is a much greater risk for significantly increasing runoff and erosion rates. The expected natural regrowth on severely burned areas will gradually reduce overland flow rates and sediment yields and generally return to pre-burn levels in approximately 4 years. Water yields may remain elevated for a longer period due to the time required for interception and transpiration rates to return to pre-burn levels (Robichaud 2010). Vegetative recovery after fuel treatments is generally very rapid as displayed in the 2004 fire treatment, with erosion rates typically dropping to pre-fire levels within 1 to 2 years (See Figure 3-1-2).

Depending on certain stream conditions, such as stream bank vegetation and stream sediment loads, shear stress (a factor affecting stream bank stability) at a channel cross section increases with increased discharge. This may increase rates of sediment transport and channel erosion. This would be magnified during major storms adding sediment inputs from hillslopes. Changes in the timing, amount, and duration of runoff change the timing, amount, and duration of in-channel erosion, sediment transport, and aggradation (Reid 2010).

Burning strongly affects soil surface characteristics, ground-cover vegetation, and organic debris on the forest floor, while All-terrain vehicle/Utility-terrain vehicle (ATV/UTV) use mechanically disrupts soils. Depending on the soil type, vegetation type, and burn intensity, burning may induce hydrophobicity in soils (DeBano 2000a, b; Robichaud 2000). Rain falling on hydrophobic soil may run off as overland flow instead of infiltrating, increasing the likelihood of gully erosion, channel incision, channel-bank erosion, and in-channel debris flows. These processes are also accelerated by burning of soil-surface litter and in-channel woody debris, and by removal of ground-cover vegetation. Canfield and others (2005) describe channel incision after a fire, and Istanbulluoglu and others (2003) describe post-fire gullying. In general, the potential for accelerated erosion is expected to increase with burn intensity (Wondzell and King 2003). Hillslopes may be particularly susceptible to other influences, such as sluffing, after burning.

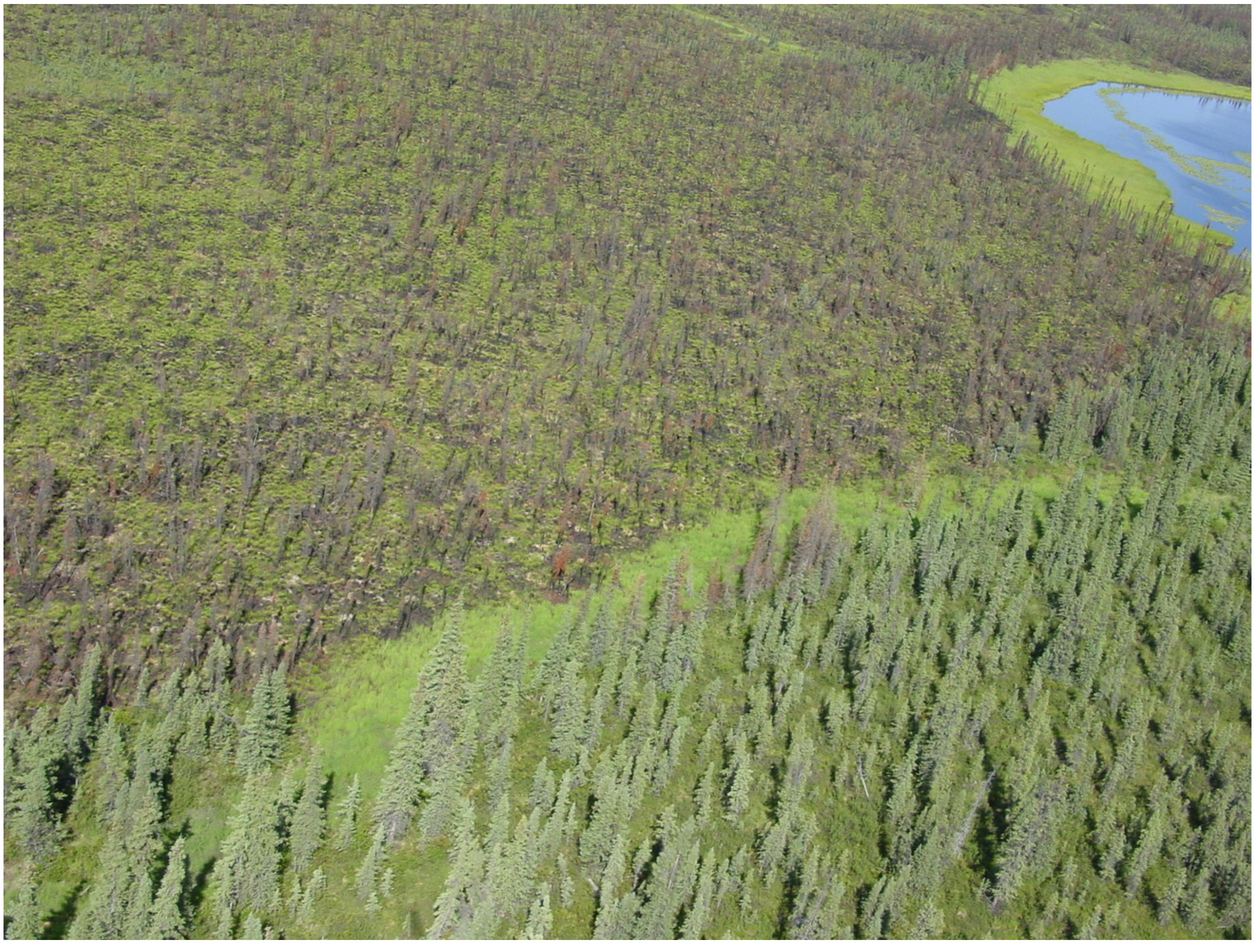

Figure 3.1.2 Revegetation of 2004 Alphabet Hills Prescribed Burn Area

Exposure of small streams to direct solar radiation is the dominant process responsible for stream temperature increases (Tiedemann and others 1978). Other mechanisms affecting stream temperature include increased air temperature, channel widening, soil water temperature increases, and streamflow modification (Ice 1999). Many of the streams in the project area with smaller surface areas will be more susceptible to heating once or if riparian vegetation and adjacent vegetation is burned. Maintaining shade in riparian zones can be used to avoid most temperature increases in small streams. As stream width increases, more of the water surface is exposed to sunlight, consequently reducing the influence of riparian canopy on stream temperature.

Water temperatures will rise faster in smaller and shallower water bodies than in larger and deeper ones. All else equal, the magnitude of any temperature change depends on both the amount of heat directed at the water surface per unit time and the duration of heating. As fire burns in surrounding vegetation and woody debris, it will raise stream temperature (Amaranthus and others 1989).

The Watershed responses to this prescribed fire may include changes in runoff characteristics, sediment yield, and water chemistry. Under the pre-fire conditions, grasses, brush, shrubs, and the forest canopy intercept precipitation and release it as throughfall, supporting infiltration.

Infiltration reduces direct overland flow from precipitation. Runoff is generated where infiltration exceeds the saturation potential of soils. As the erosive potential of overland flow is minimized, nutrients and sediments are retained on site. When the vegetative cover is removed, runoff will become flashier as more streamflow is generated by overland flow, resulting in sharper, higher peak flows. With less infiltration, vegetative uptake and retention of water, total water yields from the burned watershed will be higher. Once runoff begins, loose soils and ash will be quickly removed from steeper slopes. Fire-associated debris will be delivered directly to streams in relatively large quantities. The first storm after burning may produce a ‘rolling black’ that is a storm event high in suspended sediment and ash (Stednick 2010).

Increased sediment and turbidity are the most significant water quality responses associated with fire (Beschta 1990). This proposed burn is designed to modify vegetation types. Erosion rates following the burn will increase from decreased vegetative cover and/or modified soil properties, including decreased infiltration, hydrophobicity and movement of ash or debris and increased rill erosion from hillslopes directly to the stream channel. Soil erosion will cause decreases in soil nutrients, but unless soil erosion rates are excessive, more nutrients are usually “lost” through the consumption of vegetative fuel. Actual soil erosion and nutrient loss will vary by site as a function of vegetation type and recovery, soil type, fire severity, topography, slope position in relation to surface waters, and climate (Stednick 2010).

Dissolved nutrients in streamflow are derived mostly from weathering, decomposition of plant material, and anthropogenic sources (Stednick 2010). Vegetative communities accumulate and cycle large quantities of nutrients (Tiedemann and others 1979). It is anticipated within burned areas that this proposed fire treatment will disrupt this cycle and cause temporary nutrient leaching, volatilization, and transformation.

3.1.4 Direct and Indirect Effect from Alternative 3

Under this alternative action, prescribed fire would be allowed to occur within the Gulkana Wild and Scenic River and other BLM managed lands, however, firing (utilizing plastic sphere dispensers (PSD) or other firing mechanisms) of burn would not be allowed within the WSR corridor. After firing on State land, fire would be allowed to creep into the WSR corridor. In general, the direct and indirect effects from Alternative 3 to the water quality, hydrology, and watershed of the Gulkana WSR would be similar, but likely to a lesser degree, than those of Alternative 2. Since firing would occur outside of the corridor boundary, a wide stream buffer would be provided to the Gulkana which would decrease the likelihood of fire creeping directly on the river’s edge and riparian vegetation. This alternative does not change the possibility of effects similar to alternative 2 but makes the effects less likely to occur.

3.1.5 Cumulative Effects

The Gulkana River watershed drains approximately 2,140 square miles (5,542.6 km^2) of the eastern portion of Southcentral Alaska. The West Fork of the Gulkana drains a large portion of this watershed. Within the WSR boundaries, the West Fork is approximately 52 miles long with the North Branch approximately 15 miles and the South Branch approximately 18 miles in length. In 2004, the BLM and ADF&G were successful with the ignition of prescribed fire with the perimeter of the burn area at about 41,000 acres. Little is known about the effect the burn had on the water quality, hydrology, and the overall watershed of the Gulkana. However, the negative effects were likely short term as the burn area was quickly revegetated. This general area has a very long fire cycle and is difficult to burn, as evidenced by several failed attempts to start prescribed burns in 1982, 1984, and 2003. Natural wildfire is also seldom and when ignited has a short and unimpactful effect.

The driving force behind this project is the improvement of moose habitat, which in theory, will increase the moose density in the area. Over the past 10 years there has been a steady increase in hunting activity in the Alphabet Hills area. The availability of moose and caribou heavily influence this use. Access to the Gulkana West Fork area includes utilizing a boat via Sourdough to the West Fork and North and South Branches. There is also float plane access which reaches a multitude of lakes in the area. The most concerning access, when it comes to protection of the WSR and aquatic resources, is ATV/UTV access. It is reasonable to forecast that if this prescribed burn is successful and moose populations increase in the area, then increased and uncontrolled ATV/UTV use may occur within the WSR corridor. The presence of ATV/UTV trails may influence hillslope hydrology by rerouting shallow subsurface flows and by diverting trail drainage. It is also reasonable to predict uncontrolled and unpermitted stream crossings such as shown in Figure 3.1.3 near the North Branch. Depending on degree of trail proliferation and the amount of stream crossing within the WSR corridor, this could negatively affect overall erosion, sedimentation, and water quality of the Gulkana.

One of the Outstandingly Remarkable Values (ORV) of the Gulkana River, as defined in the Gulkana River Management Plan Revision (2006) is water quality. The ORV is "*The Gulkana is the largest clearwater river in the region, with water quality and water clarity normally excellent.*" It is reasonable to think that there will be short term water quality degradation as resulting from the burn. It is also reasonable to predict that if prescribed fire increases moose density in the area and uncontrolled UTV/ATV proliferation continues to expand, then the water quality ORV associated with the Gulkana WSR would be degraded continually and long into the future.

Figure 3.1.3 ATV crossing on unnamed creek near the North Branch within the Gulkana WSR.

3.1.6 Recommended Mitigation
Plan streamside management zones or buffers along stream channels to provide shade for stream temperatures and provide filter strips for sediment and nutrients.

3.2 Vegetation
Issue 2: Vegetation and Invasive Weeds

3.2.1 Affected Environment
This project in the Copper River Basin lies within the former bed of Glacier Lake Ahtna on fine-textured lacustrine deposits ringed by coarse glacial tills. The Copper River Basin is a large wetland complex underlain by thin to moderately thick permafrost and postmarked with lakes and ponds. A mix of low shrubs and black and white spruce forests grows on the wet organic soils. In addition, large glacial rivers with wide, gravelly, braided floodplains dissect the basin and support large cottonwood, willow, and alder stands and expansive barren areas. (USGS Unified Ecoregions of Alaska: 2001)

The Project Area for the entire Alphabet Hills Prescribed Burn Plan encompasses approximately 463,000 acres, it defines the outermost boundary within which the prescribed fires may be allowed to spread naturally as determined by local weather, topography, hydrology and fuel types. Pre-fire monitoring plots were conducted in July 2019 by ADF&G and BLM. Classification was derived from Viereck's Alaska Vegetation Classification and the Alaska Center for Conservation Science's Alaska Vegetation and Wetland Composite Map.

Vegetation in the proposed prescribed fire units is predominantly contiguous black spruce (*Picea mariana*) with areas of mixed black and white spruce (*Picea glauca*) in varying degrees of canopy cover including woodland, open and closed forests. Some areas have considerable white spruce mixed in the forest composition. Stand ages appear to be uniform and there is little disturbance evidence outside of the river corridor. Few hardwood trees exist within the burn units, however dense patches of dwarf birch (*Betula nana*) and several species of willow (*Salix spp.*) are common across both forest and shrub types. Some common willow species include Diamond-leaf willow (*S. pulchra*), Gray-leaf willow (*S. glauca*), Richardson's willow (*S. richardsonii*) and feltleaf willow (*S. alaxensis*). Scattered amidst the black spruce cover type are numerous wet sedge and grass meadows along with a network of small streams including tributaries to the Gulkana River forks. Tree line occurs at about 3,000 feet. Expansive areas where tall and low shrubs are the dominate cover include such species as alder (*Alnus crispa*), resin birch (*Betula glandulosa*), and willow (*Salix spp*.) and often occur in the transition zone from forest to alpine tundra.

Additional shrubs that are prevalent in the area include blueberry (*Vaccinium uliginosum*), crowberry (*Empetrum nigrum*), cloudberry (*Rubus chamaemorus*), highbush cranberry (*Viburnum edule*), lowbush cranberry (*V. vitis-idaea*), bearberry (*Arctostaphylos rubra*), Labrador tea (*Ledum groenlandicum*), and prickly rose (*Rosa acicularis*). Ground cover species most common are feather and sphagnum moss. Lichens and horsetail (*Equisetum spp*.) are not as common, but present in some areas as ground cover.

Vegetation varies greatly with elevation and aspect. Generally, soils on north-facing slopes are cooler, more poorly drained and often underlain by permafrost.

For this project, prescribed fire objectives and successive fire effects monitoring will target two monitoring types that were delineated using landcover and vegetation classes defined by the Alaska Center for Conservation Science's (ACCS) Alaska Vegetation and Wetland Composite (AKVWC) map (Boggs et al. 2016). The Copper River Basin is a large wetland complex underlain by thin to moderately thick permafrost and postmarked with lakes and ponds. A mix of low shrubs and black and white spruce forests grows on the wet organic soils. In addition, large glacial rivers with wide, gravelly, braided floodplains dissect the basin and support large cottonwood, willow, and alder stands and expansive barren areas. (USGS Unified Ecoregions of Alaska: 2001) These two monitoring type classifications combined represent 52,409 acres of the total 53,724 acres encompassed in the prescribed fire units. Acres of each monitoring type per unit are displayed in Figure 3.2.1.

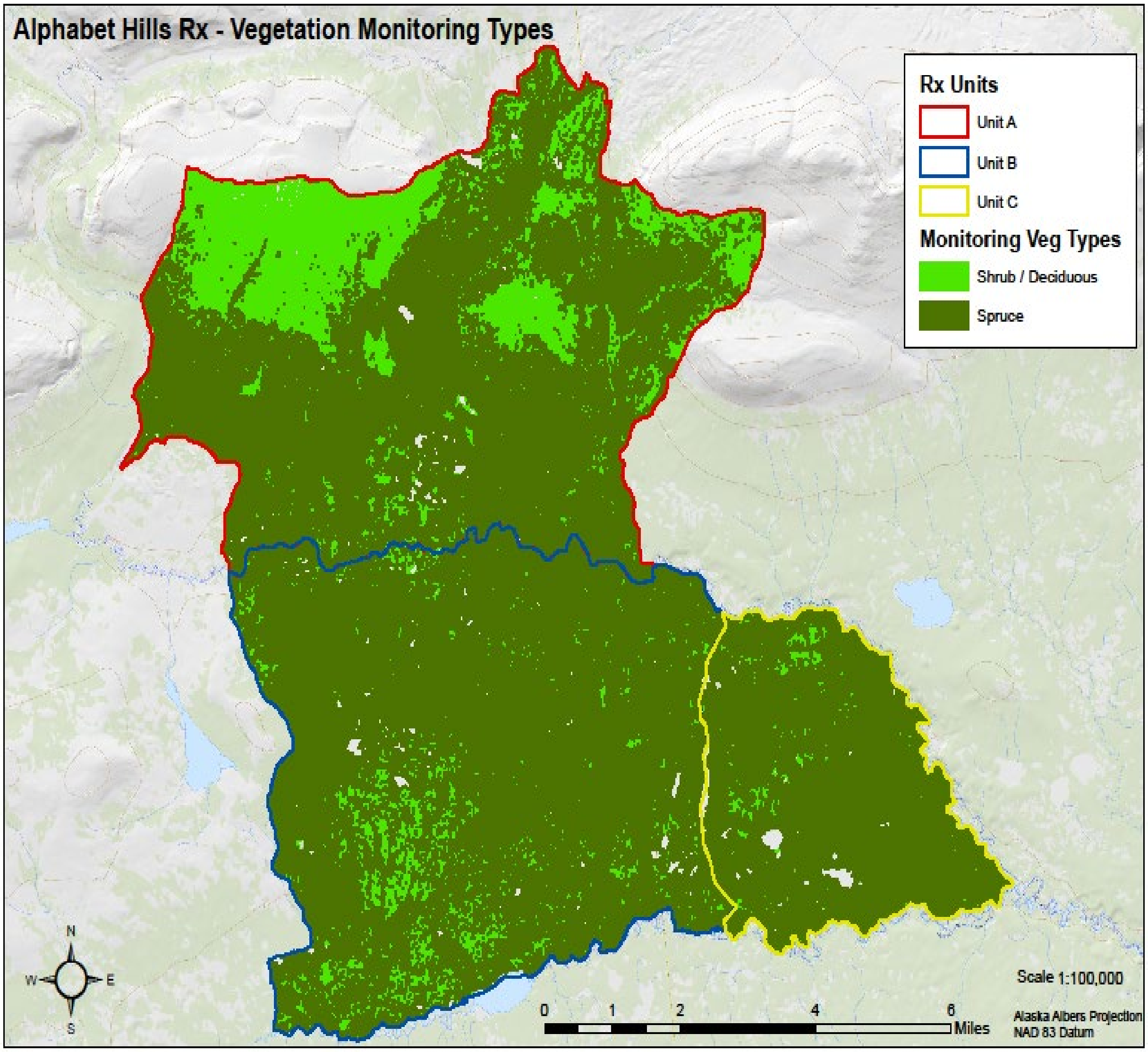

Figure 3.2.1 Alphabet Hills Prescribed Burn Units

Coarse Land Cover	Acres	Percent (All Rx Units)	CFFDRS Fuel Model
White Spruce or Black Spruce (Open-Closed)	18,729	35%	C-2 Boreal Spruce
White Spruce or Black Spruce (Woodland)	14,688	27%	C-1 Spruce Lichen Woodland
Low Shrub	9,180	17%	D-2
Tall Shrub (Open-Closed)	3,447	6%	D-2
White Spruce or Black Spruce/Lichen (Woodland-Open)	2,038	4%	C-1 Spruce Lichen Woodland
White Spruce or Black Spruce-Deciduous (Open-Closed)	1,779	3%	M-2 Boreal Mixedwood Green
Low Shrub/Lichen	1,116	2%	O-1a/b Matted/Standing Grass
Freshwater or Saltwater	816	2%	N/A, non-burnable
Dwarf Shrub	742	1%	O-1a/b
Deciduous Forest (Open-Closed)	443	1%	D-2
Herbaceous (Mesic) (Interior Alaska, Cook Inlet Basin)	205	<1%	O-1a/b
Tussock Tundra (Low shrub or Herbaceous)	217	<1%	O-1a/b
Herbaceous (Wet) (Interior Alaska, Cook Inlet Basin)	186	<1%	O-1a/b
Bareground	73	<1%	N/A, non-burnable
Dwarf Shrub-Lichen	28	<1%	O-1a/b
Herbaceous (Aquatic)	34	<1%	N/A, non-burnable

Table 3.2.1 Course Land Cover

3.2.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Left undisturbed (No Action Alternative), prescribed fire would not be utilized in the Gulkana Wild and Scenic River corridor. The forest ecosystem would remain late-successional stage which would prohibit habitat availability as a result of poor forage quantity and quality. While natural wildland fires due to lightning or other natural phenomena may occur in the project area in the future, past fire behavior in the area indicates wildland fire are cyclic, localized, and mosaic-patterned burns and would have minimal effect.

3.2.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under the Proposed Action 2, prescribed fire would be allowed to occur within the Gulkana Wild and Scenic River corridor. Direct and desired result is to achieve variable burn severities across units accommodated by a range of burning conditions (fire intensity) that creates opportunities for both seeding and vegetative reproduction by sprouting. This result is expected to occur under most mid-summer burning conditions due to localized differences in weather, topographic influence, hydrology, and fuel types. This type of prescription mimics natural fire on the landscape. A low to moderate severity fire with minimal consumption of duff and organic matter will likely only top-kill deciduous shrubs and trees, of which most are attractive forage species for moose in this area. These species can quickly put-up new growth by root crown or basal sprouting with greater success for regeneration than seed establishment. A high severity fire will consume a greater portion of the duff leaving exposed mineral soil. Indirectly this may kill most of the plants capable of root crown or basal sprouting under less severe burn conditions, this loss can be offset by the establishment of a wide variety of new plants from seeds. Post-burn regeneration is often limited to the deciduous shrub and tree species capable of sprouting that were present before the burn, and their pre-burn distribution governs subsequent abundance. While vegetative recovery is generally slower from seeding than from sprouting, reproduction resulting from a more severe burn is likely to produce a vegetative type change. This can be an added benefit for increasing wildlife diversity consistent with the new plant cover. Balancing a mix of fire severities across the units will support plant and wildlife species diversity with longevity of the project's effectiveness in providing available moose forage.

3.2.4 Direct and Indirect Effect from Alternative 3

The effects to vegetation and invasive weed infestation under Alternative 3 are the same as the alternative 2 proposed action.

3.2.5 Cumulative Effects

Alaska and the Copper River Basin transportation corridors are seeing an increase in the occurrence of non-native invasive species, new areas becoming more infested with non-native invasive species, and an increase in the number of non-native invasive species. Gravel pits in this region are frequently used by the public for rest areas, parking, and camping and recreation access. These activities all contribute to the region risk of increased non-native invasive species incidence however the project area lies outside of any infestation's and burning operations pose no threat to introducing species into the Wild and Scenic river Corridor.

3.2.6 Recommended Mitigation

Best Management Practices (CES 2014) would be recommended for mitigation measures if changes in operations were to occur, such as helicopter landing pads, so that non-native invasive species occurrence and spread can be minimized and even prevented. Specifically: cleaning equipment before it enters the project area and landing in non-infested Heli spots; avoiding areas with known infestations; cleaning equipment prior arriving in the Copper River Basin.

Best Management Practices described in PMC-00342 (CES 2014) are recommended for implementation at all actively operated and inactive gravel pits to prevent the introduction and spread of non-native invasive species into the otherwise weed-free environment of the Copper River Basin.

3.3 Travel Management

Issue 3: How would the Proposed Action affect trail proliferation and OHV use on BLM managed lands within the project area?

3.3.1 Affected Environment

The Proposed Action is comprised of three burn units totaling 53,590 surface acres of land. Approximately 10,900 surface acres of land within the project area is BLM managed with the remaining balance under ownership and management of the State of Alaska. The most recent trail inventory for the area was completed in 2008. At that time one trail was recorded within the proposed burn area. This trail is known as the West Fork Trail. This route was historically used as a winter access trail to the Valdez Creek Mining District as well as a training area for Cold War era military exercises.

3.95 miles of the West Fork Trail cross through BLM managed lands within the project area. An additional 2.5 miles of the West Fork Trail cross through lands managed by the State of Alaska. In total approximately 5.45 miles of inventoried trail could be affected by the Proposed Action. The current ground acreage disturbance of this trail is estimated at 5.2 acres assuming a trail width average of 8 feet spread over 28,776 linear feet of trail.

Recent overflight operations by BLM staff indicate a newly developed spiderweb of trails within the project area. Few, if any of these trails have been formally inventoried and therefore not captured with GPS or GIS technologies. Without a formal inventory it is impossible to know the miles of new trail within the project area (post 2008) or acres of ground disturbed. It should also be noted that State of Alaska asserted Revised Statute 2477's (RS 2477's) are found within the project area. RS 2477 was a congressional grant of rights of way which provided: "The right of way for the construction of highways over public lands, not reserved for public uses, is hereby granted." The RS 2477 was repealed in 1976 by FLPMA. While not recognized by the BLM until adjudicated individually in a court of law the State of Alaska recognizes the Gulkana-Denali winter trail and the Gulkana-Valdez Creek summer trail on both the north and south banks of the West Fork Gulkana River.

3.3.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny the Alaska Department of Fish and Game's request for prescribed fire on BLM managed lands. Prescribed fire operations would however still be possible on State of Alaska lands. If the burn was to occur and moose or caribou populations were to increase it can be expected that a rise in use of hunters utilizing OHV's to access the area could occur. This rise in use could affect BLM lands through trail proliferation and establishment of camps on BLM managed land, however total effects would be less than found in the Proposed Action Alternative.

3.3.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under the Proposed Action, prescribed fire would be allowed to occur within the Gulkana Wild and Scenic River corridor and other BLM managed lands. The current ground acreage disturbance from inventoried trails on BLM lands is 5.2 acres associated with the West Fork Trail. While providing a number of expected ground acreage disturbance from possible trail proliferation due to an increase of OHV hunters is impossible to predict, an increase can be expected. The burning of trees and vegetation in the area will make portions of the project area more suitable to cross country travel. This in combination with possible increases in caribou and moose populations will lead to increased trail proliferation.

3.3.4 Direct and Indirect Effect from Alternative 3

The effects to trail proliferation under Alternative 3 are the same as the No Action Alternative.

3.3.5 Cumulative Effects

The ownership and use of OHV's have expanded dramatically in the past twenty years. While the State of Alaska does not require registration of ATV's some owners do choose to register them as a State of Alaska registered vehicle under a snowmobile registration. In 2001 33,376 registrations existed for snowmobiles and OHV's compared to 44,734 registrations in 2018 (State of Alaska DMV). This represents an increase of 34% in snowmobile and OHV registrations within the State of Alaska from 2001 through 2018. Evidence of increased OHV use is also present from observance and recording of new OHV trails, continued expansion of existing OHV trails, and increased users at BLM managed trailheads providing OHV riding opportunities.

These facts combined with the effects of probable increased use found under all three alternatives will lead to an increase of OHV's on the landscape. A highly accurate number of increased OHV's and associated trail proliferation is hard to provide given many variables and uncertainties such as game populations, participation in hunting, and increased technology.

OHV users accessing the project area will also transit through the Tangle Lakes Archaeological District. This Connected Action associated with probable increased use will also lead to some trail disturbance and/or proliferation associated with access routes to the Alphabet Hills and project area.

3.3.6 Recommended Mitigation

Continued public education regarding the detrimental effects of irresponsible OHV use can mitigate a substantial number of these effects. Providing learning opportunities in the field, on BLM websites and social media, and through traditional publications will also serve to reduce these effects. Additionally, it would be helpful if the State of Alaska created or displayed similar information regarding the project for lands which they manage.

3.3.7 Residual Impacts

Ultimately the amount of trail proliferation is dependent upon how OHV users operate their machines in the field and the amount of unregulated cross country travel they choose to participate in. If any of the Alternatives are approved, other than the No Action, and populations of moose and caribou are increased it is reasonable to expect that ADF&G will issue more hunting permits. An increase in permits will put more OHV's in the field and ultimately lead to an increase in trail proliferation.

3.4 Subsistence

Issue 4: Federal subsistence hunting

3.4.1 Affected Environment

The proposed actions take place both on lands transferred to the State of Alaska from the BLM in 2010, and Federal Public Lands as defined in the ANILCA sec. 102(3), which fall under the regulatory authority of the Federal Subsistence Board and Subsistence Management Regulations.

The three prescribed fire units are within Alphabet Hills, an area commonly used for hunting, trapping, fishing, and other outdoor recreation. The Gulkana WSR corridor runs through the proposed burn units. The three burn units total approximately 53,590 acres and are located adjacent to the almost 38,000 acres burned in 2004. The entire Alphabet Hills Prescribed Burn Plan encompasses a much larger area of approximately 463,000 acres, which defines the boundaries that the fire may be allowed to naturally spread before being suppressed to protect private property. The project area has limited access; entry is generally via ATV or light aircraft flown to unimproved landing sites or lakes.

Wildlife habitats in the area are characterized by coniferous boreal forest, wet sedge and grass meadows, and river corridor. The vegetative community is dominated by species such as black spruce (*Picea mariana*) and white spruce (*Picea glauca*) with an understory of birch, willow, berry, grasses, some lichens, mosses, and sedges. The myriad of small stream systems running throughout the project area support wetter, riparian vegetative communities and associated wildlife. This complex ecosystem supports high biodiversity and provides suitable habitat for wildlife throughout the year. The ADF&G permits hunting opportunities in the Game Management Units (GMU) 13A and 13B, which overlap the project area. The species of interest to this project are moose (*Alces* alces), caribou (*Rangifer tarandus granti*), black bear (*Ursus americanus*), and brown bear (*Ursus arctos*). The big game species in the area most sought by subsistence users are moose and caribou. These animals are important game species for the residents of nearby communities as well as non-local Alaska residents who come to the Alphabet Hills to hunt.

The central purpose of this project is to increase forage opportunities for moose. The ecosystem within and surrounding the project area provides habitat for moose throughout the year. During the late spring and summer months, moose browse in upland shrubland and forested areas around lakes, rivers, and wetlands. Moose are powerful swimmers that can forage while completely submerged and utilize the water and thermal cover offered by nearby forests to stay cool during the warm months. They favor forbs, higher grasses, and the leaves of willow, birch, and aspen that are available during this time of year. ADF&G moose trend data for GMU 13A/B shows that in recent years moose numbers have been declining for GMU13B; numbers are below population objectives (See Table 3.4.1). This may be due to a combination of a lack of forage opportunities, high subsistence harvest, and predation in the area (Heidi Hatcher, ADF&G, personal communication).

Year	Population Index GMU13A	Population Index GMU13B	Minimum Count ABC Burn
2010	4081	5460	186
2011	4401	5447	109
2012	4159	5407	136
2013	4608	4955	122
2014	4206	4855	-
2015	4653	5115	135
2016	4156	4973	-
2017	3445	4237	240
2018	4121	3643	166
2019	-	3845	245
Population Objective	3500-4200	5300-6300	

Table 3.4.1 ADF&G Moose count data for GMU 13A/B, burn area, and population objectives.

During the winter, resources are scarcer, and moose are therefore more vulnerable to perturbation. Food is considerably harder to find, but twigs from willow bushes and other deciduous shrubs, conifers, and broad-leaved trees offer some nutrients. Coniferous forests can provide some cover from snow and allow moose to scrape the snow with their hooves to browse on mosses and lichen. Disturbance during the winter can displace moose to poorer quality habitats where fitness is reduced by factors such as decreased nutrient intake, higher stress, and greater energy expenditure (Harris et al. 2014). These factors increase the likelihood of mortality due to starvation, predation, and disease (Van Ballenberghe and Ballard 1994). The project area lies within approximately 4,186 square miles of connected moose winter habitat.

Historical fire occurrence and low fire frequency in recent years has resulted in larger regions of late successional forests that provide limited forage opportunities for moose. Early seral stages of this plant community offer more abundant and nutritious browse opportunities for moose, particularly due to increased density of willow, birch, aspen, and other shrubs. Fire can be used as an effective management tool to return plant communities to early seral stages, recycle nutrients, and encourage the regrowth of early successional species (Weber and Taylor 1992). Utilization of post-fire habitat by moose can begin as soon as the first winter after the fire, and continue to provide improved forage conditions for decades (MacCracken and Viereck 1990, Brown et al. 2015). Fire is therefore a very important management tool for increasing the capacity of landscapes to support more moose and increase harvest opportunities for subsistence hunters in the area.

Caribou from GMU13's Nelchina Caribou Herd (NCH) are common throughout the proposed burn area and are the most abundant large mammal in the interior region of southcentral Alaska. Caribou live together in large herds and migrate long distances between winter and summer habitat. The proposed project area provides winter habitat and is also considered general distribution habitat. While caribou often prefer tundra and mountainous terrain during the warmer months, the NCH may utilize boreal forest outside of the winter months during spring and fall migrations, and a large proportion of subsistence harvest occurs during this period. Caribou generally begin to shift their food habits in September, moving from a diet of leaves, flowering plants, and fungi to lichens, dried sedges, and shrubs.

NCH population numbers are quite variable from year to year due to hunting pressure, changes in habitat quality and weather patterns, ecosystem carrying capacity, and predation. These factors also influence habitat selection. ADF&G fall population estimates for 2019 estimated 46,528 individuals, which is above the population objective. Fire is another strong influence, as it dramatically alters habitat in the short term and can have lasting effects on ecosystem community structure. Fire's impacts to caribou specifically are a matter of some discussion. The increase in vascular forage post-fire could provide increased spring forage, but the loss of forage lichens has been shown to have lasting effects on caribou winter habitat selection (Joly et al. 2003, Gustine et al. 2014). The energetic costs of predator avoidance and migration make lichen very important to wintering caribou ecology (Joly et al. 2010), and fire can effectively remove lichen communities from a burned area for decades (Joly et al. 2007). Some caribou herds with large home ranges have been found to be resilient to the effects of fire (Dalerum et al. 2007); however, the amount of studies that have documented caribou selecting against burned areas indicates that this trend should not be applied as a general rule.

Year	Fall Population Estimate
2010	48653
2011	41394
2012	50646
2013	32588
2014	-
2015	46816
2016	46673
2017	41411
2018	33229
2019	46528
Population Objective	35000-40000

Table 3.4.2 Caribou fall population estimates and objectives (ADF&G).

Black and brown bears are both subsistence game species with very similar seasonal habitat requirements (Young and Beecham 1986). Bears are omnivorous and are effective predators and foragers. They prey on ungulate calves, small mammals, insects, and fish, and eat a variety of plants including berries, nuts, grasses, roots, and forbs. In the spring and summer habitat use can be influenced by plant phenology, with bears selecting low to mid elevation forests, wetlands, and other herbaceous habitats for plants in early development stages when they are particularly nutritious (Servheen 1983, Hamer and Herrero 1987). Bears follow the spatial and temporal distribution of food resources, and move to fishing salmon on large rivers and foraging in riparian forests in the fall (Munro et al. 2006). Both species retreat to hibernation dens in the winter.

3.4.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative, no burning, vegetation removal, or any ancillary actions associated with the project would be authorized. As a result, federally qualified subsistence users would encounter a more customary subsistence hunting experience on Federal land in the vicinity of the project area. There would be no disturbance or displacement of subsistence game animals such as moose, caribou, black bear, and brown bear due to project activities. Accessibility and sightability of animals would remain entirely unchanged by the project.

3.4.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under this alternative, fire would be allowed to occur within the Gulkana WSR, including firing, and would occur within the burn units and potentially the rest of the project area. During active project operations, animals would avoid the immediate and adjacent lands due to disturbance from fire, smoke, and other human activity. If burning takes place during an open hunting season, this disturbance would temporarily reduce opportunities to harvest game animals in that area. The nature of the project indicates that only small sections of the entire project area will be disturbed at one time and burns are likely to occur in a mosaic pattern. Therefore, impacts to subsistence hunting opportunities would be brief, with displaced wildlife returning to their habitats once project activity has moved on.

The project was designed to improve forage quality and habitat for moose. Moose numbers in the area have been declining and are notably below ADF&G population objectives for GMU13B, as of 2019 (Table 3.4.1). If the entirety of the burn units is consumed, 2.6% of moose winter range habitat in GMU13A/B will be affected (8% of BLM land) and should begin to provide increased forage opportunities within the year (See Table 3.4.3). If the entire project area burned, which is very unlikely, 21% of moose winter range in GMU13A/B will be impacted (27% of BLM land). While this is a relatively large percentage of direct disturbance, the temporary nature of the disruption and the habitat benefits conferred by the burn treatment will have a net positive effect on moose populations in the GMU and create increased harvest opportunities for subsistence users in the area.

The areas potentially affected by burn activities are very similar for moose calving habitat (+/- 2%) and therefore only present a notable impact if the burn extends to the entire project area boundary. Like winter range, increased nutritional yield in these areas would likely result in a net benefit to moose calving and rearing efforts. If predation pressures are high, reduced cover may increase calf mortality (Boertje et al. 2009), but the abundance of adjacent, high quality habitat would allow moose to select for calving habitat with greater cover.

If burning occurs during caribou migration through the area it has the potential to be notably disruptive to the NCH. Caribou fall migration generally begins in September, which overlaps the burn window. Implementing the mitigation measure to delay burn operations during periods of heavy caribou presence within or immediately adjacent to the project area will reduce impacts to Federal subsistence users pursuing game in the area during the hunting season. Caribou may be averse to utilizing the burned areas for some time, but the abundance of adjacent, high quality habitat would minimize impacts to the NCH. The burn units comprise only 1.7% of caribou winter range habitat in GMU13 A/B; if the entire project area burned, 13% of winter range and 5.3% of summer range in GMU A/B would be affected (Table 3.4.3). These impacts are unlikely to occur, and the breadth of the NCH's migration range would allow the herd to easily avoid the burned area without expending a notable amount of extra energy. Table 3.4.2 shows ADF&G population estimates for the NCH since 2010; current population numbers exceed population objectives, indicating that even if project actions caused some notable disturbance to caribou, population health would likely remain at target levels.

The entirety of the project area is within habitat appropriate for grizzly bears and black bears (Table 3.4.3). If the entire project area burned, it would affect 9.4% of bear habitat in the GMU. While the burn may temporarily disturb bears, the abundance of adjacent, high quality habitat ensures that impacts to bear populations will be minimal. Additionally, the burn will take place outside of the winter months, so there is no danger of burning over hibernating bears.

Direct disturbance from fire and smoke may temporarily disturb and displace game animals from the burn areas and could also disrupt subsistence hunting activities in the area. The burns are scheduled to occur anytime from July 15 through September 30, which could overlap with the subsistence hunting seasons. Hunters would be unable to access the project area during burn operations and would likely be deterred from entering adjacent areas due to smoke. However, these disturbances are short term in nature; burn duration is not expected to exceed 30 days, with wildlife again utilizing those habitats after burn activity has terminated.

It is important to note that the redistribution or funneling of game animals to the burn perimeter areas may create additional harvest opportunities for Federal subsistence users as animals move to avoid the fire and smoke.

The removal of vegetation resulting from the burn would increase sightability of game animals in burned areas. This increased sightability may provide indirect benefits to Federal subsistence users hunting moose, caribou, bears, or small mammals in that area. The broader openings within the forested habitat may increase the users' opportunity to view these animals passing through. Eventually, vegetative recruitment and succession will naturally restore browse and herbaceous vegetation.

Although activities associated with the proposed action may cause a temporary avoidance of the proposed action area and adjacent landscape by wildlife, it would not significantly reduce harvestable wildlife resources that are available for Federal subsistence use in the area.

Habitat Type	Acres in GMU 13A and B on all lands	Acres on BLM lands within 13A and B (BLM land total =1027605)	% habitat on BLM lands in 13A and 13B	BLM Acres affected in Units A, B, & C of Proposed Action	% of BLM Acres affected from the proposal within GMU 13A/13B	% of habitat affected in GMU13A and B on all lands if only Units A, B, and C burn	Potential % habitat affected in GMU13A and B if burns to outer perimeter
Moose Winter range	1,989,728	289,817	15%	23,335	8%	2.6%	21% (all lands), 27% (BLM lands)
Moose Calving	1,374,860	270,646	20%	23,335	8.6%	3.9%	24% (all lands), 25% (BLM lands)
Caribou Calving	525,781	443	.08%	0	0	0	0 – none in unit – nonissue
Caribou Summer	1,044,182	28,905	2.8%	0	0	0	5.3% (all lands), 38% (BLM lands)
Caribou Winter	3,186,845	719,661	22.6%	23,373	3.3%	1.7%	13% (all lands), 9.5% (BLM lands)
Grizzly Bear Habitat	4,932,076	1,020,546	20.7%	23,335	2.3%	1.1%	9.4% (all lands) - Entire area considered grizzly habitat

Table 3.4.3. Game species habitat affected by burn activities.

3.4.4 Direct and Indirect Effect from Alternative 3

Under this alternative, prescribed fire would be allowed to occur within the Gulkana WSR, the burn units, and the larger project area; however, firing of the burn would not be permitted within the WSR. After firing elsewhere, fire would be allowed to burn into the WSR corridor. The direct and indirect effects from Alternative 3 to game wildlife and subsistence resources would be very similar, with the WSR less likely to burn. This will likely preserve more riparian vegetation, which would not introduce any additional impacts to subsistence users or game wildlife, except that moose will continue to forage on the existing riparian vegetation and there will be no temporary sightability benefits in this area. It is possible that the effect of this alternative will be identical to Alternative 2.

3.4.5 Cumulative Effects

Alphabet Hills is commonly used for recreational and subsistence activities such as hunting, trapping, and fishing. Its limited access makes it difficult for activities involving construction or other common forms of human disturbance to take place. This project may make burned areas more navigable to humans, potentially expanding existing ORV trails, even though access to the area will not be altered. If an increased use of the area is realized it would be expected to be mostly subsistence users.

In 2004, 38,000 acres were burned adjacent to the proposed burn to restore habitat to an earlier seral stage. This treatment area has been undergoing natural succession for 16 years and will therefore present very different habitat to the proposed burn area after operations conclude. The adjacent 2004 burned area will help provide a mosaic of successional habitat for wildlife, and not appreciatively contribute to negative impacts from proposed project actions. Direct impacts to subsistence resources would be temporary and would not add to impacts from other land use actions in the area. Indirect impacts, such as temporary wildlife displacement, would not result in notable reductions of subsistence resources or wildlife populations in the long term. There may be some long-term avoidance of the burn, particularly by caribou, but cumulative impacts to wildlife population health, and subsistence use, will be minimal due to the abundance of high-quality habitat surrounding the project area, and the benefits to wildlife habitat conferred by the proposed project actions

3.4.6 Recommended Mitigation

In an effort to avoid conflict and inform Federal subsistence users of potential encounters with burn operations, smoke, or any associated ancillary activities, advanced notice of the project actions should be provided to the public through media, radio, newspaper, or signage.
In addition, the following recommended stipulations and mitigation measures should be included in the project design to minimize impacts to subsistence use wildlife and prevent additional habitat degradation or long-term disturbance:

- All waste generated during operation, maintenance, and termination activities under this authorization shall be removed or otherwise disposed of as required by state and federal law. Waste in this case refers to all discarded matter, including but not limited to human waste, trash or garbage, refuse, oil drums, petroleum products, ashes, and discarded equipment.
- Areas of operation shall be left clean of all unauthorized foreign objects.

- All fuel or lubricant spills will be cleaned up immediately, taking precedence over all other matters, except the health and safety of personnel. Spills will be cleaned up using absorbent pads or other Alaska State DEC approved methods.
- All operations will be conducted in such a manner as to minimize damage or disturbance to any fish or wildlife, and to not impede rural residents from pursuing their traditional subsistence activities.
- Flying will be conducted between 2 hours after sunrise and 2 hours before sunset, between September 1 and September 20, to not interfere with hunting season.
- Subsistence hunting season for caribou on Federal public lands runs from August 1 to September 30 and October 21 to March 31. Many subsistence hunters rely on the caribou migration and caribou may migrate through this area during these times. The permitee is to maintain vigilance for the presence of caribou during the subsistence hunting seasons listed in this paragraph. If groups of 30 or more caribou enter the burn area or within a radius of 330 feet of firing operations during the subsistence hunting seasons listed in this paragraph, firing is to be stopped until the caribou have passed through the burn units.

3.5 Fisheries and Aquatic Habitat

Issue 4: How will the proposed action impact fisheries and aquatic habitat of the watershed?

3.5.1 Affected Environment

The riparian vegetation in the Gulkana watershed is composed of a popular, willow, alder, and spruce. Vegetated riparian areas perform many beneficial functions for aquatic resources and comprise some of the most important and productive habitat on BLM-managed lands. These riparian functions may be grouped into four broad categories of habitat, water quantity, water quality, and food supply.

The complexity, hydraulic resistance, and stability provided by riparian vegetation to streams affects the size, shape, and distribution of the stream channel and habitat features such as pools, riffles, and undercut banks. The riparian vegetation also helps to maintain the hydrologic connectivity between mainstem stream channels, side channels, tributaries, backwater sloughs, and hyporheic (groundwater) zones. Water quality functions performed by riparian vegetation includes fine sediment deposition and filtering of containments, thereby reducing erosion and turbidity while maintaining high water quality required by many aquatic organisms. Riparian habitats also provide leaf litter and detritus to rivers and streams supporting the primary production that is the basis of the aquatic food supply. An example of a riparian food supply is the detritus (decomposed vegetative matter) from decaying leaves, twigs, etc. which fall into the stream and provide a key energy source fueling the base of the aquatic food chain.

Riparian vegetation condition directly influences the condition, quality, and maintenance of aquatic habitat. Riparian plants filter sediments and nutrients, provide shade, stabilize streambanks, provide cover in the form of large and small woody debris, produce leaf litter energy inputs, and promote infiltration and recharge of the alluvial aquifer (Orth and White 1993). As a result of these functions, spawning beds for fish and microhabitats for macroinvertebrates remain relatively free of damaging fine sediment deposits. Riparian vegetation reduces sedimentation of pools, thereby maintaining water depths and structural diversity of the channel. Base flow levels are augmented throughout the year by the slow release of water stored in aquifers. Complex off-channel habitats, such as backwaters, eddies, and side channels, are often formed by the interaction of streamflow and riparian features such as living vegetation and large woody debris. These areas of slower water provide critical refuge during floods for a variety of aquatic species and serve as rearing areas for juvenile fish.

The bank stabilizing function of riparian vegetation not only helps reduce erosion and influence channel morphology but also acts to supplement instream cover by the developing of undercut streambanks and by providing overhanging vegetation. Well-vegetated stream channels and stable streambanks help reduce turbidity and channel scouring resulting from high runoff rates and, in turn, can enhance primary production.

The Alaska National Interest Conservation Act of 1980, (ANILCA, P.L. 96-487) established the upper portion of the Gulkana River, including the Middle Fork and West Fork, as a component of the National Wild and Scenic Rivers System to be administered by the Secretary of the Interior through the Bureau of Land Management. The Gulkana River is the largest clear water river in the Copper River Watershed. This river's fisheries were recognized as Outstandingly Remarkable Values in the Gulkana National Wild Management Plan (BLM 2006). The Gulkana River is a major tributary to Copper River, which supports one of the largest Chinook and sockeye salmon subsistence fisheries in Alaska. The West Fork is a major tributary of the Gulkana River.

The West Fork of Gulkana River provides important habitat for eleven (Albin 1977, Table 3.5.1) different fish species in the watershed. Anadromous fish means a fish that hatches in freshwater, then migrating to the ocean for a period of growth, and then returning to freshwater to spawn. Most anadromous fish species in the West Fork of the Gulkana River die after spawning, except the steelhead. The non-anadromous fish species are termed resident (Table 3.5.1) fish species, spending their entire lives in freshwater, but not without significant watershed migrations for some species. Chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), rainbow trout and steelhead (*O. mykiss*), and Pacific lamprey (*Entosphenus tridentatus*) are among the fish species that utilize reaches of the West Fork of the Gulkana River for all, or a portion of, their spawning, incubation, rearing, and passage life phases and are important anadromous fish species that have been specified as important to anadromous fish under Alaska state statute AS 16.05.871(a), all streams, rivers, and lakes specified in the Alaska Department of Fish and Game's Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes. Catalog is a numerically ordered list (Table 3.5.1) of the water bodies with documented use by anadromous fish for these purposes.

There are high fisheries values throughout the West Fork of Gulkana River watershed. The majority of West Fork watershed is being considered when describing the environment and evaluating possible prescribed fire effects. The West Fork was broken up into five reaches to assist in clarifying and accurately reflect important habitat reach utilization of several fish species, see Figure 3.5.1 for the reach breakdown. The five reaches are: West Fork Reach 1, West Fork Reach 2, South Branch Reach 1, North Branch Reach 1, and North Branch Reach 2.

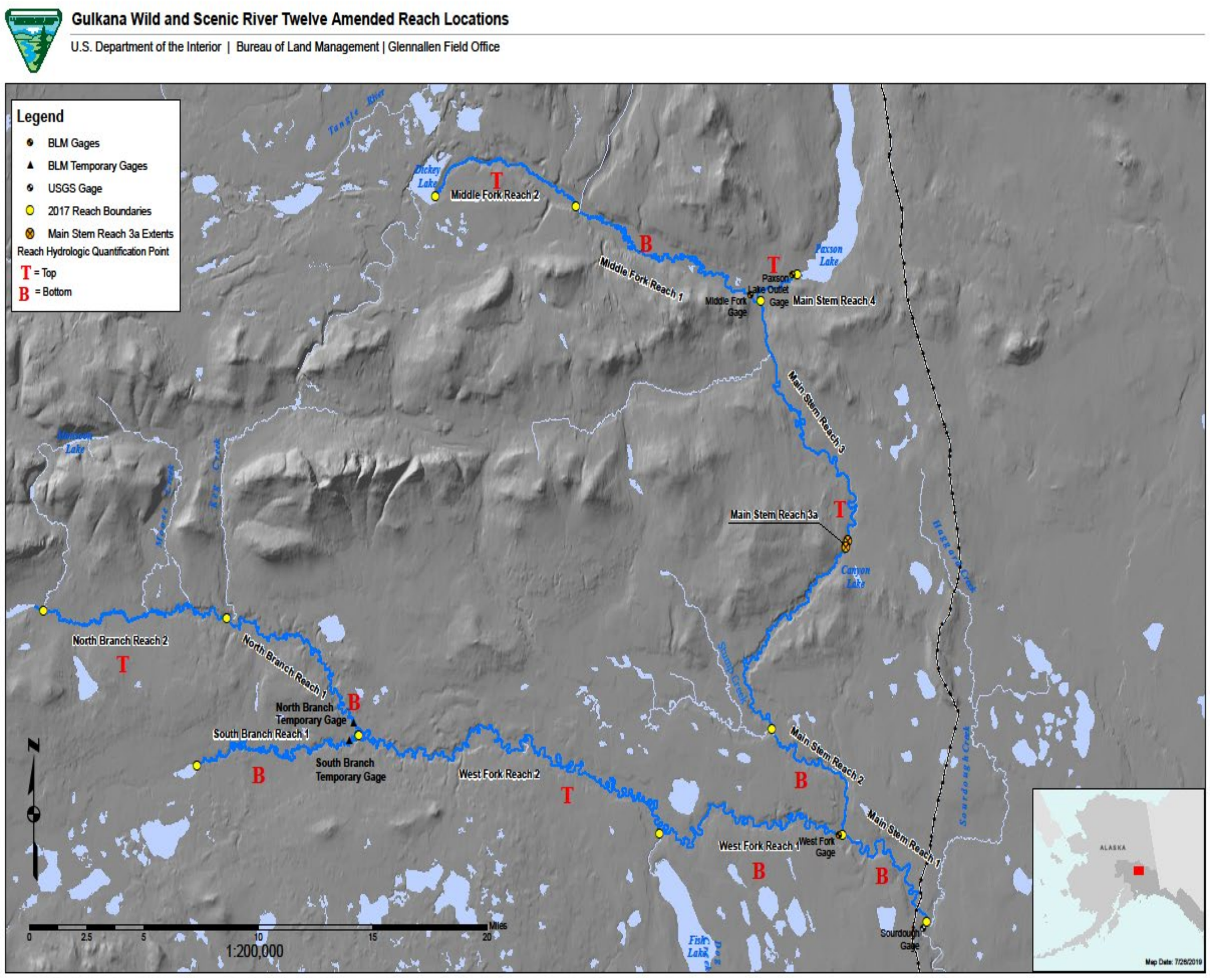

Figure: 3.5.1. Reach breakdown for the Gulkana River.

Common Name	Scientific Name	A=Anadromous R = Resident
Chinook salmon	*Oncorhynchus tshawytsha*	A
Sockeye salmon	*O. nerka*	A
Rainbow trout	*O. mykiss*	R
Steelhead	*O. mykiss*	A
Lake trout	*Salvelinus namaycush*	R
Arctic grayling	*Thymallus arcticus*	R
Round whitefish	*Prosopium cylindraceum*	A
Pacific lamprey	*Entosphenus tridentatus*	A
Longnose sucker	*Catostomus catostomus*	R
Slimy sculpin	*Cottus cognatus*	R
Burbot	*Lota lota*	R

Table 3.5.1. All fish species and their life history strategy that occur in the West Fork of Gulkana River watershed.

West Fork Reach 1 (WFR1)
WFR1 is from the confluence with the Gulkana's Main Stem upstream to the confluence with Fish Creek. Chinook (*Oncorhynchus tshawytscha*) and sockeye salmon (*O. nerka*), and Pacific lamprey (*Entosphenus tridentatus*) are among the anadromous fish species that utilize the WFR1 for all, or a portion of, their rearing and migration life phases. WFR1 has also been formally recognized as anadromous under Alaska state statute AS 16.05.871(a) in the ADF&G's Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes (AWC) as waterbody number 212-20-10080-2461-4021 (Johnson and Blossom 2019). Resident fish species that are known to occur in WFR1 (Table 3.5.1) spend their entire lives in freshwater, but not without significant watershed migrations for some species.

Chinook salmon
Spawning Chinook salmon generally enter the Gulkana River starting in late May and begin to enter the WFR1 by the last week of May (Maclean 2013). This reach is used as a migration corridor to access upriver spawning habitat. In addition to adult Chinook salmon, juvenile Chinook salmon rear in approximately the first ¼ mile of WFR1 as discovered in a recent juvenile Chinook tagging study (M. Roti, Alaska Department of Fish and Game, Sport Fish Division, Glennallen, AK, 02/2018, personal communication).

Sockeye
Sockeye salmon migration into the WFR1 coincides with the Chinook migration in the last week of May (Maclean 2013). WFR1 is important migratory habitat for sockeye salmon and includes Fish Creek, the outlet stream to Fish and Crosswind Lakes. The AWC has documented sockeye salmon present from the confluence with the Gulkana's mainstem upstream to the confluence with Fish Creek. Fish and Crosswind Lakes are important sockeye spawning and rearing habitat in the West Fork watershed. In addition to wild-reared sockeye smolts out-migrating from Fish and Crosswind Lakes, 10 million sockeye juveniles are stocked into Crosswind Lake (Stopha 2013) that out-migrate through the Fish Creek and then through WFR1. Adult sockeye salmon congregate around the mouth of Fish Creek located partially within WFR1, in late June and July before making spawning migrations to Fish and Crosswind Lake.

Rainbow trout and steelhead

The Gulkana River rainbow trout population is the northernmost wild rainbow trout population in North America (Schwanke 2015). Gulkana River rainbow trout are non-anadromous, but they move large distances between overwintering habitat and spawning sites. Recent telemetry studies have shown annual travel up to 60 miles, which makes this one of the most migratory populations documented in Alaska (Schwanke et al. 2014). The Gulkana River watershed supports the largest known fishery for rainbow trout in the Upper Copper River watershed, accounting for half of the angler effort annually since 1977 (Somerville 2013). WRF1 is important overwinter habitat for rainbow trout (Schwanke 2015). This reach is used as a migration corridor to access upriver spawning habitat. A radio telemetry survey on 3/21/2012 found 25% of radio-tagged rainbow trout overwintered in WFR1 (Schwanke 2015). A few steelhead overwinter WFR1 (Schwanke 2015).

Arctic grayling

The Gulkana River drainage supports the highest sport harvest of Arctic grayling in the Upper Copper Management Area (Somerville 2013). During the summer larger fish are usually found in the upstream reaches, and the mean size gradually decreases further downstream, closer to the stream mouth (Hughes and Reynolds 1994). Juveniles remain in or near natal streams for the duration of the rearing period. A recent telemetry study found the furthest upriver and downriver distances between spawning, summer feeding, and overwintering habitat was approximately 25 miles with a maximum movement of over 62 miles. This project also highlighted that WFR1 is important spawning and overwinter habitat for Arctic grayling (C. Schwanke, Alaska Department of Fish and Game, Sport Fish Division, personal communication). A recent (3/22/2017) telemetry study survey showed 30% of the tagged Arctic grayling migrated downstream in the fall and occupied most of the WFR1 for overwintering from November through mid-May (Schwanke 2019, in preparation). WFR1 appears to more important to Arctic grayling than rainbow trout and steelhead for overwintering. Overwintering is probably the most critical period for Arctic grayling (Alexander and Oswood 1997). This telemetry data also showed 10% of the tagged grayling spawned in this reach.

West Fork Reach 2 (WFR2)

WFR2 is from the confluence with Fish Creek to the confluence of the South Branch of the West Fork. Chinook (*Oncorhynchus tshawytscha*) and sockeye salmon (*O. nerka*), and Pacific lamprey (*Entosphenus tridentatus*) are among the anadromous fish species that utilize the WFR2 for all, or a portion of, their rearing and migration life phases. WFR2 has also been formally recognized as anadromous under Alaska state statute AS 16.05.871(a) in the Alaska Department of Fish and Game's (ADF&G) Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes (AWC) as waterbody numbers 212-20-10080-2461-3091-4042 and 212-20-10080-2461-3091-4046 (Johnson and Blossom 2019). Resident fish species that are known to occur in WFR2 (Table 3.5.1) spend their entire lives in freshwater, but not without significant watershed migrations for some species.

Chinook salmon

Chinook salmon generally enter the Gulkana River starting in late May and begin to enter the WFR2 by the first week of June. WFR2 reach is used as a migration corridor to access upriver spawning habitat, i.e., Keg and Moose Creek and the mainstem North Branch of the West Fork.

Adult Chinook were documented as present in WFR2 between Victor Creek and an unnamed tributary, AWC #212-20-10080-2461-3091-4046. Juvenile Chinook salmon were documented rearing between confluence of unnamed creek and the South Branch of the West Fork, AWC 212-20-10080-2461-3091-4049. Juvenile Chinook salmon were also recently discovered in the tributary and are in the process of being added to AWC. (T. Sundlov, Bureau of Land Management Glennallen, AK, 2/2018, personal communication).

Sockeye salmon

Sockeye salmon generally enter the Gulkana River starting in late May and begin to enter the WFR2 by the first week of June.

Adult sockeye salmon also congregate in WFR2 at the mouth Victor Creek in late June and July before migrating up the creek to spawn. Spawning sockeye salmon were documented spawning in WFR2 between the Fish Lake Confluence to the Victor Creek Confluence, AWC 212-20-10080-2461-3091-4042. Aerial survey data show Victor Creek as one of the most important sockeye spawning streams in the West Fork, and on 7/22/96, 3,440 sockeye salmon were counted in Victor Creek. The WFR2 reach is also used as a migration corridor to access further upriver spawning habitat, i.e., Keg and Moose Creeks and Moonsoon Lake. Adult Chinook salmon adults were documented as present between the confluence of Victor Creek to confluence of unnamed creek, AWC 212-20-10080-2461-3091-4046 and juveniles were documented rearing between confluence of unnamed creek and the South Branch of the West Fork, 212-20-10080-2461-3091-4049.

Longnose sucker

The longnose sucker is the only species of sucker in Alaska. Longnose suckers are found throughout the Gulkana River watershed. Spawning occurs in the spring and peaks when water temperatures have reached 6 C° and spawning suckers have been documented migrating up Popular Grove Creek (MacPhee and Watts 1975). Dozens of schools of up to 100 suckers were observed in August on the WFR2 (Albin 1977). He observed schools of 50 or more above the Victor Creek. This was confirmed by Tim Sundlov on a float trip in September of 2017 (T. Sundlov, Bureau of Land Management Glennallen, AK, 2/2018, personal communication). The West Fork is consistently warmer than mainstem Gulkana River and longnose suckers most likely have a higher thermal habitat niche than Arctic grayling.

Pacific lamprey

A juvenile lamprey was observed in WFR2, ¼ mile downstream of Victor Creek in September of 2017 (T. Sundlov, Bureau of Land Management Glennallen, AK, 2/2018, personal communication).

South Branch Reach 1 (SBR1)
SBR1 is from the confluence with the West Fork of Gulkana upstream to the South Branch headwaters lake.

Chinook Salmon
Chinook (*Oncorhynchus tshawytscha*) is the only anadromous fish species that utilizes the SBR1 for rearing. SBR1 has also been formally recognized as anadromous under Alaska state statute AS 16.05.871(a) in the Alaska Department of Fish and Game's (ADF&G) Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes (AWC) as waterbody number 212-20-10080-2461-3091-4049 and documented as rearing in the first ¼ mile of SBR1. Resident fish species that are known to occur in SBR1 (Table 3.5.1) spend their entire lives in freshwater, but not without significant watershed migrations for some species.

North Branch Reach 1 (NBR1)
The NBR1extends from immediately below the confluence with the South Branch Gulkana River upstream to the confluence with Keg Creek. Chinook (*Oncorhynchus tshawytscha*) and sockeye salmon (*O. nerka*) are among the anadromous fish species that utilize the NBR1 for all, or a portion of, their spawning, incubation, rearing, and migration life phases. Documentation has also been formally recognized as anadromous under Alaska state statute AS 16.05.871(a) in the Alaska Department of Fish and Game's (ADF&G) Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes (AWC) as waterbodies number 212-20-10080-2461-3091 and 212-20-10080-2461-3091-4122 (Johnson and Blossom 2019). NBR1 also provides important habitat for resident (non-anadromous) fish populations.

Chinook salmon
Chinook salmon generally begin to enter the NBR1 by the first week of June. An aerial spawning ground survey (7/2/96) counted six Chinook salmon in Keg Creek. Spawning occurs throughout most of the watershed starting in July and continuing into August. NBR1 has also been formally recognized and documented for anadromous Chinook salmon spawning as waterbody number 212-20-10080-2461-3091 (Johnson and Blossom 2019).

Sockeye salmon
Sockeye salmon migration into the NBR1 coincides with the Chinook migration beginning in the first week of June. The NBR1 is important spawning and migratory habitat for sockeye salmon and includes an important spawning tributary, Keg Creek. An aerial survey on 7/6/1984 documented 2,075 sockeye salmon and on 7/2/96, 1,150 sockeye salmon in Keg Creek. The AWC has documented sockeye spawning approximately ½ mile downstream of the mouth of Keg Creek and adult sockeye present at the mouth of Keg Creek in the NBR1.

North Branch Reach 2 (NBR2)
NBR2 extends from upstream of Keg Creek confluence westward to Bear Lake outlet stream. Moose Creek is a significant spawning tributary to this reach. This reach is also used as a migration corridor to access upriver mainstem and tributary spawning habitat. Chinook (*Oncorhynchus tshawytscha*) and sockeye salmon (*O. nerka*) are among the anadromous fish species that utilize the NBR2 for all, or a portion of, their spawning, incubation, rearing, and migration life phases. Documentation has also been formally recognized as anadromous under Alaska state statute AS 16.05.871(a) in the Alaska Department of Fish and Game's (ADF&G)

Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes (AWC) as waterbodies number 212-20-10080-2461-3091 and 212-20-10080-2461-3091-4142 (Johnson and Blossom 2019). NBR2 also provides important habitat for resident (non-anadromous) fish populations.

Chinook Salmon

Chinook salmon generally begin to enter the NBR2 by the first week of June. The reach between Keg and Moose Creek is the most productive spawning reach for Chinook salmon in the West Fork of Gulkana watershed. Migrating Chinook salmon were observed throughout this reach and several aggregates of actively spawning Chinook salmon were observed (Fleming 2004). Fleming (2004) observed aggregates of spawning Chinook salmon, three miles downstream of the Bear Lake outlet. In this section of the reach, the channel includes alternating riffles and runs with gravel and small cobble for substrate. The river channel then becomes highly incised, meandering, with sand and silt substrates over the next six miles to Moose Creek, with one bedrock area forming a short rapid. Immediately upstream of Moose Creek the river, approximately 40' wide, straightens into riffle-run sequences that were heavily utilized by spawning Chinook, Fleming (2004), counted 143 Chinook (120 live and 23 carcasses) in NBR2 upstream of Moose Creek. The AWC has documented Chinook salmon spawning approximately 2 miles upstream of Keg Creek and at the mouth of Moose Creek. Aerial survey spawning ground survey on 7/2/96 documented 129 Chinook salmon in the NBR2 between Moose and Keg Creeks and 38 kings in Moose Creek. An aerial spawning ground survey on 7/2/96 counted six Chinook salmon in Keg Creek. The AWC has documented Chinook salmon spawning and rearing at the Bear Lake outlet stream and Chinook spawning a 1/10th of mile downstream of the Bear Lake outlet stream. In addition, the AWC has documented Chinook salmon rearing at the confluence of an unnamed tributary out of Porkchop Lake.

Sockeye salmon

Sockeye salmon migration into the NBR2 coincides with the Chinook migration beginning in the first week of June. The NBR2 is important spawning and migratory habitat for sockeye salmon. The AWC has documented adult sockeye present at the mouth of Keg Creek and spawning for 3 miles upstream in the NBR2. Fleming (2004) observed migrating sockeye salmon throughout this reach and observed (20) river-spawning sockeye in the first mile downstream of Moose Creek. Aerial survey spawning ground survey on 7/2/96 documented 160 sockeye salmon in the NBR2 between Moose and Keg Creeks and 10 sockeye salmon in Moose Creek.

3.5.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny the Alaska Department of Fish and Game's request to utilize BLM managed lands as part of the Alphabet Hills prescribed burn project. Prescribed fire operations would however still be possible on over 42,725 acres of State lands.

There is no active fire suppression plan to prohibit the fire from burning adjacent BLM managed lands. Wildfires within the wild river corridor will be managed in accordance with the Alaska Interagency Fire Management Plan of June 1983. This plan shows the Gulkana National Wild River corridor managed under a "limited" fire suppression class, where suppression of wildfires is not necessary or desired. The project is relying on natural river and stream riparian corridors as vegetation buffers to stop the fire from entering BLM managed lands. Forest fires can easily blow across tree crowns to the other side of rivers and streams and generate their own wind and embers that can blow across rivers and streams. If the fire crosses rivers and streams it can create impacts and benefits similar or equal to the impacts and benefits in Alternative 2.

3.5.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under the Proposed Action Alternative (Alternative 2), the BLM would allow the Alaska Department of Fish and Game to utilize prescribed fire on BLM managed lands located within Unit A, B and C the Gulkana National Wild and Scenic River corridor. Unit A is 23,198 acres (2,827 acres or 12.2% are BLM lands), Unit B with 21,984 acres (4,143 BLM acres or 18.8% BLM lands.), and Unit C with 8,408 acres (3,895 BLM acres or 46.3% BLM lands). The three burn units consist of 10,865 acres or 20.2% of BLM managed lands and 42,725 acres or 79.7% of State managed lands, a total of 53,590 acres.

Salmonids have evolved to natural fire disturbance regimes that a create dynamic habitat patterns over space and time. Quantitative fire risk analysis depends on characterizing and combining fire behavior and effect. Fire behavior probabilities are extremely difficult to predict because they depend on spatial and temporal factors controlling fire growth, thus wildfire effects on fisheries and aquatic habitat are difficult to predict. The likelihood of fire burning a specific area is dependent on the fuels, topography, weather, and relative fire direction allowing each fire to reach that location. Given the inherent complexities of the wildfire effect on aquatic ecosystems and our limited ability to quantify them, it is impossible to predict and quantify precise effects.

Fires can have many specific influences on aquatic ecosystems, including decreased stream channel stability, greater and more variable discharge, altered coarse woody debris delivery and storage, increased nutrient availability, higher sediment delivery and transport, and increased solar radiation and altered water temperature regimes (McMahon and deCalesta, 1990; Reeves et al., 1995; Minshall et al., 1997, 2001; Benda et al., 1998; Gresswell, 1999). The most common and long-term change to stream habitat associated with fire is stream water temperatures. Stream temperatures increase after a fire and remain higher until riparian vegetation recovers.

Fire can remove riparian vegetation and increased direct solar radiation to the stream surface from the loss of riparian and leading to warmer summer water temperatures (Amaranthus et al. 1989). Increasing light and stream water temperatures, which promote allochthonous production, can have repercussions for aquatic communities and food weds (Cooper et al. 2015). Allochontus inputs decrease after riparian vegetation loss but rebound as riparian vegetation recovers (Britton 1990). These effects are not uniform and depend on burn severity, size, location, and proximity to fish populations, because downstream West Fork of Gulkana reaches WFR1 and WFR2 (Figure X) may cool rapidly if riparian shade is present. This resiliency, however, appears predicated on connectivity to robust fish population segments elsewhere in the watershed.

When riparian and terrestrial vegetation is removed by fire, runoff and erosion/sedimentation increase. Removing the vegetative cover, altering the natural topsoil, can increase the potential for erosion, increase runoff; and create more sediment in waterbodies. The main factors influencing erosion rate include the volume and velocity of runoff from precipitation, the rate of precipitation infiltration through the soil, the amount of plant cover, the slope length or the distance from the point of origin of overland flow to the point of deposition. Short-term impacts - habitat may be dramatically altered. Large influxes of sediment can lower pool density, a detriment to fish and aquatic organisms (Madej and Ozaki, 1996). Increased sediment storage results in decreased substrate sizes and increased floodplain widths and side channels. These changes can lead to decreased survival of fish in the egg and alevin stages; decreased density, biomass, and diversity of aquatic insects; and decreased primary production (Van Nieuwenhuyse 1983 and Buhl and Hamilton 1990).

Water quality impacts to fish and aquatic habitat from the proposed action would occur because of degraded water quality in the form of elevated sediment and turbidity. These degraded conditions are expected to be most noticeable immediately following fire and during the following spring as the higher flows associated with snow melt and ice out create erosion. Following the first high spring flow, impacts to water quality would lessen but persist for several years until the streambank riparian vegetation becomes reestablished.

The resultant turbidity within the North Branch of West Fork of Gulkana River would decrease the quality of egg to fry habitat and survival. The current spawning aggregation of Chinook salmon spawning in upper NBWF has the high probability of being the most affected. Also, initial stream water temperatures may not be suitable for salmonid eggs and fry, because of elevated water temperatures (Hitt, 2003) or excess sediment levels (Helvey, 1980). This analysis is not considering potential changes in precipitation timing or intensity. Both elements have changed in recent decades (Arismendi et al., 2012, Safeeq et al., 2013), and will likely change further in a warming climate (Bernstein et al., 2007). As Alaska continues to warm, fires will become larger and more frequent. The sensitivity of the egg/fry life stage to sedimentation and warmer stream temperatures because of fire may be greater into the future because of changes in the hydrologic and climate regime. For example, Lanini et al. (2009), showed that the timing and intensity of precipitation after wildfire affected in-stream sedimentation rates.

Long-term effects coincide with revegetation of watersheds and stream channel reorganization in the aftermath of fire. Overwintering habitat may improve for juvenile Chinook salmon through increased delivery of large woody debris. The improvement is primarily the result of delivery of large wood to channel by erosion and debris flows. Also, fires may result in increased aquatic productivity by stimulating primary and secondary production (Minshall 2003; Spencer et al., 2003).

Large, well-connected watersheds are at lower risk to fire impacts. In larger interconnected systems, fish populations appear to be more resilient to the effects of fire. Gulkana watershed is mostly a connected watershed and should be therefore more resilient to the effects of wildfire. Existing evidence suggests fires and disturbance in general can pose greater threats to fishes when habitats become fragmented and stream connectivity is disrupted.

3.5.4 Direct and Indirect Effects from Alternative 3

Under the Proposed Action Alternative (Alternative 3), the BLM would allow the Alaska Department of Fish and Game to utilize prescribed fire on BLM managed lands located within the Gulkana National Wild and Scenic River corridor with aerial ignitions only being allowed in Unit A of the North Branch of the West Folk of the Gulkana River. Unit A is 23,198 acres (2,827 acres or 12.2% BLM lands. As stated in Alternative 1 this project is relying on natural river and stream riparian corridors as vegetation buffers to stop the fire from entering BLM managed lands. Forest fires can easily blow across tree crowns to the other side of rivers and streams and generate their own wind and embers that can blow across rivers and streams. If the fire crosses river and streams it can create impacts and benefits similar or equal to impacts in Alternative 2.

3.5.5 Cumulative Effects

Given the inherent complexities of the wildfire effects on aquatic ecosystems and our limited ability to quantify them, it is impossible to predict and quantify precise effects. A major limitation to evaluating the effects or managing fire itself, is lack of information. A prescribed fin 2004 burned 38,000 acres adjacent to Units A and B and no stream habitat or water quality fire data was collected as part of a monitoring effort. Developing a review of future prescribed burns in the Gulkana watershed would be greatly benefited by post-fire by new information gained through monitoring. Also, the Gulkana River wildfires within the wild river corridor are managed in accordance with the Alaska Interagency Fire Management Plan of June 1983. This plan is now 38 years old, and it should be reviewed to see if it is still sufficient for management of the Gulkana River and its Outstandingly Remarkable Values (ORV's). This river's fisheries were recognized as ORV's in the Gulkana National Wild Management Plan of 2006 well after the publication of the 1983 Alaska Interagency Fire Management Plan.

Minshall et al. (1997) suggested effects of fire on aquatic ecosystems can be considered in terms of midterm and long-term consequences. Fire disturbance to streams should be considered over larger temporal and spatial scales (decades and over hundreds square miles (watershed) if effects are to be understood. Salmonids have evolved to natural fire disturbance regimes that a create dynamic habitat patterns over space and time. From a management perspective, the focus should shift to land use planning from a watershed perspective. This fisheries analysis has described the fisheries environment from a watershed perspective.

Past prescribed fires in West Fork of Gulkana watershed has burned 38,000 acres of the watershed and resulted in loss and degradation of riparian-wetland vegetation and aquatic stream habitat. No stream habitat has been collected to determine if the stream habitat has recovered. To calculate the amount of riparian vegetation and aquatic stream habitat acreage lost and recovered would require an on-the-ground watershed analysis. There is no data available stream habitat and fish population sizes for the West Fork of the Gulkana.

3.4.6 Recommended Mitigation

Water temperature throughout the West Fork of the Gulkana watershed should be collected and monitored before and after the prescribed burn. Maintaining stream habitat connectivity will continue to be important.

3.6 Cultural/Historical Resources

> **Issue 6:** Will the prescribed burn have an adverse effect to cultural resources on or eligible for the National Register of Historic Places?

3.6.1 Affected Environment

The Gulkana River territory and this project area was traditionally used by the Gulkana-Gakona band of the Western Ahtna for winter trapping and travel, spring through fall hunting, and summer fishing and wild plant gathering (Cohen 1980; DeLaguna and McClellan 1981; Kari 1983:47-61; Reckord 1983; Kari and Tuttle 2005). Using the rivers as travel corridors between semi-permanent winter villages which were typically located near river confluences, and seasonal satellite camps, the Ahtna were able to exploit the Basin's seasonally abundant resources (Shinkwin 1979:22-25). Fish, primarily harvested in the summer, would also likely have been stored in buried caches. These caches were not limited just to the village sites, they were also located throughout the band's territory as a means of storing itinerant game procured far from the villages, acting as both future food reserves and insurance against insect or animal depredation of other caches. We know the Ahtna used a variety of fish trapping structures and implements; however, the organic nature of the materials used in their construction has left little for the archaeologist to find. Similarly, the seasonal satellite camps were very likely expediently constructed of locally available materials and may also have incorporated natural features (e.g., close-growing brush or trees as windbreak) such that almost no archaeological "footprint" is left behind.

Ahtna ties to the landscape and access to its resources (e.g., particular hunting and fishing grounds) appear to have been clan-based (Reckord 1983:164-167), although permission could be obtained by members of other clans to use an area. Kari (1983) has recorded the Ahtna names for numerous locations throughout the Gulkana River drainage; many of these names reflecting a particular subsistence activity undertaken at or near the location, e.g. "caribou fence lake" and "fish swim to it creek". Blair (2004:3-5) provides further summary of traditional Ahtna subsistence patterns. The extensive land use pattern for the area is still tied to many of the travel routes still in full or partial use today (Kari and Tuttle 2005:29), a useful point in selecting areas to further investigate for archaeological evidence.

Historically, segments of the West Fork were used in the early 20th century by those on their way northwest from the Copper River vicinity to the Valdez Creek mining district (Cohen 1980:30-54; Dessauer and Harvey 1980:4b, 101; Reckord 1983:172). Reckord (1983:172) notes that many of the routes used by Euro-Americans for travel and transport were often Native footpaths, usually widened and hardened to support larger vehicles and freight loads. Dessauer and Harvey's (1980:25) mention of the historic route along the Middle Fork of the Gulkana between the river basin and the Tangle Lakes area matches Blair's (2004) discussion of the Native use of this travel corridor. In such a wet, swampy environment the high ground routes had been identified by the Natives for efficient travel generations before the first white people ventured into the area. Additionally, using the river during the winter was an effective means of travel for both Natives and Euro-Americans. Several early-20th century cabins have been reported along the river and its tributaries (Dessauer and Harvey 1980:115-116); many being used as temporary winter dwellings by trappers maintaining their traplines.

J. C. Murphy, an early prospector and miner in the area, describes his summer and winter travels to Valdez Creek prior to 1908 (in Cohen 1980:37-39 and Dessauer and Harvey 1980:23). The summer route left Valdez and followed the government trail north 102 miles to Copper Center, then 28 miles to Gulkana. Here, at Bear Creek, the route left the government trail and headed west about eight miles to "low flat country", where a trail covering the remaining 135 miles northwest to Valdez Creek was found. The winter route also followed the government trail from Valdez to Copper Center, but here it diverged to follow the Copper River to Gulkana from where it then followed the West Fork of the Gulkana River. Travelers continued northwest up Keg Creek and followed it for about twelve miles until a westerly overland trail to Portage Creek was reached, about fifteen miles away; this was followed downstream (north) for about twelve miles to the Maclaren River, which was then followed to its confluence with the Susitna River. The remaining 36 miles to Valdez Creek were covered by heading up the Susitna. Cohen's (1980: Fig. 7) map shows the location of the government trail from Valdez to Fairbanks in 1904. Dessauer and Harvey (1980:23-24) note that this was a recommended freight route in the winter due to the smoothness of the ice for sledding, but difficult in summer due to the swampy muskeg. It was abandoned as a summer trail after 1913 when a shorter overland route from Paxson's Roadhouse was established. Historic Euro-American use of the river as a travel corridor appears to be directly linked to the boom-and-bust mining cycles of the Valdez Creek district, and with declining interest and productivity in the post-World War II era, the river saw less traffic each year in the last half of the 20th century; however, hunters, recreationalists, and a few trappers still use the river to the present day.

Most of the archaeological surveys in the burn area have been either focused on the Gulkana Wild and Scenic River's West Fork (Jangala and Ciccone 2010) or within a previous 2004 burn area (Muenster 1999). The current project area contains 28 known cultural resource sites spanning from several undated prehistoric sites as well as historic sites associated with mining, trapping and early transportation in the Copper River Basin. Due to the lack of archaeological excavations within the project area, there are few well documented dates for these sites. However, north of the Gulkana River is a single dated hearth feature within the project area, which dates to between 920-790 CAL yr. BP (Jangala and Ciccone 2010). Although many of the sites in the burn area are prehistoric lithic scatters, a number of sites, including the remains of log cabins and covered cache pits, contain combustible materials. Historically, the Alphabet Hills area was reportedly burned by wildfires in 1899 by the Abercrombie expedition. No other historic reports of wildfires have been located for the area.

3.6.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

There are no anticipated effects from this alternative and management would remain similar to present, with infrequent, naturally occurring wildfires.

3.6.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

The lead federal agency for the National Historic Preservation Act's (NHPA) Section Compliance for this project is the U.S. Fish and Wildlife Service (USFWS), who will be contracting most of the work to the Office of History and Archaeology's Survey Division. As the lead federal agency, the USFWS will, in consultation with the Alaska State Historic Preservation Officer and affected Federally Recognized Tribes, determine the work necessary to comply with the NHPA's Section 106.

The entire prescribed burn project area contains 28 known prehistoric and historic sites that could be adversely affected if the prescribed fire exceeded the proposed burn units. However, Units A, B and C, where prescribed fire lighting will occur, contains the seven known cultural resources that are most likely to be adversely affected by fire. There are two cabin ruins and one cache pit constructed with wooden elements that are likely to be consumed during a fire. There are also five buried prehistoric sites that could be affected by fire directly. Some lithic artifacts may experience heat alteration, which could potentially affect their data potential for archaeology. Artifacts made of obsidian may experience the distortion of hydration rims at temperatures beyond 400° C, potentially affecting their use in dating sites (Skinner, Thatcher and Davis 1997). These kinds of temperatures may be encountered in areas with heavy ground fuels or smoldering duff, heavily altering obsidian hydration rims (Deal 2002).

Indirectly, increased soil erosion after fire removes soil stabilizing vegetation could also adversely affect any of the buried prehistoric and historic sites by displacement and exposure on the surface. The loss of soil can result in the loss of archaeological data and context for buried sites, leaving artifacts on the surface with no stratigraphic context for analysis. This may also adversely affect undiscovered buried prehistoric and historic sites. However, these sites are unlikely to be discovered due to thick surface vegetation until the surface is exposed by a prescribed fire.

3.6.4 Direct and Indirect Effects from Alternative 3 – Limited Burn Alternative

The lead federal agency for the National Historic Preservation Act's (NHPA) Section Compliance for this project is the U.S. Fish and Wildlife Service (USFWS), who will be contracting most of the work to the Office of History and Archaeology's Survey Division. As the lead federal agency, the USFWS will, in consultation with the Alaska State Historic Preservation Officer (SHPO) and affected Federally Recognized Tribes, determine the specific work necessary to comply with the NHPA's Section 106.

Unit A contains a single recorded cabin site with two courses of logs. Prescribed fire in this area is likely to remove any remaining combustible materials and expose non-combustible artifacts on the sites surface, resulting in an adverse effect

Indirectly, increased soil erosion after fire removes soil stabilizing vegetation could also adversely affect any undiscovered buried prehistoric and historic sites by displacement and exposure on the surface. The loss of soil can result in the loss of archaeological data and context for undiscovered buried sites, leaving artifacts on the surface with no stratigraphic context for analysis. However, these sites are unlikely to be discovered due to thick surface vegetation until after a prescribed burn.

3.6.5 Cumulative Effects

No cumulative effects to cultural resources is expected from this project.

3.6.6 Recommended Mitigation

The seven sites within prescribed fire Units A, B, and C as well as the remaining twenty-one sites within the project's boundaries need to be evaluated for their eligibility for the National Register of Historic Places. Since USFWS is the NHPA Section 106 lead agency for this project, it is their responsibility to recommend mitigations for sites within the Area of Potential Effect (APE) in consultation with the Alaska State Historic Preservation Officer and the BLM. The following recommendations were included in a USFWS Letter to the Alaska SHPO on 12 January 2021 and concurred on by SHPO in a letter dated 12 February 2021:

"The USFWS recommends a finding of No Adverse Effect by taking measures to avoid and protect the known eligible and unevaluated sites in the APE, including proactive protection measures and pre-burn and post-burn site inspections. These include requesting that no aerial ignitions will happen within 1.0 km from the nearest eligible or unevaluated site, and USFWS cultural resources staff will coordinate with ADF&G and BLM Glenallen Field Office cultural resource staff during burn implementation to monitor fire progress and coordinate site protection measures.

Burn Unit A: No eligible or unevaluated sites, however site GUL-259, Moose Creek Cabin consisting of only several courses of logs, and although recommended as ineligible, will be inspected pre-fire and postfire to determine if any artifacts or features were revealed. Burn Unit B: No eligible or unevaluated sites, therefore no avoidance or protection measures necessary. Burn Unit C: Site GUL-440, consists of a single flake but may be indicative of a larger site. This site will be inspected post-fire to determine if any additional artifacts or features are revealed. GUL-282, an unevaluated historic cabin (Markel Ewan Cabin), will have a blackline created around the site with a minimum 50m buffer around the site boundary to protect the structure. GUL-282: The Markel Ewan cabin, 3 consisting of only several courses of logs, will have pre-fire and post-fire inspections done to determine if any artifacts or features were revealed.

As for the eligible and unevaluated sites outside the primary burn units, the following avoidance or protections measures will be implemented: GUL-352, a prehistoric site near a lake, has several hearth features that are considered eligible under criterion D as it may have significant research potential. Pre-burn inspection of the site will be conducted and one of the eroding hearths will be sampled for diet reconstruction research currently being conducted. Post-fire inspection will also be conducted for this site to gauge the effects of the fire as well as to locate any additional artifacts or features revealed by the burn. GUL-372, is a cache pit with collapsed wooden elements, which does not have sufficient information for an eligibility determination at this time. If the prescribed fire goes beyond the primary burn units, a sprinkler system fed from the Gulkana River will be employed to protect the site. Post-fire inspection will also be conducted to ensure protection measures were successful.

No protection measures are recommended for the remaining sites at this time as they are either located in sparely vegetated areas less likely to be affected by the burn, and/or are prehistoric and consist of lithic materials that have most likely burned over in the past. If WSFR funding allows a limited amount of postfire cultural resource surveys may be conducted in several high-probability areas."

3.7 Wildlife

Issue 7: Affects to migratory birds, waterfowl, and raptors.

3.7.1 Affected Environment

Bird habitats in the area are characterized by coniferous boreal forest, wet sedge and grass meadows, and the river corridor. The vegetative community is dominated by species such as black spruce (*Picea mariana*) and white spruce (*Picea glauca*) with an understory of birch, willow, berries, grasses, some lichens, mosses, and sedges. The WSR and the myriad of small stream systems running throughout the project area support wetter, riparian vegetative communities and associated avian wildlife. This complex ecosystem supports high biodiversity and provides suitable habitat for birds throughout the year. Over 60 species of birds have been documented in the Gulkana WSR, including trumpeter swans, ducks, geese, loons, hawks, eagles, owls, grouse, jays, thrushes, waxwings, warblers, sparrows, flycatchers, and others. Uncompromised nesting and brood rearing habitats for many of these birds are present within the project area.

Limited avian species identification work or occurrence mapping have been done in the specific project area. Therefore, the potential presence or absence of Sensitive Species and species of interest birds is based on their known preferred breeding habitat characteristics and the documented vegetation species/community types known to exist on site. Species that could (or do) occupy habitat within or near the proposed project area include (but are not limited to): olive-sided flycatcher, rusty blackbird, lesser Canada goose, bald eagle, trumpeter swan, and red-throated loon. There are no threatened or endangered species or habitat for such within or adjacent to the proposed site.

The Migratory Bird Treaty Act (MBTA), as amended, was implemented for the protection of migratory birds. Unless permitted by regulations, the MBTA makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including feathers or other body parts, nests, eggs, or migratory bird products. In addition, Executive Order 13186 sets forth the responsibilities of Federal agencies to implement the provisions of the MBTA by integrating bird conservation principles and practices into agency activities and by ensuring that Federal agencies evaluate the effects of actions and agency plans on migratory birds.

Trumpeter swans, lesser Canada geese, and other waterfowl nest and rear their young along and nearby the Gulkana river system and on many of the lakes and potholes within the wild river boundaries and surrounding areas. Breeding trumpeter swans specifically select nesting sites in areas surrounded by water. They feed predominantly on submerged aquatic vegetation during nest selection and egg laying but shift to emergent forbs and sedges during incubation (Grant et al. 1994). Many northern breeding waterfowl have similar foraging habits. A 2015 survey completed by the USFWS documented 99 trumpeter swan observations within the project area, though only 7 of them (7%) are within the burn units. Trumpeter swans are disturbed to varying degrees by differing stimuli (Henson and Grant 1991); short disturbances such as aircraft flyovers have been shown to alert swans, but not notably impact their incubation or brood rearing success. Fire can have several different effects on the habitat, such as reducing cover, forage availability, or altering drainage (Schindler et al. 1996). One study in Alaska observed that swans are more likely to occupy habitat within historical fire perimeters (Schmidt et al. 2009), indicating that fire may improve the quality of swan brood rearing habitat, likely as a result of an increase in nutrients recycled by the fire.

Habitat Type	**Acres in GMU 13A and B on all lands**	**Acres on BLM lands within 13A and B (BLM land total =1027605)**	**% habitat on BLM lands in 13A and 13B**	**BLM Acres affected in Units A, B, & C of Proposed Action**	**% of BLM Acres affected from the proposal within GMU 13A/13B**	**% of habitat affected in GMU on all lands**	**Potential % habitat affected in GMU13A and B if burns to outer perimeter**
Waterfowl Habitat	2,179,198	295,457	13.6%	20,887	7%	1.7%	14.5% (waterfowl habitat on all lands in 13A and B), 18% (BLM lands)
Trumpeter Swan Habitat	548,357	140,241	26%	5,826	4.2%	1.9%	18% all lands), 9.5% (of habitat on BLM lands)

Table 3.7.1. Waterfowl and trumpeter swan habitat affected by project actions.

Lakes, ponds, and rivers provide ideal habitat for bald eagles, as their primary prey is fish. As a result, bald eagles prefer to nest in hardwood trees close to bodies of water. The Bald and Golden Eagle Protection Act (BGEPA) was implemented to protect eagles from any "take", including their nests, parts, and eggs. Under BGEPA, any actions that disturb bald eagles are prohibited, where "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." Furthermore, "disturb" includes any impacts of human activity outside of the nesting period that would alter a nest site enough to detrimentally affect eagles upon their return to the nest.

Bald eagle nesting surveys have been conducted along the Gulkana River for over thirty years now and have provided valuable information for biologists. Through these surveys, and with additional data supplied by the USFWS, 10 bald eagle nesting territories have been identified within the project area boundaries. Actual nest occupancy rates vary from year to year depending on various climatic conditions and biological situations. Four of the nests are within the Gulkana WSR, and a total of six nests are within the burn units or within 0.5 miles of the burn units (See Figure 3.7.1). This is important to note, because in addition to direct disturbance from fire, smoke can disturb nesting eagles to such an extent that they abandon nesting efforts, which can lead to eaglet death. Dates vary, but bald eagles in Alaska generally begin building nests in January, with egg laying and incubation beginning in April. A successful nest will fledge one or two eaglets (rarely three) in approximately four months. It is possible that after an early unsuccessful nesting attempt, a pair may try again. After fledging, young eagles usually remain close to the nest for roughly 6 weeks, as they remain dependent on their parents for food. Throughout the roughly 6 month breeding cycle the eagles are particularly vulnerable to disturbance (Steidl and Anthony 2000).

Golden eagles are also protected under the BGEPA, the MBTA, and the Lacey Act. Disturbances near important roosting or foraging areas can stress eagles to a degree that leads to reproductive failure, nest abandonment, mortality elsewhere. Range wide, golden eagles are currently experiencing a stable population (U.S. Fish and Wildlife Service 2011).

Golden eagle habitat encompasses a wide variety of ecosystems, from grasslands to tundra to desert and to forested and woodland brushlands. They are primarily an aerial predator with prey ranging from small to medium sized mammals, reptiles, and birds. They are opportunistic and will scavenge and consume carrion. Golden eagles build nests on cliffs and trees large enough to support a nest and favor undisturbed areas. Human activities have been noted to be disruptive to golden eagle nesting efforts (U.S. Fish and Wildlife Service 2011). They lay one to four eggs, with most successful nests fledging two eagles. Territories may have one or more nests and eagles might switch occupancy of nests within the territory from year to year.

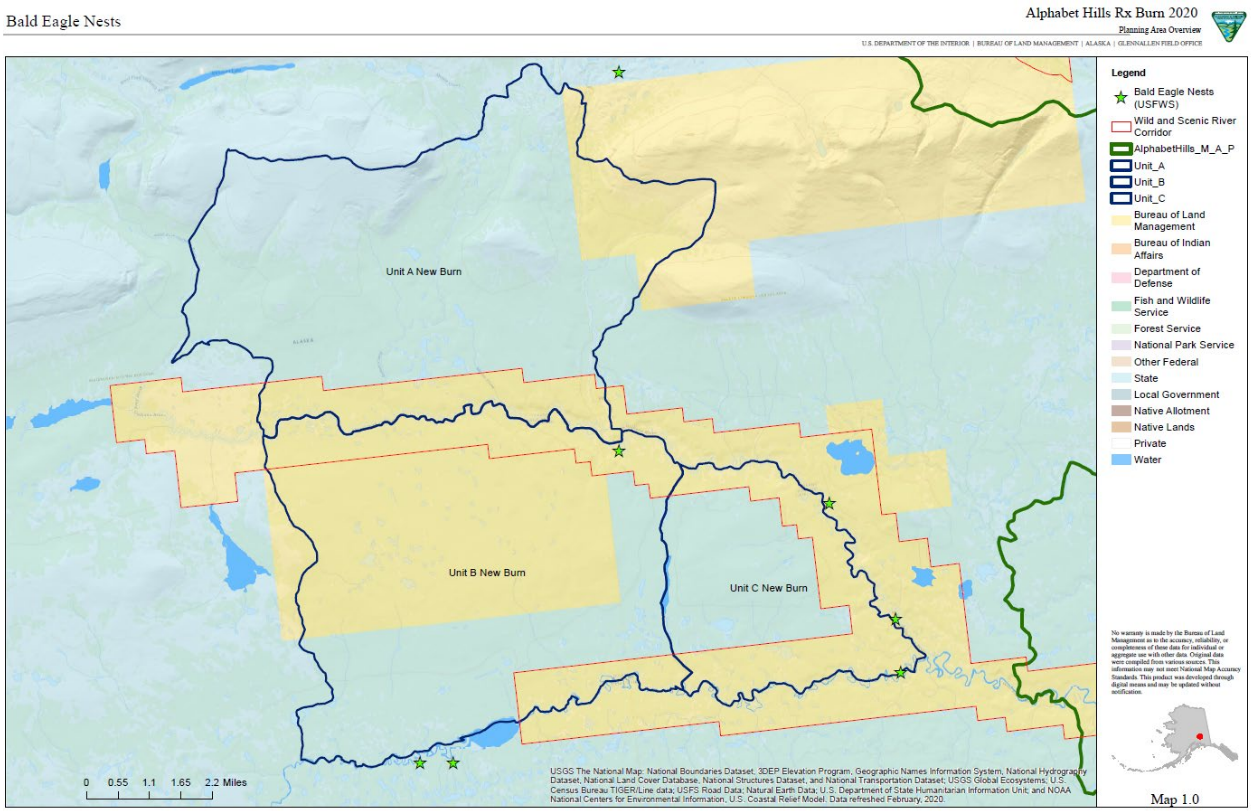

Figure 3.7.1 Locations of bald eagle nests relative to the burn units and WSR corridor.

3.7.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative, no burning, vegetation removal, or any ancillary actions associated with the project would be authorized. As a result, avian species that are currently present within the project area would be expected to remain. There would be no disturbance or displacement of nesting or brood rearing birds such as migratory waterfowl, land birds, songbirds, trumpeter swans, bald eagles, or others due to project activities. No permits or mitigation measures would be required.

3.7.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Effects to waterfowl and trumpeter swans during breeding and brood rearing are going to depend on the timing of the burn. Implementing the mitigation measure to establish 0.25-mile buffers around lakes, ponds, and marshes with trumpeter swan nests during the nesting season (May 1 – August 31) will notably reduce impacts to swans, waterfowl, and other migratory birds utilizing the proposed project areas. The density of lakes and riparian areas within the project area make it unlikely that many nests and swan habitat will be lost; therefore, impacts to swan populations during the nesting season would likely be minimal (Julian Fischer, USFWS, personal communication). Outside of the breeding season, it is possible that burn operations could temporarily disturb or displace birds from their habitat. However, these impacts would be temporary, and an abundance of adjacent, high quality habitat would prevent serious productivity reductions in displaced birds. An analysis of habitat in GMU13A/B (used to reference adjacent habitat) shows that the burn units account for only 1.7% of general waterfowl habitat and 1.9% of mapped trumpeter swan habitat (See Table 3.7.1). In the unlikely event that the entire project area burns, 14.5% of general waterfowl habitat and 18% of trumpeter swan habitat would be affected. These percentages constitute a notable amount of impacted habitat, but would not likely affect waterfowl, swans, or migratory birds on a population level. In fact, the quality of brood rearing habitat may increase as a result of the fire (Schmidt et al. 2009) resulting in a net benefit to migratory birds from project actions.

Other migratory birds that utilize the project area, such as olive-sided flycatchers and rusty blackbirds, are also most vulnerable to disturbance during the nesting period. In order to mitigate impacts to nesting migratory burns, burning will not occur from April 15 to July 15, in accordance with the Migratory Bird Treaty Act. Certain species will nest later in the season and may be temporarily displaced from their nesting grounds by project activities. However, the limited scope of the project, and the lack of Threatened or Endangered species in the project area ensure that there will be no population level impacts to migratory bird species. Additionally, an abundance of adjacent, high quality habitat is available, which will allow species to relocate at minimal energetic cost and could provide opportunities for re-nesting attempts to any displaced nesting birds.

There is a real danger of bald and golden eagle take if the burn occurs during the nesting season. Even if the nest trees do not burn the smoke from nearby fire could be enough to cause adults to abandon the nest. To mitigate this, stipulations have been applied to prevent burning occurring within ¼ of bald eagle nests and with ½ mile of golden eagle nests during the nesting season (April 1 – August 31). Nest trees will also be protected outside of the nesting season, since damage to nests could dissuade eagles from returning and prevent breeding efforts; this would constitute a "take" under BGEPA. With these protections, impacts to eagles will be effectively mitigated and project actions are very unlikely to result in a "take". The burn is unlikely to detrimentally affect eagles indirectly, as adjacent habitat will continue to sustain prey populations, and fire may temporarily increase eagle sightability of small mammal prey species, increasing the amount of foraging habitat and conferring a minor benefit to eagles hunting outside of aquatic areas.

3.7.4 Direct and Indirect Effects from Alternative 3

Under this alternative, prescribed fire would be allowed to occur within the Gulkana WSR, the burn units, and the larger project area; however, firing of the burn would not be permitted within the WSR. After firing elsewhere, fire would be allowed to burn into the WSR corridor. The direct and indirect effects from Alternative 3 to avian species would be very similar, with the WSR less likely to burn. Since all the bald eagle nests on BLM managed land are within the WSR, this would decrease the likelihood of disturbance to bald eagles or their nests. Mitigation measures would remain the same. There would be no temporary sightability benefits in this area.

3.7.5 Cumulative Effects

Past human disturbances are similar to those in the subsistence uses cumulative effects section. Present disturbances have been described above in Alternative 2. Reasonably foreseeable impacts from disturbances/projects similarly do not included increased human presence in the area and could include improved forage and nesting habitat for birds. Avoidance, including nest abandonment associated with disturbance from the burning can be mitigated with implementation of nesting timing stipulations and protective buffers around nests.

3.7.6 Recommended Mitigation

In an effort to avoid conflict and inform Federal subsistence users of potential encounters with burn operations, smoke, or any associated ancillary activities, advanced notice of the project actions should be provided to the public through media, radio, newspaper, or signage.
In addition, the following recommended stipulations and mitigation measures should be included in the project design to minimize impacts to subsistence use wildlife and prevent additional habitat degradation or long-term disturbance:

- Consistent with the Migratory Bird Treaty Act, operations that require vegetation removal will avoid the migratory bird nesting period of April 15 to July 15. (ROP-F&W-a-13; EARMP)
- Within one-fourth mile of bald eagle nests, the following uses will not be permitted from April 1 to August 31: a) surface disturbing activities; or b) FLPMA leases or permits. (ROP-F&W-b-4; EARMP)
- Consistent with the Bald and Golden Eagle Protection Act and U.S. Fish and Wildlife Service recommendation, surface disturbing activities will not be permitted within one-half mile of golden eagle nests from March 1 to August 31.
- Consistent with the Bald and Golden Eagle Protection Act, bald and golden eagle nests and nest trees will be protected from burns, damage, or other disturbance that could dissuade eagles from returning to the nest.
- Aircraft associated with permitted activities will maintain an altitude of 1,000 feet within one-half mile of documented eagle nests. (ROP-F&W-b-4; EARMP)
- Within one-fourth mile of lakes, ponds, or marshes with trumpeter swan nests, the following uses will not be permitted from May 1 to August 31: a) ground disturbance or surface use exceeding 14 days; b) FLPMA leases; c) FLPMA permits where surface use exceeds 14 days; or d) overland access to permitted activities. (ROP-F&W-b-1; EARMP)

3.8 Visual Resources

Issue 8: How would the Proposed Action affect Visual Resources on BLM managed lands within the project area?

3.8.1 Affected Environment:

Consistent with the outstandingly remarkable values and objectives identified in the 2007 Revised Gulkana River Management Plan, activities within the Gulkana National Wild River corridor will be managed consistent with a Class I Visual Resource Management Class. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

3.8.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny the Alaska Department of Fish and Game's request for prescribed fire on BLM managed lands. Prescribed fire operations would however still be possible on State of Alaska lands.

3.7.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under the Proposed Action, prescribed fire would be allowed to occur within the Gulkana Wild and Scenic River corridor and other BLM managed lands. The visual resource rating worksheet completed for the proposed action resulted in a short-term temporary change to the visual resources in the area. No long-term change to the Visual Resource Management (VRM) class would occur as a result of this action. Once regrowth of the vegetation occurs, the contrast between the unburned vegetation and the burned landscape would disappear.

3.7.4 Direct and Indirect Effect from Alternative 3

The effects to Visual Resources class I under Alternative 3 are the same as the No Action Alternative.

3.7.5 Cumulative Effects

Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on visual resources. There would be short-term, localized, adverse effects on the visual resources from smoke, closures, and burned vegetation within the river corridor. These effects would be negligible to minor, depending on the location and size of wildfires.

3.8.6 Recommended Mitigation

A VRM contrast rating (BLM Handbook H-8431 Visual Resource Contrast Rating) will be required for all prescribed fire treatments regardless of the VRM class to ensure compliance with the VRM class objective. Contrast ratings will be conducted by field office staff familiar with VRM and will follow the established process as described in the BLM Handbook. The results of the contrast ratings, indicating the degree of contrast between the proposed project and the characteristic landscape. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

3.9 Air Quality

Issue 9: How will the proposed action affect air quality in the region?

3.9.1 Affected Environment

The Environmental Protection Agency (EPA) has set national standards, National Ambient Air Quality Standards (NAAQS) for six classes of air pollutants considered to be key indicators of air quality. These include carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, particulate matter 10 microns or smaller (PM10) and particulate matter 2.5 microns or smaller (PM2.5). Several pollutants can be found in smoke; however, particulate matter is typically the most concerning from a health and visibility standpoint. Smoke is the primary pollutant resulting from the combustion of fuels during prescribed fires (NWCG, 2020).

PM2.5 poses the greatest risk to human health because of the small size of the particles, which can cause respiratory and heart problems; especially, in sensitive populations (EPA, 2020). PM2.5 is directly emitted into the atmosphere from combustions sources such as wildfire. The larger particles in PM10 are of lesser concern to human health, but they can cause reduced visibility on a local scale in the form of dust.

Wildfires are a significant contributor of particulate pollutants (especially from June through October), when smoke from wildfires is most abundant. Based on the National Emissions Inventory (EPA, 2017), agricultural burning, wildfires, and prescribed fires together made-up 43 percent of national PM2.5 emissions and 17 percent of national PM10 emissions in 2017. The project area is unclassifiable and are assumed to be in attainment with the national ambient air quality standards.

3.9.2 Direct and Indirect Effects from Alternative 1 - No Action Alternative

Under the No Action Alternative (Alternative 1), the BLM would deny the Alaska Department of Fish and Game's request for prescribed fire on BLM managed lands. Prescribed fire operations would however still be possible on over 42,000 acres of State lands. If the burn was to occur and BLM lands avoided the total effects would be less than found in the Proposed Action Alternative.

3.9.3 Direct and Indirect Effects from Alternative 2 - Proposed Action Alternative

Under this Action Alternative a prescribed burn would take place in Units A, B and C totaling over 53,000 acres of State and BLM Lands (20% BLM lands). As a part of this prescribed burn the State and Federal cooperators on this project applied and was approved for an Open Burn Permit from the Alaska DEC Division of Air Quality.

For this burn, a screening-level modeling analysis was completed using the United States Forest Service BlueSky Playground Version 3 smoke modeling tool (https://tools.airfire.org/playground/v3/emissionsinputs.php). BlueSky is a modeling framework that links a variety of independent modeling modules for fire characteristic information, fuel loading, fire consumption, smoke emissions and dispersion. The BlueSky modeling modules:

- Lookup fuels information from a spatially allocated fuels map based on project location.
    - The fuel bed was assumed to be mostly spruce and shrubs with a low moisture level (30%).
- Calculate hourly and total fire consumption based on fuel loading rates and characteristics data.
- Calculate speciated emissions for pollutants including fine particulate matter ($PM_{2.5}$) and carbon dioxide (CO_2).
- Models smoke dispersion and ambient concentrations.
    - Used National Oceanic Atmospheric Administration (NOAA) HYSPLIT for modeling air / smoke parcel transport and dispersion (https://www.arl.noaa.gov/hysplit/hysplit/).
- Used archived 12-km resolution gridded weather model data for period selected.

For Burn Units A, B, and C the total estimated emissions were:

Pollutant	***Emissions per year (in tons)***
$PM_{2.5}$	*2,719*
PM_{10}	*3,208*
CO	*29,784*
NO_X	*606*
SO_2	*285*
GHG	*530,283*

Table 3.9.1 Total Emissions for Burn Units A, B and C.

Burning within prescriptions, regulations and best management practices of the smoke management program is expected to minimize smoke emissions. Under the burn permit DEC staff will be conducting air quality monitoring during the burn. During the firing operation, smoke is not expected to impact communities surrounding the burn but will likely be seen. However, in the days and weeks after firing, smoldering is likely to cause smoke to be seen on the highways and in surrounding communities. Contingency planning for heavy smoke events after the fire is included in the outreach & communications plan. If special mitigations become necessary for health and safety concerns, actions are delineated in the smoke management plan to include notifications and safety messaging to vulnerable populations. DOT will be posting signage on the surrounding highways in coordination with ADF&G.

Short range weather forecasting is expected to mitigate smoke impacts during firing. Due to increased uncertainty of long-term weather forecasts, it is possible that smoldering and burning of additional acreage in the Project Area may increase the impact of smoke. Regulatory concern is not expected. The prescription window does require a southerly component to the wind during firing; the remote nature of the project area decreases the likelihood for intense smoke impacts to communities (closest community is Lake Louise at 28 miles south).

Clear messaging and notifications must be used prior to and during the operation to alert potential communities of smoke influence; if smoke from smoldering impacts highways, signage and highway alerts (Alaska 511 web page, DOT signs, radio) can be used to notify drivers before reaching smoke impacted stretches of road. Project personnel are unlikely to be affected by smoke during the operation; five people are expected to be in aircraft during firing and 1-2 people will be in aircraft during patrols after ignition.

The impacts to air quality from prescribed fires within the project area are expected to be temporary, localized and intermittent. Mechanical and manual treatment methods are expected to have short-term impacts on air quality from vehicle and equipment related exhaust emissions and from ground disturbing activities that result in particulate matter in the air. These emissions would be temporary and intermittent and are not expected to affect the local or regional air quality conditions in the long-term. The effects of prescribed fire can cause locally high particulate matter concentrations. This may reduce visibility temporarily in the area. Prescribed fire also emits carbon monoxide, nitrogen oxide and sulfur oxide. This would temporarily reduce air quality until the gases and particulates that make up the smoke dissipate. Emissions from prescribed fire could exceed air quality standards; however, this is regulated by the state through a state smoke management program.

3.9.4 Direct and Indirect Effect from Alternative 3

Under this action alternative the prescribed burn would only take place in Unit A totaling over 23,000 acres of State and BLM Lands (12% BLM lands). The estimated level of acres burned per day would remain the same from Alternative 2. Thus, the intensity of the impacts from this action alternative are similar to those from Alternative 2. However, the duration and effects from smoldering would be shorten by half. Below is a table estimating the emissions from a Unit A Burn.

Pollutant	Emissions per year (in tons)
$PM_{2.5}$	1,177
PM_{10}	1,389
CO	12,893
NO_X	262
SO_2	123
GHG	229,548

Table 3.9.2 Emissions from Unit A Burn Only

The details of the burn plan such as monitoring, public engagement that were described in Alternative 2 all apply equally to this alternative. The impacts to air quality from prescribed fires within the project area are expected to be temporary, localized and intermittent are not expected to affect the local or regional air quality conditions in the long-term. The effects of prescribed fire can cause locally high particulate matter concentrations. This may reduce visibility temporarily in the area. Prescribed fire also emits carbon monoxide, nitrogen oxide and sulfur oxide. This would temporarily reduce air quality until the gases and particulates that make up the smoke dissipate. Emissions from prescribed fire could exceed air quality standards; however, this is regulated by the state through a state smoke management program

3.9.5 Cumulative Effects

The emissions from past and present activities have left the project area with good levels of air quality. The proposed action will reduce the levels of air quality but only temporally. Shortly after the fires have smoldered out the air quality in the project area will return to levels similar to before the project. As required in the States burn plan air quality will be monitored during the exercise and mitigation measures listed in Appendix C will assure that this project will not have a cumulative impact to air quality in the area.

4.0 Consultation and Coordination

As lead agency for NHPA Section 106 for this project, the U.S. Fish and Wildlife Service conducted consultations with the Alaska State Historic Preservation Officer, Alaska Department of Fish and Game as well as sending consultation letters to Ahtna Inc, Gulkana Village, Gakona Village and Kluti-Kaah Village. No responding comments were received from Federally Recognized Tribes or ANCSA Corporations.

5.0 List of Preparers

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Appendices

Appendix A – Acronyms
Appendix B – References
Appendix C – Stipulations/Mitigation Measures

Appendix A – Acronyms

ACCS	Alaska Center for Conservation Science's
ADF&G	Alaska Department of Fish & Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
AKVWC	Alaska Vegetation and Wetland Composite
APE	Area of Potential Effect
ATV/UTV	All-terrain vehicle/Utility-terrain vehicle
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
DNR	Department of Natural Resources
EARMP	East Alaska Resource Management Plan
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GMU	Game Management Unit
km	Kilometers
MAP	Maximum Allowable Perimeter
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NCH	Nelchina Caribou Herd
NHPA	Nation Historic Protection Act
OHVs	Off-Highway Vehicles
ORV	Outstandingly Remarkable Values
PM 2.5	Particulate matter 2.5 microns or smaller
PM 10	Particulate matter 10 microns or smaller
SHPO	State Historic Preservation Officer
USFWS	United State Fish and Wildlife Service
WSR	Wild and Scenic River
VRM	Visual Resource Management

Appendix B – References

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Appendix C – Stipulations/Mitigation