U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Ambler Road

Draft Supplemental Environmental Impact Statement

Volume 3: Appendices L–P

Mission

To sustain the health, diversity, and productivity of public lands for the use and enjoyment of present and future generations.

Cover photograph: Middle Fork of the Koyukuk River in fall foliage.

Photograph courtesy of BLM staff

DOI-BLM-AK-F030-2016-0008-EIS

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Appendix L. Subsistence Technical Report

Note: This entire Appendix has been revised from the previous version and replaced with new content that is specific to the Supplemental EIS process only. Therefore, none of the text has been highlighted to indicate new or substantially revised text.

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List of Acronyms

AAC	Alaska Administrative Code
ADF&G	Alaska Department of Fish and Game
AIDEA	Alaska Industrial Development and Export Authority
AMDIAR	Ambler Mining District Industrial Access Road
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ATV	all-terrain vehicle
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
DMTS	Delong Mountain Transportation System
DOI	U.S. Department of the Interior
EIS	Environmental Impact Statement
FWS	U.S. Fish and Wildlife Service
GAAR	Gates of the Arctic National Park and Preserve
GMU	Game Management Unit
GPS	Global positioning system
HHH	Hodzana Hills Caribou Herd
NPS	National Park Service
ROW	Right-of-way
SLM	small land mammals
SRB&A	Stephen R. Braund & Associates
TH	Teshekpuk Herd
WAH	Western Arctic Caribou Herd
WG	Working Group

1. Introduction

The Alaska Industrial Development and Export Authority (AIDEA) is proposing to construct an all-season industrial access transportation corridor extending from the Dalton Highway to the Ambler Mining District in Northwest Alaska. The road would provide access for exploration and development of the Ambler Mining District and is referred to as the Ambler Mining District Industrial Access Road (AMDIAR). In 2020, the Bureau of Land Management (BLM) developed an Environmental Impact Statement (EIS) in response to a right-of-way (ROW) application from AIDEA. The final EIS analyzed the potential impacts of the road on physical characteristics, biological resources, and social systems, including subsistence uses and resources. In February 2022, after identifying deficiencies in the original EIS, the U.S. Department of the Interior (DOI) was granted a voluntary remand and is preparing a Supplemental EIS to address the identified deficiencies. This Subsistence Technical Report has been prepared to inform the affected environment and environmental consequences section of the Ambler Road Supplemental EIS. The report provides an overview of subsistence uses in potentially affected communities and regions, in addition to a discussion of the potential impacts of the AMDIAR on subsistence resources and uses.

2. Study Area

The subsistence study area for the Ambler Road Supplemental EIS includes communities that harvest subsistence resources within or near the project area, use project area to access subsistence use areas, or harvest resources that migrate through the project area and are later harvested elsewhere. For the purposes of the subsistence analysis, the study communities include any community located within 50 miles of one more of the project alternatives, and any community with documented subsistence use areas within 30 miles of one or more of the project alternatives. These criteria aim to capture communities that may experience direct or indirect impacts on their subsistence uses resulting from construction and operation of the AMDIAR. Based on the criteria, there are 27 primary subsistence study communities (see Table 1 and Map 1). The subsistence study communities are grouped into five primary regions based on their location. These regions include Kobuk River region, Kotzebue Sound region, Koyukuk River region, Tanana River region, and Yukon River region. In addition, the project is within the range of the Western Arctic Caribou Herd (WAH), a highly migratory and important subsistence resource to communities in Western and Northwestern Alaska. This section includes a separate subset of the 42 members of the WAH Working Group (WG) (Map 1); these caribou subsistence study communities are referred to as the WAH study communities and include 16 of the subsistence study communities listed in Table 1. Inclusion of the WAH study communities captures potential indirect or cumulative impacts to communities who use caribou that migrate through the project area and are later harvested elsewhere. Finally, the project crosses tributaries of several river basins, including the Kobuk-Selawik River, Koyukuk River, and Yukon River basins. Thirty-two communities are located downstream from these tributaries and harvest fish which could be affected by the project. These 32 fish study communities overlap with 15 of the primary subsistence study communities, and 15 of the caribou subsistence study communities (see Appendix F, Table 15). Data presented for the fish study communities are focused on the three key subsistence species (Chinook salmon, chum salmon, and sheefish) with the greatest likelihood to experience downstream effects due to the presence of key spawning grounds for those species in the project area.

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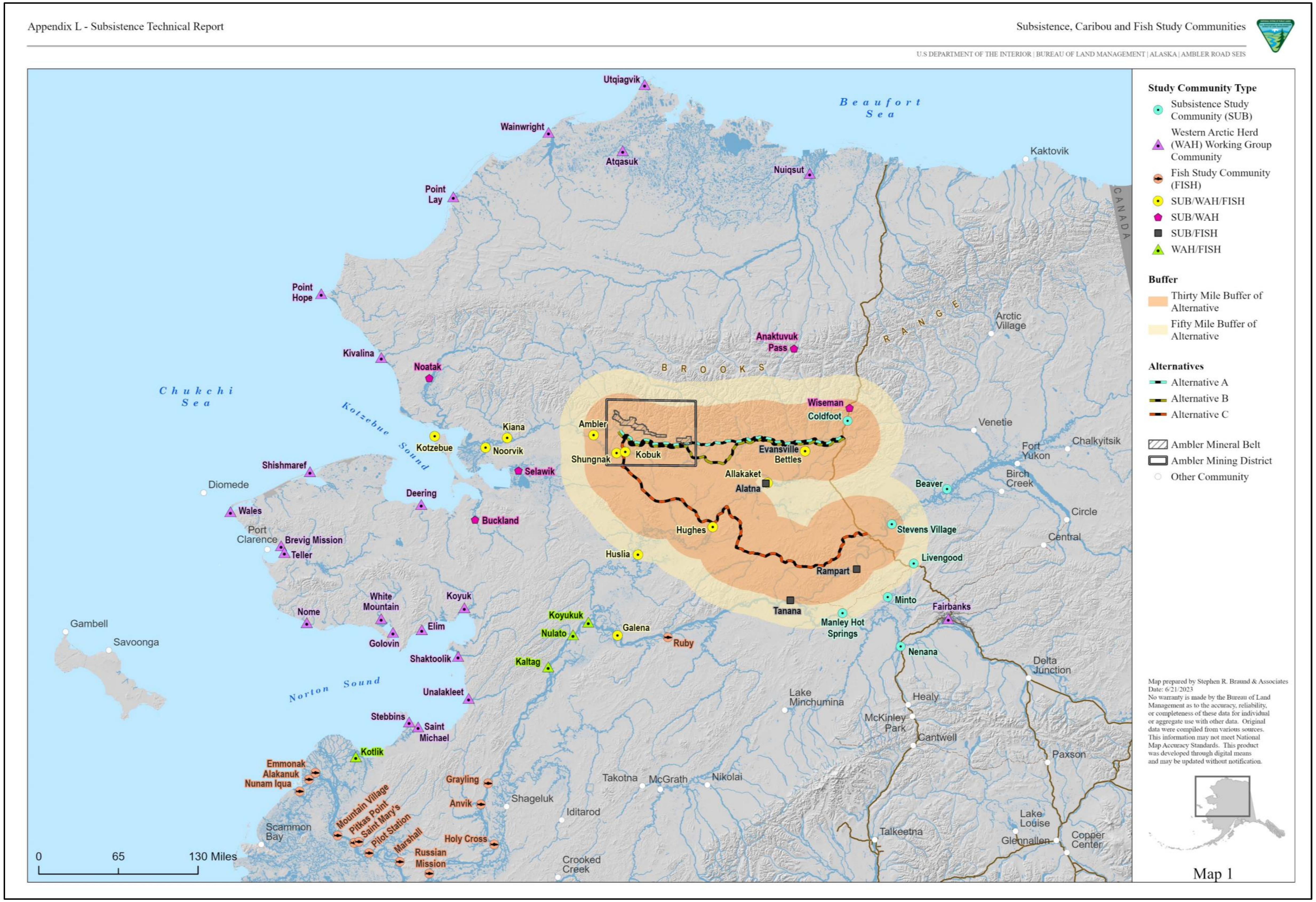

Map 1. Subsistence, Western Arctic Caribou Herd, and Fish study communities

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Table 1. Ambler Road EIS subsistence, WAH WG, and Fish study communities

Study community number	Study community	Study community type	Community within 50 miles	Community use areas overlap the project	Community use areas within 30 miles	Member of WAH WG
1	Beaver	SUB	No	No	Yes	No
2	Coldfoot	SUB	Yes	Yes	Yes	No
3	Livengood	SUB	Yes	No	No	No
4	Manley Hot Springs	SUB	Yes	No	Yes	No
5	Minto	SUB	Yes	No	Yes	No
6	Nenana	SUB	No	No	Yes	No
7	Stevens Village	SUB	Yes	Yes	Yes	No
8	Alatna	SUB/FISH	Yes	Yes	Yes	Yes
9	Evansville	SUB/FISH	Yes	Yes	Yes	No
10	Rampart	SUB/FISH	Yes	Yes	Yes	No
11	Tanana	SUB/FISH	Yes	Yes	Yes	No
12	Anaktuvuk Pass	SUB/WAH	No	Yes	Yes	Yes
13	Buckland	SUB/WAH	No	No	Yes	Yes
14	Noatak	SUB/WAH	No	No	Yes	Yes
15	Selawik	SUB/WAH	No	Yes	Yes	Yes
16	Wiseman	SUB/WAH	Yes	Yes	Yes	Yes
17	Allakaket	SUB/WAH/FISH	Yes	Yes	Yes	Yes
18	Ambler	SUB/WAH/FISH	Yes	Yes	Yes	Yes
19	Bettles	SUB/WAH/FISH	Yes	Yes	Yes	Yes
20	Galena	SUB/WAH/FISH	No	Yes	Yes	Yes
21	Hughes	SUB/WAH/FISH	Yes	Yes	Yes	Yes
22	Huslia	SUB/WAH/FISH	Yes	No	No	Yes
23	Kiana	SUB/WAH/FISH	No	Yes	Yes	Yes
24	Kobuk	SUB/WAH/FISH	Yes	Yes	Yes	Yes
25	Kotzebue	SUB/WAH/FISH	No	No	Yes	Yes
26	Noorvik	SUB/WAH/FISH	No	No	Yes	Yes
27	Shungnak	SUB/WAH/FISH	Yes	Yes	Yes	Yes
28	Alakanuk	FISH	No	No	No	No
29	Anvik	FISH	No	No	No	No
30	Emmonak	FISH	No	No	No	No
31	Grayling	FISH	No	No	No	No
32	Holy Cross	FISH	No	No	No	No
33	Marshall	FISH	No	No	No	No
34	Mountain Village	FISH	No	No	No	No
35	Nunam Iqua	FISH	No	No	No	No
36	Pilot Station	FISH	No	No	No	No

Study community number	Study community	Study community type	Community within 50 miles	Community use areas overlap the project	Community use areas within 30 miles	Member of WAH WG
37	Pitka's Point	FISH	No	No	No	No
38	Ruby	FISH	No	No	No	No
39	Russian Mission	FISH	No	No	No	No
40	St. Mary's	FISH	No	No	No	No
41	Atqasuk	WAH	No	No	No	Yes
42	Brevig Mission	WAH	No	No	No	Yes
43	Deering	WAH	Yes	No	No	Yes
44	Elim	WAH	Yes	No	No	Yes
45	Fairbanks	WAH	No	No	No	Yes
46	Golovin	WAH	Yes	No	No	Yes
47	Kivalina	WAH	Yes	No	No	Yes
48	Koyuk	WAH	Yes	No	No	Yes
49	Nome	WAH	No	No	No	Yes
50	Nuiqsut	WAH	No	No	No	Yes
51	Point Hope	WAH	No	No	No	Yes
52	Point Lay	WAH	No	No	No	Yes
53	Shaktoolik	WAH	No	No	No	Yes
54	Shishmaref	WAH	No	No	No	Yes
55	St. Michael	WAH	No	No	No	Yes
56	Stebbins	WAH	No	No	No	Yes
57	Teller	WAH	No	No	No	Yes
58	Unalakleet	WAH	No	No	No	Yes
59	Utqiagvik	WAH	No	No	No	Yes
60	Wainwright	WAH	No	No	No	Yes
61	Wales	WAH	No	No	No	Yes
62	White Mountain	WAH	Yes	No	No	Yes
63	Kaltag	WAH/FISH	No	No	No	Yes
64	Kotlik	WAH/FISH	No	No	No	Yes
65	Koyukuk	WAH/FISH	No	No	No	Yes
66	Nulato	WAH/FISH	No	No	No	Yes

Notes: SUB = Subsistence Study Community; WAH=Western Arctic Caribou Herd Working Group Study Community; FISH = Fish Study Community

3. Subsistence Definition and Regulatory Setting

Subsistence uses are central to the customs and traditions of indigenous peoples in Alaska. Subsistence customs and traditions encompass processing, sharing networks, cooperative and individual hunting, fishing, gathering, and ceremonial activities. These activities are guided by traditional knowledge based on a long-standing relationship with the environment. Both federal and state regulations define subsistence uses to include the customary and traditional uses of wild renewable resources for food, shelter, fuel, clothing, and other uses (Alaska National Interest Lands Conservation Act [ANILCA], Title VIII, Section 803, and Alaska Statute 16.05.940[33]). The Alaska Federation of Natives views subsistence to not only encompass the practices of hunting, fishing, and gathering but as a way of life that has sustained Alaska Natives for thousands of years and a set of values associated with those practices (Alaska Federation of Natives 2012).

Subsistence fishing and hunting are traditional activities that include transmission of traditional knowledge between generations, maintain the connection of people to their land and environment, and support healthy diet and nutrition in rural communities in Alaska. The Alaska Department of Fish and Game (ADF&G) estimates that the annual wild food harvest in rural areas Interior Alaska is approximately 6.4 million pounds or 613 pounds per person per year, and in the Arctic it is approximately 10.5 million pounds or 516 pounds per person per year (Wolfe 2000). Subsistence harvest levels vary widely among individuals in a community, from one community to the next, and from year to year. Sharing of subsistence foods is common in rural Alaska and can exceed 80 percent of households giving or receiving resources (ADF&G 2019). Sharing does not just occur between households within a community; sharing is based on social and kinship ties, which form complex social networks that connect communities and regions. Documentation of social networks for just three communities in the Upper Kobuk Region documented sharing ties that extended from Northwest Alaska to the major urban centers of Alaska, the North Slope, other Northwest communities, Southeast, Southwest, and Interior Alaska, during a single study year (Braem, Mikow, Wilson, and Kostick 2015). Sharing activities strengthen and affirm kinship and social ties, and are integral to maintaining the cultural identity of subsistence users. The term harvest and its variants – harvesters and harvested – are used as the inclusive term to characterize the broad spectrum of subsistence activities, including hunting, fishing, trapping, and gathering.

Subsistence is part of a rural economic system called a “mixed, subsistence-market” economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods (Wolfe 2000). According to Wolfe and Walker (1987), fishing and hunting for subsistence resources provides a reliable economic base for rural regions; these important activities are conducted by domestic family groups who have invested in subsistence equipment such as fish wheels, gillnets, motorized skiffs, rifles, traps, all-terrain vehicles (ATVs), and snowmachines. Subsistence is not oriented toward sales, profits, or capital accumulation (commercial market production) but is focused toward meeting the self-limiting needs of families and their extended kin and communities. Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from activities such as commercial fishing, trapping, and/or wages from public sector employment, construction, firefighting, oil and gas industry, or other services) provides the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker 1987). Data show that subsistence in rural Alaska has remained stable over time, with the exception of some regional variation, regardless of income levels (Burnsilver et al. 2016). Thus, while the mixed cash economy is an important feature of subsistence in Alaska, economic growth or decline is not necessarily associated with corresponding increases or decreases in subsistence harvests.

Participation in subsistence activities promotes transmission of traditional knowledge from generation to generation and serves to maintain peoples’ connection to the physical and biological environment. The subsistence way of life encompasses cultural values such as sharing, respect for elders, respect for the environment, hard work, and humility. In addition to being culturally important, subsistence is a critical source of nutrition for residents in areas of Alaska where food prices are high. While some people earn income from employment, these and other residents rely on subsistence to sustain them throughout the year and, as noted above, use money from the cash economy to support subsistence activities.

Furthermore, subsistence activities support a healthy diet and contribute to residents' and communities' social, spiritual, and physical well-being.

In the State of Alaska, subsistence is regulated in multiple ways including federal and state regulations and local traditions, norms, and values that guide subsistence hunting and fishing practices. The AMDIAR is located on state, federal (BLM, National Park Service [NPS], and U.S. Fish and Wildlife Service [FWS]), and private (including Native corporation) lands. The federal and state governments regulate subsistence hunting and fishing in the state under a dual-management system. The federal government recognizes subsistence priorities for rural residents on federal public lands, while Alaska considers all residents to have an equal right to hunt and fish when resource abundance and harvestable surpluses are sufficient to meet the demand for all subsistence and other uses.

The U.S. Congress adopted ANILCA recognizing that "the situation in Alaska is unique" regarding food supplies and subsistence practices. ANILCA specifies that any decision to withdraw, reserve, lease, or permit the use, occupancy, or disposition of public lands must evaluate the effects of such decisions on subsistence uses and needs (16 U.S. Code 3111–3126). In 1990, the U.S. Department of the Interior (DOI) and the U.S. Department of Agriculture established a Federal Subsistence Board to administer the Federal Subsistence Management Program (55 Federal Register 27114). The Federal Subsistence Board, under Title VIII of ANILCA and regulations at 36 Code of Federal Regulations (CFR) 242.1 and 50 CFR 100.1, recognizes and regulates subsistence practices for rural residents on federal lands. Federal regulations recognize subsistence activities based on a person's residence in Alaska, defined as either rural or nonrural. Only individuals who permanently reside outside federally designated nonrural areas are considered rural residents and qualify for subsistence harvesting on federal lands under federal subsistence regulations. Nonrural residents may harvest fish and game on most federal lands (unless these are closed to non-federally qualified subsistence uses), but these harvests occur under state regulations. The Fairbanks nonrural area is the closest nonrural area to the project area. All of the 27 subsistence study communities are located outside federal nonrural areas and therefore are qualified as subsistence users on most federal lands.

The Alaska Board of Fisheries and the Alaska Board of Game have adopted regulations enforced by the state for subsistence fishing and hunting on all state lands (except nonsubsistence areas) and waters, and private lands, including those lands conveyed to Alaska Native Claims Settlement Act (ANCSA) groups. State law is based on Alaska Statute 16 and Title 5 of the Alaska Administrative Code (AAC) (05 AAC 01, 02, 85, 92, and 99) and regulates state subsistence uses. Under Alaska law, when there is sufficient harvestable surplus to provide for all subsistence and other uses, all Alaskan residents qualify as eligible subsistence users.

The state distinguishes subsistence harvests from personal use, general hunting, sport, or commercial harvests based on where the harvest occurs and the resource being harvested, not where the harvester resides (as is the case under federal law). More specifically, state law provides for subsistence hunting and fishing regulations in areas outside the boundaries of "nonsubsistence areas," as defined in state regulations (5 AAC 99.015). According to these regulations, a nonsubsistence area is "an area or community where dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area or community" (5 AAC 99.016).

Activities permitted in these nonsubsistence areas include general hunting and personal use, sport, guided sport, and commercial fishing. There is no subsistence priority in these areas; therefore, no subsistence hunting or fishing regulations manage the harvest of resources. The closest state nonsubsistence area to the project is the Fairbanks Nonsubsistence Area. The entire project lies outside state nonsubsistence areas and therefore hunting and fishing on state lands in the project area may qualify as subsistence under state regulations.

4. Data Sources

Sources of subsistence data for the study communities are provided in Table 2, which shows data that can be incorporated into subsistence use area maps, tables, and figures discussed in Section 5, Overview of Subsistence Uses. Additional data on subsistence include ethnographic studies on harvest methods, Indigenous knowledge (IK) studies, or subsistence studies which are specific to a geographic area or season. These sources are not shown in Table 2 because they include data which are not comparable to other comprehensive data sources within the region or because they provide qualitative information that were not in a format to incorporate into study maps, tables, or figures.

This document incorporates IK throughout the document to provide context, additional information, or to fill in gaps in data. The review of IK was not exhaustive, instead relying on recent scoping testimony and meeting transcripts associated with the Project or regional wildlife and subsistence management. Sources of IK reviewed for this document include newsletters and meeting minutes for the Ambler Access Project Subsistence Advisory Committee (AIDEA 2022, 2023), government-to-government consultation for the project (Alatna Tribal Council 2022; Allakaket Tribal Council 2022; Evansville Village Council 2022); and meeting transcripts for Regional Subsistence Advisory Committees in the Northwest Arctic and Western Interior regions (Northwest Arctic Subsistence Regional Advisory Council 2022a, 2022b, 2023; Western Interior Federal Subsistence Regional Advisory Council 2022a, 2022b).

4.1. Harvest Data

Harvest data for the study communities are available primarily through the ADF&G, Division of Subsistence, although other agencies or entities have periodically conducted subsistence harvest studies in the region. Harvest data provide quantitative estimates of the amount of fish and game harvested by each study community, by subsistence species, in addition to household-level harvest and participation rates. They are useful for analyzing community harvests and uses (e.g., household participation and sharing) over time, for determining community harvest levels by species, and for comparing subsistence resources to one another in terms of household uses and harvests. Harvest data accuracy depends on various factors, including survey sample sizes and the accuracy of harvester recall. However, they are generally the only source of information for quantitative community-wide harvests for all resources and are collected throughout Alaska. Subsistence harvests and uses can vary widely from year to year based on a variety of factors, including resource availability, harvest regulations, and environmental conditions. Thus, estimated harvest data may under- or overestimate overall uses of subsistence resources by community households.

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Table 2. Subsistence data sources for Ambler Road EIS subsistence study communities

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Alatna	(ADF&G 2019)	ALL	1983	N/D	N/D	N/D	N/D
Alatna	(ADF&G 2019)	ALL	1984	N/D	N/D	N/D	N/D
Alatna	(Andersen, Brown, Walker, and Elkin 2004a)	NSF	2002	NSF	2002	N/D	N/D
Alatna	(Andersen, Brown, Walker, and Jennings 2004b)	LLM	2001-02	LLM	2001-02	N/D	N/D
Alatna	(Andersen, Utermohle, and Brown 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Alatna	(Andersen, Utermohle, and Brown 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Alatna	(Andersen, Utermohle, and Jennings 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Alatna	(Brown, Walker, and Vanek 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Alatna	(Clark and Clark 1978)	N/D	N/D	ALL	1961-62, 1968	N/D	N/D
Alatna	(Holen, Hazell, and Koster 2012)	ALL	2011	LLM	2011	Bears, SLM, Migratory Birds, Berries	2011
Alatna	(Jones, Arundale, Moses, Nictune, Simon, Williams, William, Henzie, William, Ambrose, Williams, and Beetus 1997)	N/D	N/D	N/D	N/D	ALL	Traditional
Alatna	(Marcotte and Haynes 1985)	ALL	1982	ALL	1982	ALL	1981-1982 1981-83
Alatna	(Ristroph, Allakaket Tribal Council, and Alatna Tribal Council 2019)	N/D	N/D	N/D	N/D	ALL	Traditional
Alatna	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015
Alatna	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2012
Alatna	(YRDFA 2008)	N/D	N/D	ALL	Historic	N/D	N/D
Allakaket	(ADF&G 2019)	ALL	1983	N/D	N/D	N/D	N/D
Allakaket	(ADF&G 2019)	ALL	1984	N/D	N/D	N/D	N/D
Allakaket	(Andersen et al. 2004a)	NSF	2002	NSF	2002	N/D	N/D

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Allakaket	(Andersen et al. 2004b)	LLM	2001-02	LLM	2001-02	N/D	N/D
Allakaket	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Allakaket	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Allakaket	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Allakaket	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Allakaket	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Allakaket	(Jones et al. 1997)	N/D	N/D	N/D	N/D	ALL	Traditional
Allakaket	(Marcotte and Haynes 1985)	ALL	1982	ALL	1982	ALL	1981-1982 1981-83
Allakaket	(Ristroph et al. 2019)	N/D	N/D	N/D	N/D	ALL	Traditional
Allakaket	(SRB&A 2016)	N/D	N/D	ALL	2006-2016	ALL	2006-2015
Allakaket	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2012
Allakaket	(YRDFA 2008)	N/D	N/D	ALL	Historic	N/D	N/D
Ambler	(ADF&G 2019)	LLM, SLM	2003	N/D	N/D	N/D	N/D
Ambler	(Anderson, Anderson, Bane, Nelson, and Towarak 1998)	N/D	N/D	ALL	1974-1975	N/D	N/D
Ambler	(Braem 2012a)	LLM, SLM	2009-10	Moose, Caribou	2009-10	N/D	N/D
Ambler	(Braem et al. 2015)	ALL	2012	ALL	2012	ALL	2012
Ambler	(Braem, Godduhn, Mikow, Brenner, Trainor, Wilson, and Kostick 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Ambler	(Georgette 2000)	Birds	1997	N/D	N/D	N/D	N/D
Ambler	(Schroeder, Anderson, and Hildreth 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca 1925-1985
Ambler	(Watson 2018)	N/D	N/D	ALL	Post-1958	ALL	Lifetime to 2016
Anaktuvuk Pass	(Adams, Stephenson, Dale, Ahgook, and Demma 2008)	Wolves	1986-1991	N/D	N/D	N/D	N/D

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Anaktuvuk Pass	(Bacon, Hepa, Brower, Pederson, Olemaun, George, and Corrigan 2009)	ALL	1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03	ALL	1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03	N/D	N/D
Anaktuvuk Pass	(Brower and Opie 1996)	ALL	1994-95	ALL	1994-95	N/D	N/D
Anaktuvuk Pass	(Brown, Braem, Mikow, Trainor, Slayton, Runfola, Ikuta, Kostick, McDevitt, Park, and Simon 2016)	ALL	2014	LLM, SLM, Birds	2014	ALL	2014
Anaktuvuk Pass	(Fuller and George 1999)	ALL	1992	ALL	1992	N/D	N/D
Anaktuvuk Pass	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Anaktuvuk Pass	(Pedersen 1979)	N/D	N/D	N/D	N/D	ALL	Lifetime Pre-1979
Anaktuvuk Pass	(Pedersen and Hugo 2005)	Fish	2001-02, 2002-03	Fish	2001-02, 2002-03	Fish	2001-02, 2002-03
Anaktuvuk Pass	(Pedersen and Nageak 2009)	Caribou	2006-07	Caribou	2006-07	Caribou	2006-07
Anaktuvuk Pass	(Pedersen and Opie 1991)	Caribou	1990-91	N/D	N/D	N/D	N/D
Anaktuvuk Pass	(Pedersen and Opie 1992)	Caribou	1991-92	N/D	N/D	N/D	N/D
Anaktuvuk Pass	(Pedersen and Opie 1994)	Caribou	1993-94	N/D	N/D	N/D	N/D
Anaktuvuk Pass	(Spearman, Pedersen, and Brown 1979)	N/D	N/D	ALL	General	N/D	N/D
Anaktuvuk Pass	(SRB&A 2013)	N/D	N/D	ALL	2001-2010	ALL	2001-2010
Beaver	(Andersen and Jennings 2001)	Birds	2000	Bird	2000	N/D	N/D
Beaver	(Brown and Godduhn 2015)	N/D	N/D	N/D	N/D	Salmon[a]	2010

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Beaver	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Beaver	(Koskey and Mull 2011)	NSF	2005	NSF	2005	N/D	N/D
Beaver	(SRB&A 2007)	N/D	N/D	ALL	1997-2006	ALL	1997-2006
Beaver	(Stevens and Maracle n.d.)	LLM, SLM	2010-11	LLM, SLM	2010-11	N/D	N/D
Beaver	(Sumida 1989)	ALL	1984-85	ALL	1985	ALL	1930-86
Beaver	(Van Lanen, Stevens, Brown, Maracle, and Koster 2012)	LLM, SLM	2008-09, 2009-10	LLM, SLM	2008-09, 2009-10	N/D	N/D
Bettles	(ADF&G 2019)	ALL	1983	N/D	N/D	N/D	N/D
Bettles	(ADF&G 2019)	ALL	1984	N/D	N/D	N/D	N/D
Bettles	(Andersen et al. 2004a)	NSF	2002	NSF	2002	N/D	N/D
Bettles	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Bettles	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Bettles	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Bettles	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Bettles	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Bettles	(Marcotte and Haynes 1985)	ALL	1982	ALL	1982	ALL	1981-82 1981-83
Bettles	(SRB&A 2016)	N/D	N/D	ALL	2006-2016	ALL	2006-2015
Bettles	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2016
Buckland	(Braem 2012a)	LLM, SLM	2009-10	LLM, SLM	2009-10	N/D	N/D
Buckland	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Buckland	(Georgette 2000)	Birds	1996	N/D	N/D	N/D	N/D
Buckland	(Gonzalez, Mikow, and Kostick 2018)	LLM, SLM	2016-17	LLM, SLM	2016-17	N/D	N/D
Buckland	(Kevin Waring Associates 1992)	N/D	N/D	Beluga, Caribou, Fish	c. 1980	N/D	N/D
Buckland	(Magdanz, Smith, Braem, and Koster 2011a)	ALL	2003	N/D	N/D	N/D	N/D

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Buckland	(Mikow and Cunningham 2020)	ALL	2018	LLM. SLM, MM, Birds	2018	ALL	2018
Buckland	(Satterthwaite-Phillips, Christopher Krenz, Glenn Gray, and Dodd 2016)	N/D	N/D	N/D	N/D	ALL[a]	Lifetime to 2014
Buckland	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca 1925-1985
Coldfoot	(Holen et al. 2012)	ALL	2011	N/D	N/D	ALL	2011
Coldfoot	(SRB&A 2016)	N/D	N/D	ALL	2005-2014	ALL	2005-2014
Evansville	(ADF&G 2019)	ALL	1983	N/D	N/D	N/D	N/D
Evansville	(ADF&G 2019)	ALL	1984	N/D	N/D	N/D	N/D
Evansville	(Andersen et al. 2004a)	NSF	2002	NSF	2002	N/D	N/D
Evansville	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Evansville	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Evansville	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Evansville	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Evansville	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Evansville	(Marcotte and Haynes 1985)	ALL	1982	ALL	1982	ALL	1981-1982 1981-83
Evansville	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015
Evansville	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2016
Galena	(ADF&G 2019)	LLM	1996 -97	N/D	N/D	N/D	N/D
Galena	(Andersen et al. 2004b)	LLM	2001-02	LLM	2001-02	N/D	N/D
Galena	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Galena	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Galena	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Galena	(Brown, Koester, and Koontz 2010)	NSF	2006	NSF	2006	NSF[a]	2006

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Galena	(Brown, Brenner, Ikuta, Mikow, Retherford, Slayton, Trainor, Park, Koster, and Kostick 2015)	All	2010	LLM, SLM, Birds	2010	ALL	2010
Galena	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Galena	(Marcotte 1988)	ALL	1985-1986	N/D	N/D	Fish	1986
Galena	(Robert and Andrews 1984)	N/D	N/D	Furbearers	1981-82	N/D	N/D
Hughes	(Andersen et al. 2004a)	NSF	2002	NSF	2002	N/D	N/D
Hughes	(Marcotte and Haynes 1985)	ALL	1982	ALL	1982	ALL	1981-1982; 1981-83
Hughes	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2016
Hughes	(Webb 1999)	Migratory Birds	1998	N/D	N/D	N/D	N/D
Hughes	(Webb and Koyukuk/Nowitna Refuge Complex (U.S.) 2000)	Migratory Birds	1998-99	N/D	N/D	N/D	N/D
Hughes	(Wilson and Kostick 2016)	ALL	2014	LLM, SLM, Birds	2014	ALL	2014
Hughes	(YRDFA 2008)	N/D	N/D	ALL	Historic	N/D	N/D
Huslia	(Andersen et al. 2004a)	NSF	2002	NSF	2002	N/D	N/D
Huslia	(Andersen et al. 2004b)	LLM	2001-02	LLM	2001-02	N/D	N/D
Huslia	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Huslia	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Huslia	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Huslia	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Huslia	(Marcotte 1986)	ALL	1983	ALL	1983	ALL	1981-83
Huslia	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2016
Kiana	(ADF&G 2019)	LLM, SLM	1999	N/D	N/D	N/D	N/D
Kiana	(Anderson et al. 1998)	N/D	N/D	ALL	1974-1975	N/D	N/D
Kiana	(Braem 2012a)	LLM, SLM	2009-10	Moose, Caribou	2009-10	N/D	N/D

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Kiana	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Kiana	(Georgette 2000)	Birds	1996	N/D	N/D	N/D	N/D
Kiana	(Magdanz, Koster, Naves, and Fox 2011b)	ALL	2006	N/D	N/D	N/D	N/D
Kiana	(Magdanz et al. 2011a)	Fish	1994-2004	N/D	N/D	N/D	N/D
Kiana	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca. 1925-1986
Kiana	(Wolfe and Paige 1995)	Birds	1993	N/D	N/D	N/D	N/D
Kobuk	(ADF&G 2019)	LLM, SLM	2004	N/D	N/D	N/D	N/D
Kobuk	(Anderson et al. 1998)	N/D	N/D	ALL	1974-1975	N/D	N/D
Kobuk	(Braem 2012a)	LLM, SLM	2009-10	Moose, Caribou	2009-10	N/D	N/D
Kobuk	(Braem et al. 2015)	ALL	2012	ALL	ca. 2012	ALL	2012
Kobuk	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Kobuk	(Georgette 2000)	Birds	1996-1997	N/D	N/D	N/D	N/D
Kobuk	(Magdanz et al. 2011a)	Fish	1994-2004	N/D	N/D	N/D	N/D
Kobuk	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca. 1925-1985
Kobuk	(Watson 2018)	N/D	N/D	N/D	N/D	ALL	Lifetime to 2016
Kotzebue	(Braem, Mikow, Brenner, Godduhn, Retherford, and Kostick 2017)	ALL	2014	LLM, SLM, Birds	2014	ALL	2014
Kotzebue	(Georgette and Loon 1993)	ALL	1986	ALL	1986	N/D	N/D
Kotzebue	(Georgette 2000)	Birds	1997	N/D	N/D	N/D	N/D
Kotzebue	(Godduhn, Braem, and Kostick 2014)	LLM, SLM	2012 - 2013	N/D	N/D	N/D	N/D
Kotzebue	(Magdanz, Georgette, and Evak 1995)	ALL	1991	N/D	N/D	N/D	N/D
Kotzebue	(Mikow and Kostick 2016)	LLM, SLM	2013 - 2014	N/D	N/D	N/D	N/D
Kotzebue	(Naves and Braem 2014)	Birds	2012	N/D	N/D	N/D	N/D
Kotzebue	(Satterthwaite-Phillips et al. 2016)	N/D	N/D	N/D	N/D	ALL[a]	Lifetime to 2014

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Kotzebue	(Whiting 2006)	ALL	2002-2004	N/D	N/D	N/D	N/D
Manley Hot Springs	(ADF&G 2019)	LLM, Fish	2004	N/D	N/D	N/D	N/D
Manley Hot Springs	(Betts 1997)	N/D	N/D	ALL	General	ALL	1975-1995
Manley Hot Springs	(Brown, Slayton, Trainor, Koster, and Kostick 2014)	ALL	2012	N/D	N/D	ALL	2012
Minto	(ADF&G 2019)	LLM, SLM, NSF	2004	N/D	N/D	N/D	N/D
Minto	(Andrews 1988)	ALL	1983-84	ALL	1960-84	ALL	1960-84
Minto	(Andrews and Napoleon 1985)	N/D	N/D	N/D	N/D	Moose	1960-85
Minto	(Brown et al. 2014)	ALL	2012	N/D	N/D	ALL	2012
Minto	(Marcotte and Haynes 1985)	NSF	1994	N/D	N/D	N/D	N/D
Minto	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015
Nenana	(ADF&G 2019)	NSF, LLM, SLM	2004	N/D	N/D	N/D	N/D
Nenana	(Brown and Kostick 2017)	ALL	2015	N/D	N/D	ALL	2015
Nenana	(Shinkwin and Case 1984)	N/D	N/D	N/D	N/D	ALL	1981-1982
Nenana	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015
Noatak	(ADF&G 2019)	ALL	1994	N/D	N/D	N/D	N/D
Noatak	(ADF&G 2019)	LLM, SLM	1999	N/D	N/D	N/D	N/D
Noatak	(ADF&G 2019)	LLM, SLM	2002	N/D	N/D	N/D	N/D
Noatak	(Braem and Kostick 2014)	LLM, SLM	2010-11	Caribou	2010-11	N/D	N/D
Noatak	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Noatak	(Georgette 2000)	Birds	1997	N/D	N/D	N/D	N/D
Noatak	(Magdanz, Braem, Robbins, and Koster 2010)	ALL	2007	N/D	N/D	ALL	2007
Noatak	(Mikow, Braem, and Kostick 2014)	LLM, SLM	2011-12	Caribou	2011-12	N/D	N/D

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Noatak	(Satterthwaite-Phillips et al. 2016)	N/D	N/D	N/D	N/D	ALL[a]	Lifetime to 2014
Noatak	(SRB&A 2009)	N/D	N/D	ALL	1998-2007	ALL	1998-2007
Noatak	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca 1925-1985
Noorvik	(ADF&G 2019)	LLM, SLM	2002	N/D	N/D	N/D	N/D
Noorvik	(Anderson et al. 1998)			ALL	1974-1975	N/D	N/D
Noorvik	(Braem 2012b)	LLM, SLM	2008-09	LLM, SLM	2008-09	N/D	N/D
Noorvik	(Braem et al. 2017)	ALL	2012	LLM, SLM, Birds	2012	ALL	2012
Noorvik	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Noorvik	(Georgette 2000)	Birds	1996	N/D	N/D	N/D	N/D
Noorvik	(Satterthwaite-Phillips et al. 2016)	N/D	N/D	N/D	N/D	ALL[a]	Lifetime to 2014
Noorvik	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca 1925-1985
Rampart	(ADF&G 2023)	LLM, SLM, NSF	1999	N/D	N/D	N/D	N/D
Rampart	(Andersen and Jennings 2001)	Birds	2000	Birds	N/D	N/D	N/D
Rampart	(Betts 1997)	N/D	N/D	ALL	General	ALL	1975-1995
Rampart	(Brown et al. 2016)	ALL	2014	LLM, SLM, Birds	2014	ALL	2014
Selawik	(ADF&G 2023)	LLM, SLM, NSF	2006	N/D	N/D	N/D	N/D
Selawik	(ADF&G 2023)	LLM, SLM	1998	N/D	N/D	N/D	N/D
Selawik	(Braem, Fox, Magdanz, and Koster 2013)	ALL	2010-11	LLM, SLM, Birds	2010-11	ALL	2010-11
Selawik	(Braem et al. 2018)	Salmon, NSF	2013-2014	N/D	N/D	N/D	N/D
Selawik	(Georgette 2000)	Birds	1997-1998	N/D	N/D	N/D	N/D
Selawik	(Satterthwaite-Phillips et al. 2016)	N/D	N/D	N/D	N/D	ALL[a]	Lifetime to 2014

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Selawik	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime (ca. 1925-1985)
Selawik	(Wolfe and Paige 2002)	Birds	1993	N/D	N/D	N/D	N/D
Shungnak	(Andersen and Jennings 2001)	Birds	2000	Birds	2000	N/D	N/D
Shungnak	(Braem 2012b)	LLM, SLM	2008-09	Caribou	2008-09	N/D	N/D
Shungnak	(Braem et al. 2015)	ALL	2012	ALL	ca. 2012	ALL	2012
Shungnak	(Braem et al. 2018)	Salmon, NSF	2012-2014	N/D	N/D	N/D	N/D
Shungnak	(Magdanz, Walker, and Paciorek 2004)	ALL	2002	N/D	N/D	N/D	N/D
Shungnak	(Schroeder et al. 1987)	N/D	N/D	N/D	N/D	ALL	Lifetime ca 1925-1985
Shungnak	(Watson 2018)	N/D	N/D	ALL	pre-1958	ALL	Lifetime to 2016
Shungnak	(Wolfe and Paige 1995)	Birds	1993	N/D	N/D	N/D	N/D
Stevens Village	(ADF&G 2019)	LLM	1996	N/D	N/D	N/D	N/D
Stevens Village	(Brown et al. 2016)	ALL	2014	SLM, Birds	2014	N/D	N/D
Stevens Village	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015
Stevens Village	(Stevens and Maracle n.d.)	LLM, SLM	2010-11	LLM, SLM	2010-11	N/D	N/D
Stevens Village	(Sumida 1988)	ALL	1983-84	ALL	N/D	ALL	1974-1984
Stevens Village	(Sumida and Alexander 1985)	N/D	N/D	Selected	1984	Moose, Furbearers	1974-1984
Stevens Village	(Van Lanen et al. 2012)	LLM, SLM	2008-09, 2009-10	LLM, SLM	2008-09, 2009-10	N/D	N/D
Stevens Village	(Wolfe and Scott 2010)	LLM, Fish	2008	N/D	N/D	N/D	N/D
Tanana	(Andersen et al. 1998)	LLM	1997-98	LLM	1997-98	N/D	N/D
Tanana	(Andersen et al. 2000)	LLM	1998-99	LLM	1998-99	N/D	N/D
Tanana	(Andersen et al. 2001)	LLM	1999-00	LLM	1999-00	N/D	N/D
Tanana	(Brown et al. 2010)	NSF	2006	NSF	2006	NSF	2006
Tanana	(Brown et al. 2016)	ALL	2014	LLM, SLM, Birds	2014	ALL	2014

Community	Source	Harvest data - resources addressed	Harvest data - study period	Timing of subsistence – resources addressed	Timing of subsistence - study period	Use areas – resources addressed	Use area - study period
Tanana	(Brown et al. 2004)	LLM	2002-03	LLM	2002-03	N/D	N/D
Tanana	(Case and Halpin 1990)	ALL	1987	ALL	1987	ALL	1968-1988
Tanana	(Wolfe and Scott 2010)	ALL	2008	N/D	N/D	N/D	N/D
Wiseman	(Holen et al. 2012)	ALL	2011	LLM	2011	ALL	2011
Wiseman	(Scott 1998)	ALL	1991	ALL		ALL	1992
Wiseman	(SRB&A 2016)	N/D	N/D	ALL	2006-2015	ALL	2006-2015

Notes: ca = circa; LLM = Large land mammals; N/D = No data; ALL = All resources/comprehensive; NSF = Non-salmon fish; SLM = Small land mammals

This table lists the primary publications associated with the harvest data for each time period; however, where available, the data are downloaded from the Alaska Department of Fish and Game's Community Subsistence Information System (CSIS), which is available at: www.adfg.alaska.gov/sb/CSIS/. The CSIS often includes more updated harvest estimates than those provided in the original publications reporting the data.

[a] Stephen R. Braund & Associates (SRB&A) requested this use area data for use in the Ambler Road Environmental Impact Statement (EIS), but the data were either unavailable or not provided to SRB&A.

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4.1.1 Subsistence Use Area and Travel Method Data

Subsistence use area data primarily measure the geographic extent of residents' use of their environment to harvest subsistence resources. There are various methods of representing subsistence use area data. The most common method is to show the outline of the extent of a community's use area during a certain time period. This method does not differentiate between areas used periodically or by one harvester and areas used by multiple harvesters on a regular basis. Another method is to track harvesters' activities using global positioning system (GPS) units and are the most accurate method for documenting residents' travel during a specific time period; however, such studies are not available for the study region and may underrepresent a community's traditional use areas due to the narrow temporal and spatial focus. A third method maps subsistence use areas on separate overlays during individual interviews with active harvesters and creates subsistence use area maps differentiating between areas where a small number of individuals reported using the area and areas where a higher number of individuals reported using the area. Alternatively, the maps may differentiate between areas where a high number of subsistence use areas or target resources were reported, versus areas where a low number of subsistence use areas or target resources were reported. This method provides a measure of harvest effort in terms of the number of respondents reporting subsistence activities within geographic areas and, in the case of multiple resource maps, includes the number of species targeted. The overlapping use area method does not represent harvest success or intensity of use in terms of frequency or duration of trips. Subsistence mapping studies are also the most common source of information for characterizing travel methods used to access subsistence use areas; however, this type of information not always documented for all studies.

In general, subsistence use areas are documented for a subset of harvesters within a community, as it is usually not possible to interview every single hunter or harvester of a given resource. Even household harvest surveys do not necessarily document the use areas of every harvester in a community, as interviews are generally conducted with household heads, and these individuals are not necessarily the only or primary harvesters in a household. Thus, the subsistence use areas shown on the maps in this report likely do not represent the extent of all subsistence uses for a community, and other areas may be used.

In addition, subsistence use areas are documented for varying time periods, including lifetime, 10-year, or 1-year time periods. Lifetime use areas are useful for capturing long-term trends in subsistence use patterns and the extent of traditional land use areas. Shorter time periods are useful for capturing "current" subsistence use patterns and revealing recent trends in subsistence use. It is important to include all time periods when establishing a baseline of subsistence uses, as residents may return to previously used traditional areas in the event of environmental or regulatory changes, or changes in resource distribution or migration. Even if a community shows a change in traditional uses over time (e.g., constricted use areas), traditional land use areas are still important to the cultural identity, and protection of traditional land use areas ensures the ability of communities to adapt to future changes.

4.2. Timing of Subsistence Activities Data

Data on the timing of subsistence activities are available through various types of research including harvest studies (i.e., number harvested by month), subsistence mapping studies (i.e., months by use area, number of trips by month), and ethnographic studies (e.g., generalized depictions or narrative descriptions of subsistence activities by month or season). Data on the timing of subsistence activities are useful for characterizing a community's seasonal round, their use of the land, and for analyzing potential impacts based on the timing of subsistence activities in the context of the timing of development activities.

4.3. Resource Importance Data

Subsistence has both material/economic significance as well as cultural importance. This technical report chose several key subsistence indicators as measures of "Resource Importance" including harvest amount, sharing, and participation. These indicators are available in a majority of subsistence harvest studies to allow for the measuring of change over time and/or they encompass a broad range of subsistence characteristics including material harvest, effort, and sharing. Measures of material and cultural importance are established through the use of available quantitative measures. While all subsistence activities and resources are of high importance to a community, the importance of individual resources relative to one another varies according to material and cultural measures. The ADF&G Division of Subsistence and Stephen R. Braund & Associates (SRB&A) subsistence studies have systematically collected community harvest and use data in Alaska since the 1980s. These data allow for the quantitative measurement of certain aspects of cultural and material importance of subsistence resources used in this analysis.

In most cases, Resource Importance, as discussed in this report, is organized around 14 resource categories rather than at a species level, which number in the hundreds. Resource categories are based on species groupings such as salmon, non-salmon fish, berries, and small land mammals/furbearers; in some cases, single species represent their own resource category (e.g., caribou). The list of 14 resource categories is provided in Table 3. For the caribou and fish study communities, resource importance was calculated for selected species (caribou, Chinook salmon, chum salmon, and sheefish).

Table 3. Resource categories for subsistence impact analysis

Resource category number	Resource	Example species
1	Moose	N/A
2	Caribou	N/A
3	Dall sheep	N/A
4	Bear	Black and brown bear
5	Other large land mammals	Goat, elk, bison, deer
6	Small land mammals furbearers	Hare, fox, porcupine, wolf
7	Marine mammals	Bowhead, bearded seal, walrus
8	Migratory birds	Ducks, geese, crane
9	Upland birds	Grouse, ptarmigan
10	Bird eggs	Gull eggs, duck eggs
11	Salmon	Chinook, sockeye, coho
12	Non-salmon fish	Grayling, trout, sheefish, whitefish
13	Marine invertebrates	Clams, cockles, shrimp
14	Vegetation	Blueberries, cranberries, tundra tea, firewood

Note: N/A = Not applicable

In this analysis, material importance is quantitatively measured in terms of a resource's contribution toward each community's total subsistence harvest (i.e., edible pounds for each resource divided by the total edible pounds for all resources [percent of total harvest]). ADF&G data that can be used to quantitatively measure the cultural importance of subsistence resources include data related to participation (percent of households attempting harvests of each resource) and sharing (percent of households receiving each resource). These measures were chosen as informing the cultural importance of subsistence resources because participation in subsistence activities promotes the transmission of skills from generation to generation, and sharing of subsistence resources between households strengthens community cohesion in the region. Furthermore, both participation and sharing are key to the cultural identity of community members.

The ranges for material importance were developed based on the fact that all resource categories contribute to a cumulative 100 percent of harvest. Because many subsistence communities rely on a diverse resource base from which they harvest, it is not unusual for the top contributing resource categories to only contribute in the teens to lower 20 percent of harvest. Thus, the ranges for material importance below in Table 4 allow for all study communities to have a high, moderate, and low resources, and they reflect the nature of subsistence harvests across an often diverse resource base where few resource categories represent a high percentage of the total community harvest.

The ranges for cultural importance are specific to each community's unique behavior of attempting to harvest and receiving. This community-centric approach, where every community's ranges are defined based on that community's unique set of data, takes into account cultural variation between communities and between the ways certain resources are harvested. Whereas, a community's harvest (material importance) will always total 100 percent, the cultural measures of importance are unique to each community and may exhibit a wide range of variation depending on the community's cultural and environmental setting (e.g., proximity to urban areas, regulatory restrictions, proximity to resources). For each variable by community, a range is determined by subtracting the lowest percentage of households within each variable (e.g., attempting to harvest) from the highest percentage of the same variable (e.g., 100-40 = 60). That range (e.g., 60) is then divided into thirds in order to determine the high, moderate, and low ranges (e.g., Low = 40–60; Moderate = 60–80; High = 80–100). As an example, in one community, the range of households trying to harvest different resources may be 20–50 percent, whereas in a second community it may be as high as 40–100 percent. Reasons for these differences may include work commitments, geographic and climatic restraints, urban disruption, or regulatory environment which limit or facilitate the opportunities for attempting to harvest. A community-centric approach takes into account the unique community range in both examples above, standardizing the high range to 40–50 percent for the first community and 80-100 percent for the second community.

Table 4. List of quantitative measures for material importance

Importance category / Quantitative measure	High (H)	Moderate (M)	Low (L)
Material importance % of total harvest (in pounds)	H ≥20%	20%> M ≥2%	L <2%

For the final determination as a high, moderate, or low resource of importance the top value from the three variables of percent of total harvest, percent of households attempting to harvest, and percent of households receiving is selected as the final classification of importance. For example, moose may represent 15 percent of total harvest (moderate), top third of households attempting to harvest (high), and bottom third in receiving (low). The final selection ranks moose overall as a resource of high importance in this example due to the cultural importance of participation and attempting to harvest. Lastly, if no harvest data exist for a particular resource, the final selection ranks that resource importance as "Indeterminate."

This analysis, while reflecting one method of quantitatively measuring the importance of subsistence resources, does not take into account a multitude of factors for which quantitative data do not exist (e.g., spirituality, ethics and values, ideologies, identities, celebration and ceremonies). Rankings of resources under high, moderate, and low importance should be viewed only in terms of the indicators presented here and not in terms of overall importance. Subsistence harvesters in the study communities routinely view all of the resources they harvest during their seasonal cycle of availability as important to their community and/or individual health and cultural identity. To take into account the aspects of subsistence such as spirituality, values, and identity that could be impacted and which are not easily characterized by quantitative data, the Project relies on the traditional knowledge and concerns identified in the scoping comments for this Project in both assessing impacts and providing potential mitigation measures and other potential strategies to minimize construction and operational impacts on resources and subsistence harvesters.

5. Overview of Subsistence Uses

5.1. Kobuk River

The Kobuk River region includes the communities of Ambler, Kiana, Kobuk, Noorvik, and Shungnak. Of these communities, Kobuk and Shungnak are closest to the proposed road corridors, followed by Ambler, Kiana, and Noorvik, which are located on the Kobuk River at varying distances downstream from the project corridors.

5.1.1 Subsistence Use Areas

Subsistence use areas for the Kobuk River region study communities are focused around the Kobuk River, but extending both south toward the Koyukuk River drainage and north into the Brooks Range and as far as the North Slope of Alaska. Residents' subsistence uses also extend downriver and into the marine waters of Kotzebue Sound and the Chukchi Sea. More recently documented subsistence use areas (Watson 2018; Satterthwaite-Phillips et al. 2016) indicate a smaller extent of overland travel. In particular, recent studies show less extensive travel to the north of the study communities into the Brooks Range and onto the North Slope. Watson (2018) discusses that some of the shifts in use areas may reflect changes in migratory routes of the WAH; changes in traditional hunting methods to avoid diverting caribou during their fall migration (thereby hunting them farther south); decreased need for extensive overland travel (e.g., less reliance on furbearer trapping); and increased reliance on fish resources (thus greater focus on riverine use areas). Except for Noorvik, subsistence use areas for Kobuk River region study communities overlap with the western portion of the project alternatives.

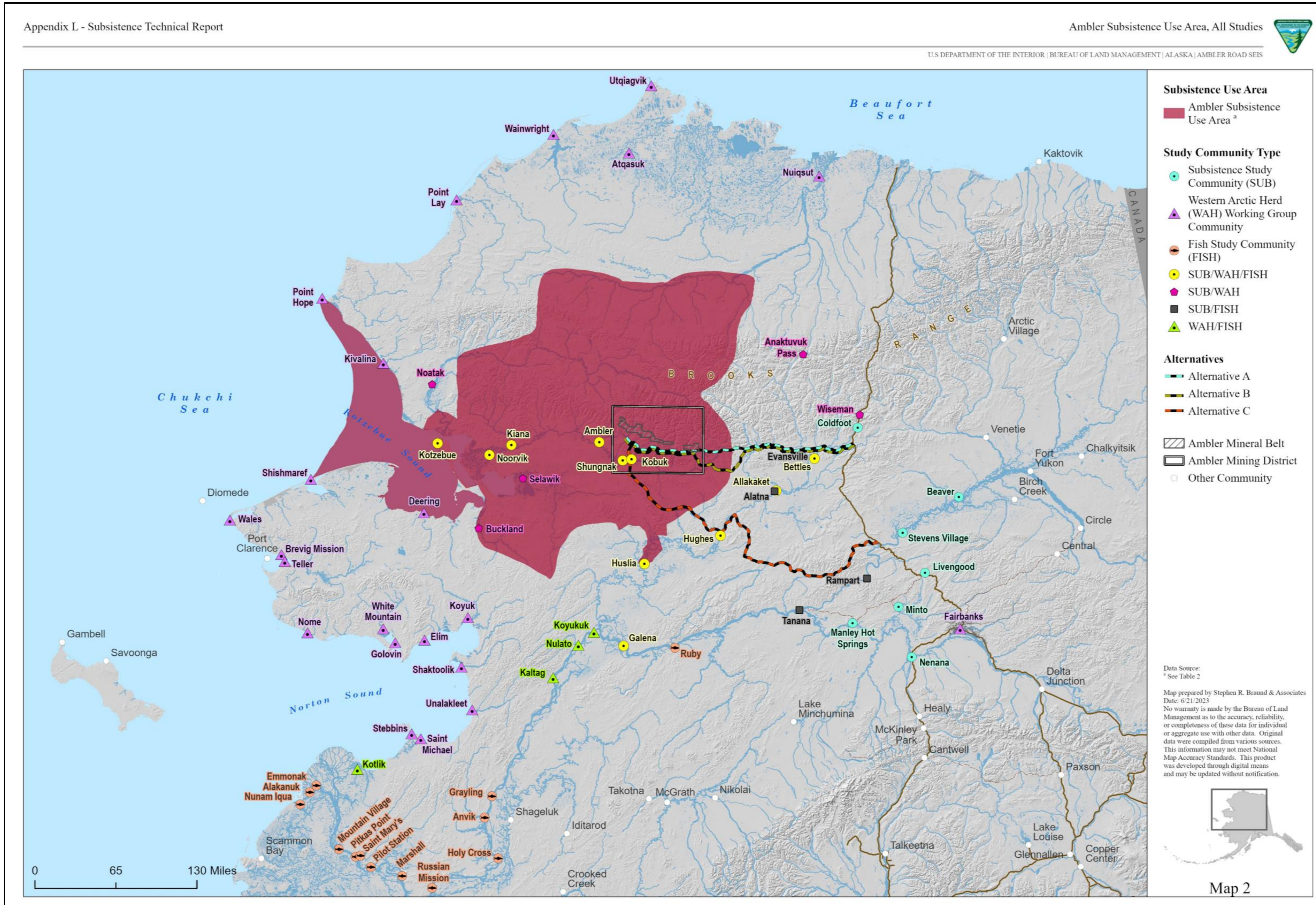
As shown on Map 2, Ambler subsistence use areas for all available time periods (Lifetime ca. 1925-1985; 2012; and Lifetime to 2016) extend west to the Chukchi Sea and Kotzebue Sound; north through the Brooks Range onto the North Slope surrounding the headwaters of the Colville River; east to the headwaters of the Kobuk River; and south toward Buckland and Huslia. Recent subsistence use areas documented for Ambler (Watson 2018) indicate that the contemporary subsistence use area of Ambler is somewhat smaller in that use areas do not extend as far north into the Brooks Range. As noted above in Section 4.1.1, Subsistence Use Area and Travel Method Data, even if certain traditional land use areas are not depicted on contemporary subsistence use area maps, communities maintain cultural ties to traditional use areas, and the protection of these areas is key to maintaining cultural identity and the ability to adapt to future changes. Contemporary use areas are focused around the Kobuk and Ambler rivers, north into the southern foothills of the Brooks Range, and south toward the Selawik and Koyukuk rivers. Based on Watson (2018), contemporary caribou hunting generally occurs along the Kobuk and Ambler rivers and in a large overland area south of the community toward Selawik River and Huslia. Moose hunting occurs in a similar area but with less extensive overland use. Furbearer trapping 2occurs in an overland area focused along the mid- to upper-Kobuk River and south toward Huslia and the Selawik River. Contemporary fishing occurs in a more extensive area than historic fishing and indicates a shift away from lakes toward rivers. Salmon and non-salmon fishing areas extend from Kotzebue Sound to the headwaters of the Kobuk River, along the Selawik area, and in the Koyukuk River drainage. Waterfowl hunting occurs over a similar area as fishing, focused along the entirety of the Kobuk River and in some overland areas both north and south of the river. Marine mammal hunting occurs downriver from Ambler into Kotzebue Sound. Contemporary berry harvesting areas extend along the Kobuk River and in a large overland area to the east, northeast, and southeast of the community, although respondents indicated that their primary berry harvesting areas are located closer to the community of Ambler.

As shown on Map 3, Kiana use areas occur in a large area extending along the Kobuk River, north into the Brooks Range and the headwaters of the Colville River, south toward Buckland, and west into Kotzebue Sound and along the Chukchi Sea coast. Kiana use areas are only available from Schroeder et al. (1987), which depict lifetime use areas for the period circa 1925–1986. More recent use areas are not available.

Kobuk subsistence use areas (Map 4) extend along the entire Kobuk River drainage to Norutak Lake, north into the Brooks Range, west into Kotzebue Sound, and south to an area surrounding Selawik Lake and River. Use areas have been documented for the Lifetime ca. 1925-1985; Lifetime to 2016; and 2012 time periods. Contemporary subsistence use areas as shown in Watson (2018) occur over a similar area but with lesser use to the north of the community into the Brooks Range and a greater focus along river drainages rather than large overland areas. Contemporary caribou hunting occurs in the upper Kobuk River, southern Brooks Range, and overland toward Buckland and the Dakli River. Moose hunting is focused solely long the Kobuk River upriver from Shungnak, in addition to a small overland area extending toward the Ambler River. Contemporary trapping is focused in a smaller area than historic trapping areas and occurs in an area near the Kobuk River and north toward the Ambler River. Fishing and waterfowl hunting both occur in a similar area which is focused along the Kobuk River upriver from Shungnak to Pah River. Contemporary marine mammal use areas occur within Kotzebue Sound, with the entire Kobuk River used for travel to those hunting areas. Finally, contemporary vegetation harvesting areas for Kobuk occur along the entire Kobuk River drainage downriver to the Kotzebue area.

Shungnak use areas (Map 6) for all available time periods (Lifetime ca. 1925-1985; Lifetime to 2016; and 2012) occur over a large area extending from the Colville River in the north to Buckland and Huslia in the south, west into Kotzebue Sound, and east to the headwaters of the Kobuk River. Contemporary use areas for Buckland as shown in Watson (2018) continue to occur in a large overland area which extends north into the Brooks Range although not as far as the North Slope. Contemporary use areas extend south to Buckland and Huslia but are primarily focused on the Kobuk River, Brooks Range to Noatak River, and south to Selawik River. Unlike other Kobuk River study communities, contemporary Shungnak use areas do not extend to marine areas in Kotzebue Sound. Caribou hunting generally occurs over a larger area than other resource pursuits, extending to the Noatak River in the north and the Buckland and Huslia areas in the south in addition to the mid- to upper-Kobuk River drainage. Moose hunting focuses along river drainages including the Ambler and Kobuk rivers. Sheep hunting extends north of the community of Shungnak into the Brooks Range as far as the Noatak River while trapping occurs in overland areas both north and south of the Kobuk River. Waterfowl hunting occurs along the Kobuk River and tributaries in addition to lakes and overland areas south of the community toward the Selawik and Dakli rivers. Similar to Ambler and Kobuk, Shungnak fishing areas have shifted from lake-focused fishing to fishing along the Kobuk River. Vegetation harvesting occurs relatively close to the community of Shungnak along the Kobuk River between Shungnak and Kobuk.

Noorvik is the only study community in the Kobuk River region whose use areas do not overlap directly with the project area; however, use areas for this community occur directly downriver from the project area on the Kobuk River and near Shungnak. As shown on Map 5, Noorvik subsistence use areas for all available time periods (Lifetime ca. 1925-1985; Lifetime to 2014; and 2012) extend from the Chukchi Sea as far as Point Hope and throughout Kotzebue Sound; north into the Brooks Range and as far as the upper Colville River; south toward Buckland and surrounding Selawik River, and east to Shungnak. According to Satterthwaite-Phillips et al. (2016), more recently documented subsistence use areas for the community of Noorvik indicate a shift to the south, with use areas focused along the Kobuk River, Kotzebue Sound, and south in overland areas near Buckland and Deering. Noorvik use areas for small game and large game extend along the Kobuk River near Ambler but with more intensive focus around the mouth of the Kobuk River and to the southwest of the community toward Deering and Buckland. Other resource pursuits, including plant gathering, bird hunting, and fishing, also focus around the lower Kobuk River and to the southwest of the community near Buckland and Deering. Fishing also occurs with great intensity in Kotzebue Sound and near the mouth of Selawik Lake (Satterthwaite-Phillips et al. 2016).



Map 2. Ambler subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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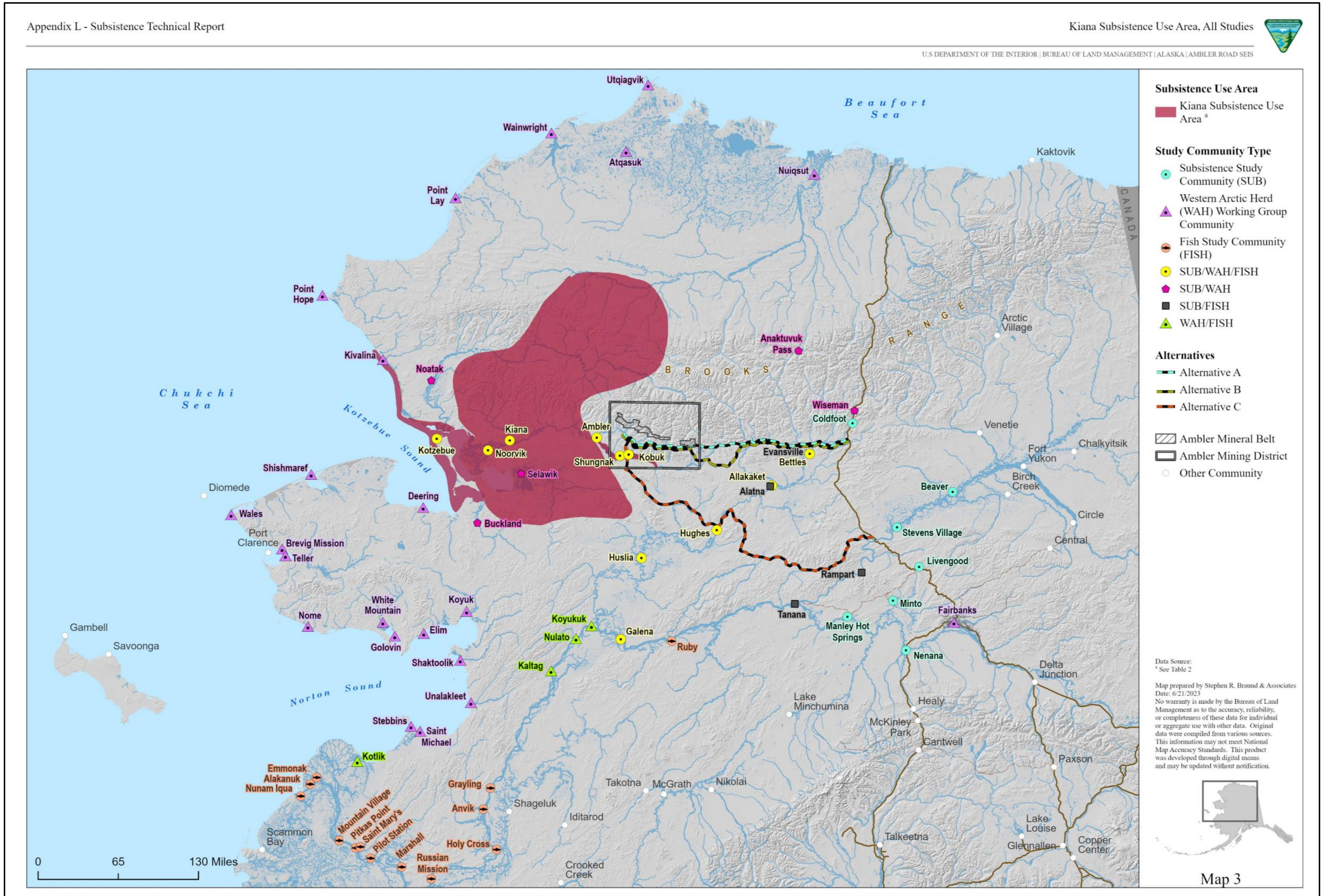

Map 3. Kiana subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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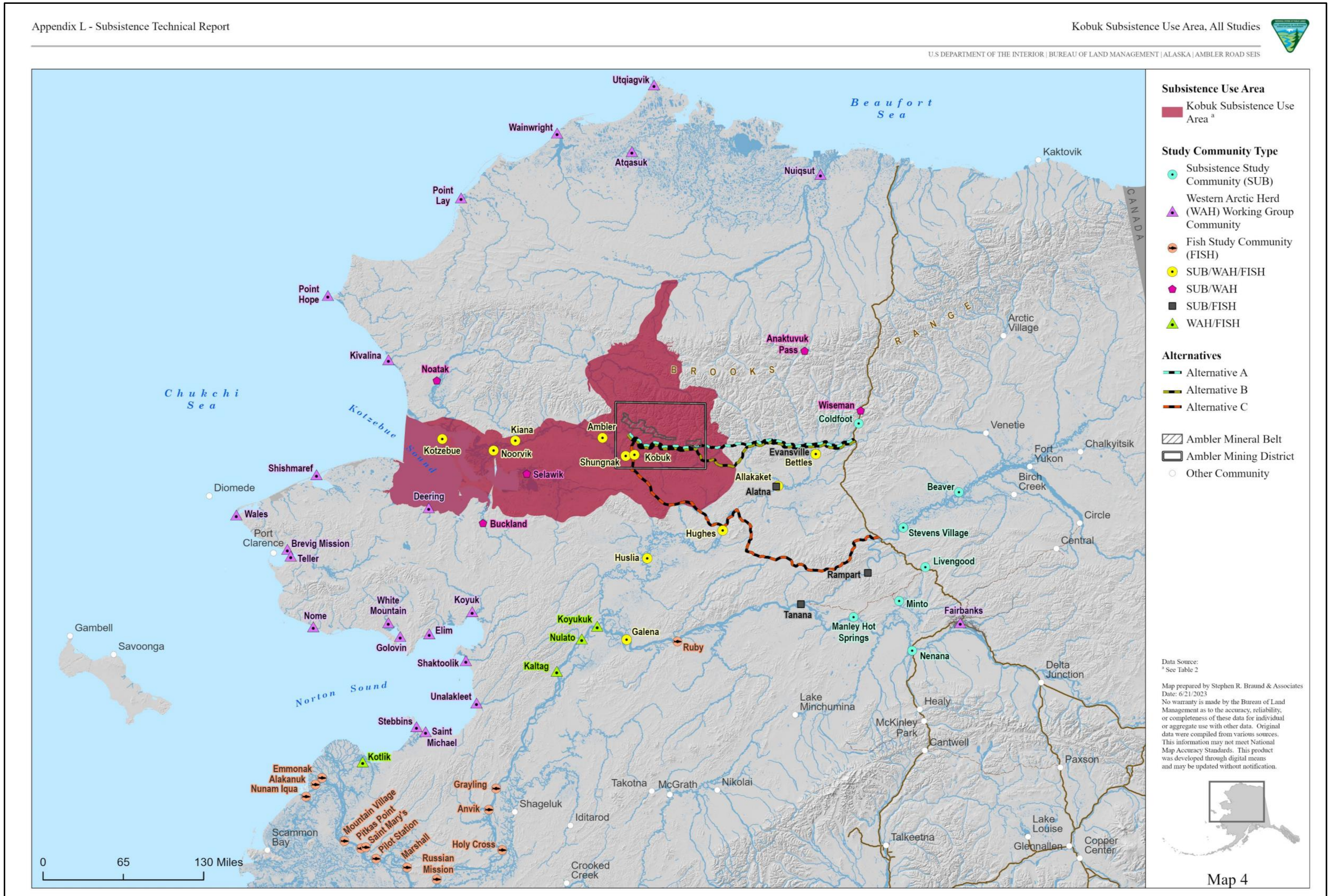

Map 4. Kobuk subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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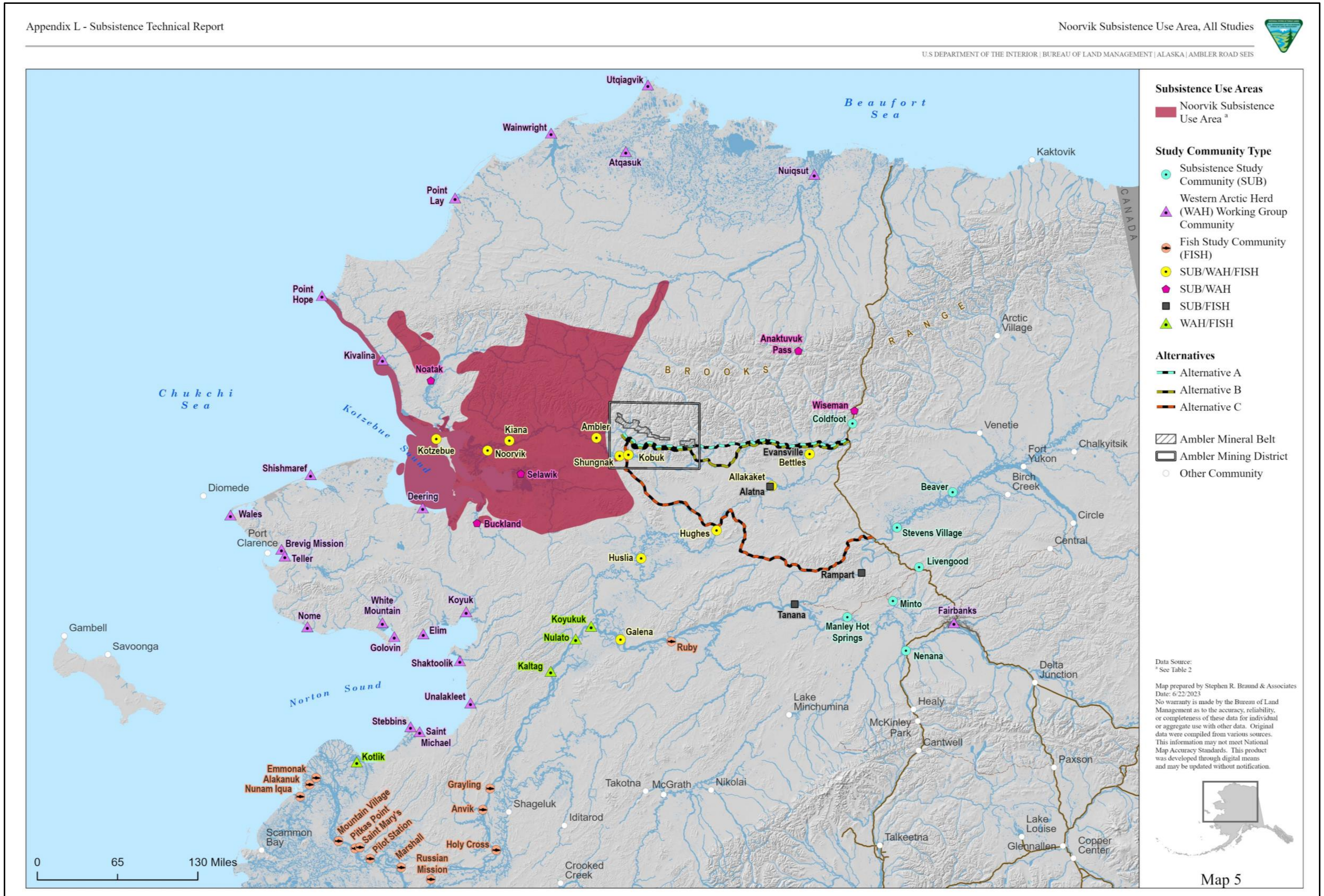

Map 5. Noorvik subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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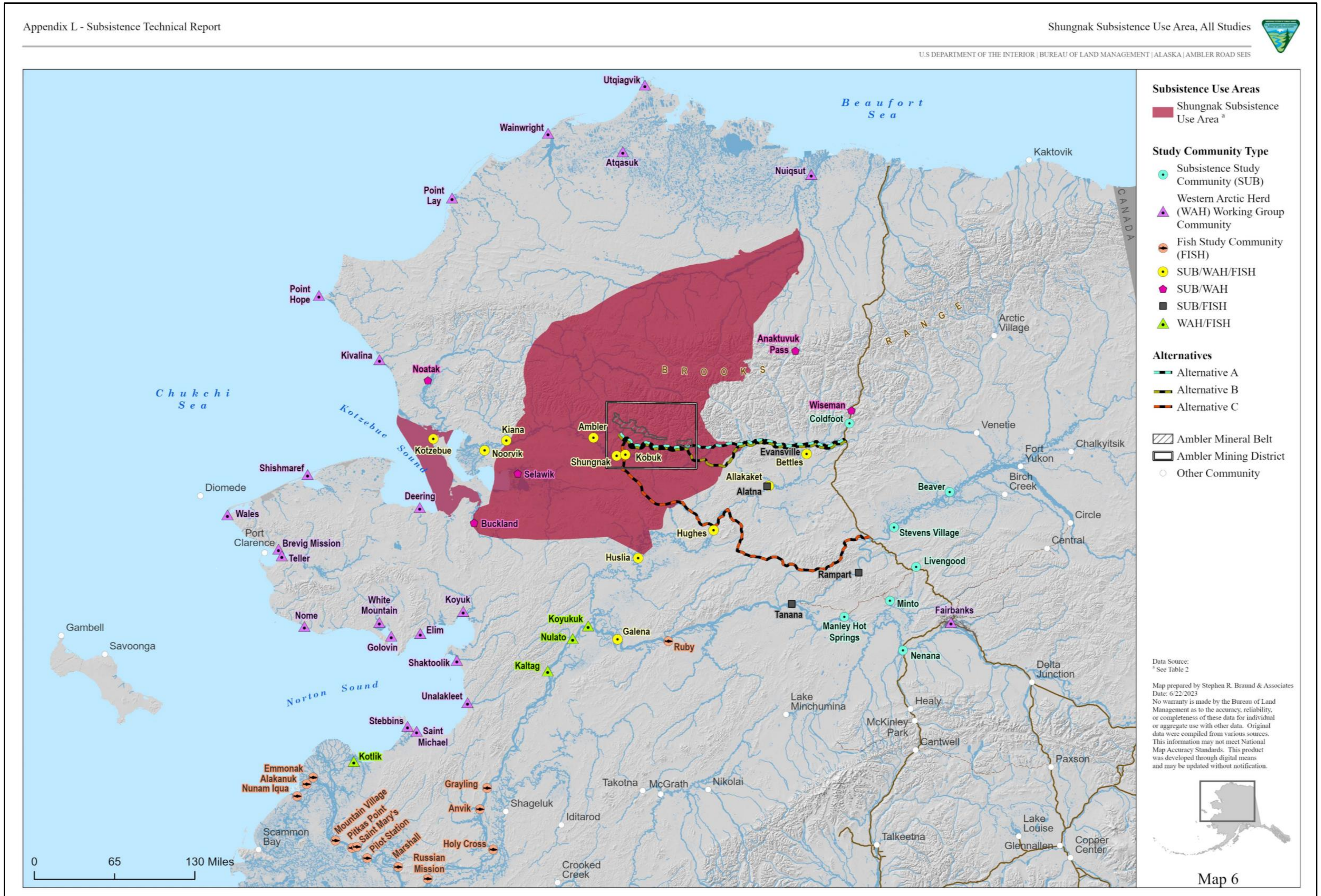

Map 6. Shungnak subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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5.1.2 Harvest Data

Harvest data for the Kobuk River study communities are provided on Figure 1 through Figure 3 and in Table 5. As shown on Figure 1, based on an average of available data, caribou is the primary resource harvested among the study communities in terms of percentage of usable pounds (39 percent), followed by non-salmon fish (31 percent), and salmon (18 percent). Other resources which contribute smaller amounts in terms of pounds include moose, vegetation, migratory birds, small land mammals/furbearers, and marine mammals. Resource contribution varies by study community. Communities located farther downriver (Kiana and Noorvik) and closer to Kotzebue Sound show a higher reliance on marine mammals. In addition, the community of Ambler shows a higher reliance on caribou than some other communities and a lower reliance on salmon, although recent fish-only studies show higher per capita harvests of salmon for Ambler.

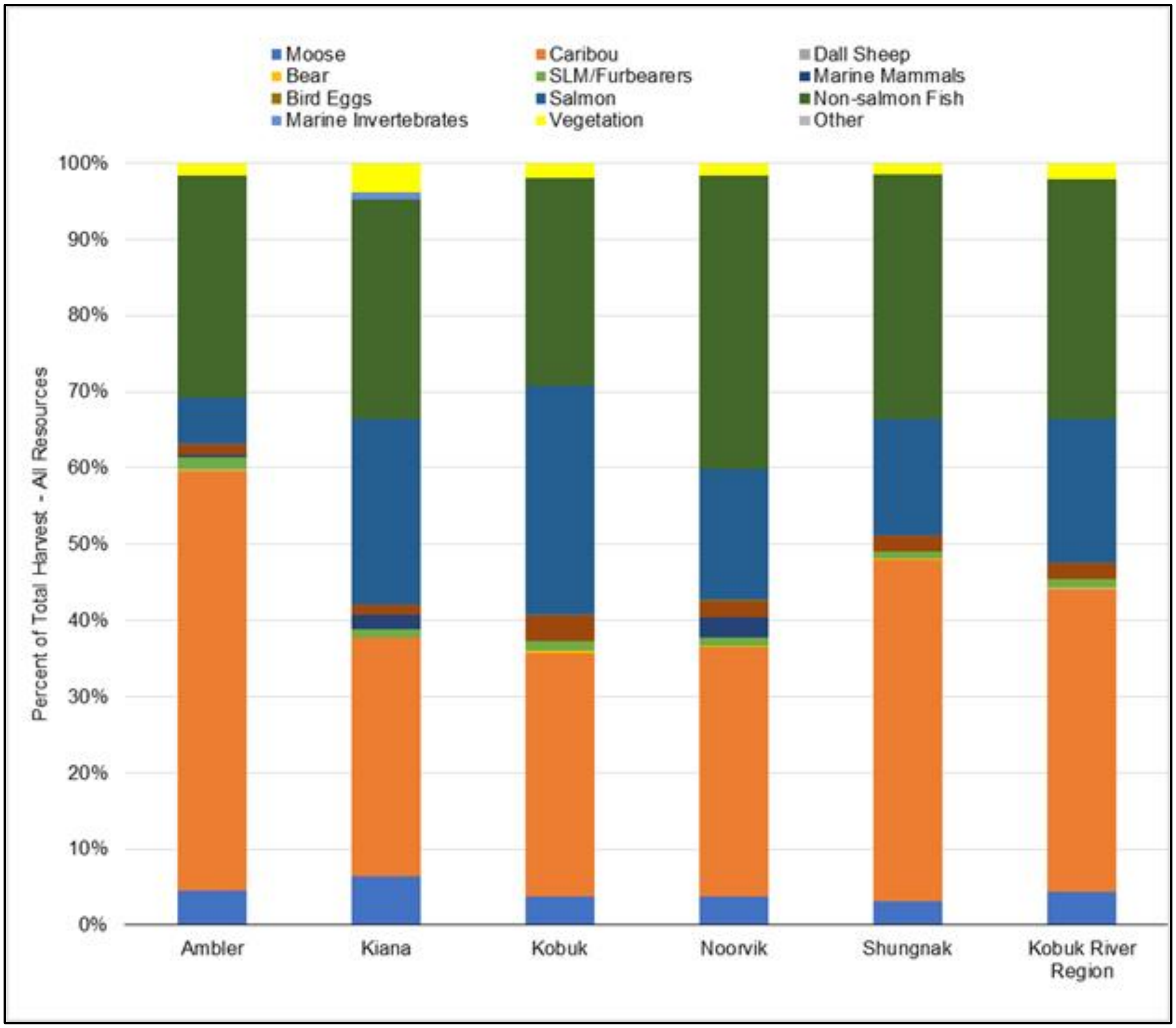

Figure 1. All resources percent of total harvest by Kobuk River region communities

Source: See Table 2 for citations, time period, and resources addressed.
Notes: Data represent the average percent of harvest across all available study years for comprehensive (i.e., all resources) household harvest surveys. In many cases, averages represent only a single study year. Available study years for each community are as follows: Ambler (2012); Kiana (2006); Kobuk (2012); Noorvik (2012); Shungnak (2002, 2012).

Average participation rates among Kobuk River communities, in terms of the average percentage of households attempting harvests by resource during individual study years, are shown on Figure 2. These data are based on averages across available study years; it is likely that in some years (or across all years) a higher percentage of households participates in each resource activity. Across all Kobuk River study communities, households most commonly participate in harvests of vegetation (85 percent of households), followed by non-salmon fish (74 percent), caribou (71 percent), and salmon (57 percent). Fewer households participate in harvests of Dall sheep, marine mammals, and small land mammals/furbearers. The average percentage of households receiving different resources is shown on Figure 3. This figure shows that while certain resources are not commonly harvested within a community, they may still be highly consumed through sharing. For example, while few Kobuk River region households participate in marine mammal hunting (less than 10 percent; Figure 2), an average of over 60 percent of households receive marine mammals. Other resources which are widely shared among Kobuk River region communities include non-salmon fish, salmon, caribou, vegetation, and migratory birds.

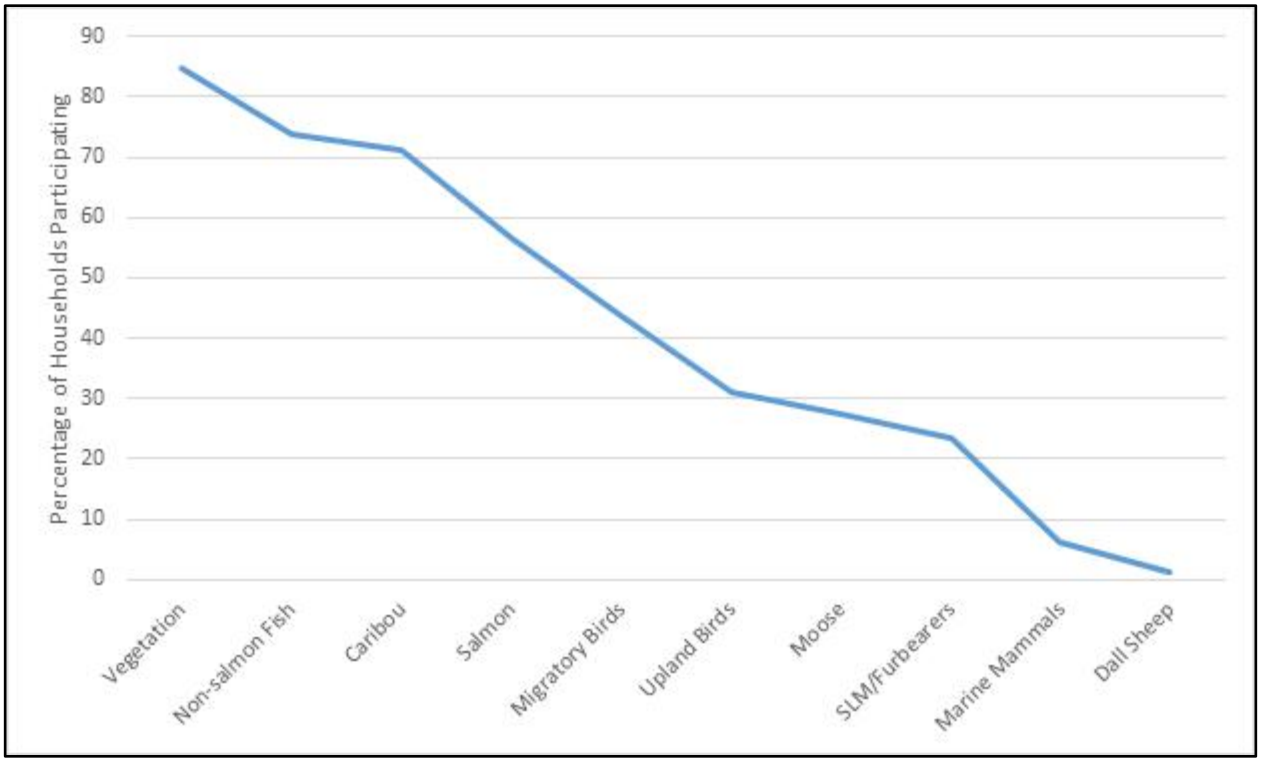

Figure 2. Percent of households attempting harvests of resources, Kobuk River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years Available study years for each community are as follows: Ambler (1997; 2003; 2009-10; 2012; 2012-2014); Kiana (1993; 1994-2004; 1996; 1999; 2009-10; 2012-2014); Kobuk (1994-2004; 1996-1997; 2004; 2009-10; 2012; 2012-2014); Noorvik (1996; 2002; 2008-09; 2012; 2012-2014); Shungnak (1996; 2000; 2002; 2008-09; 2012; 2012-2014).

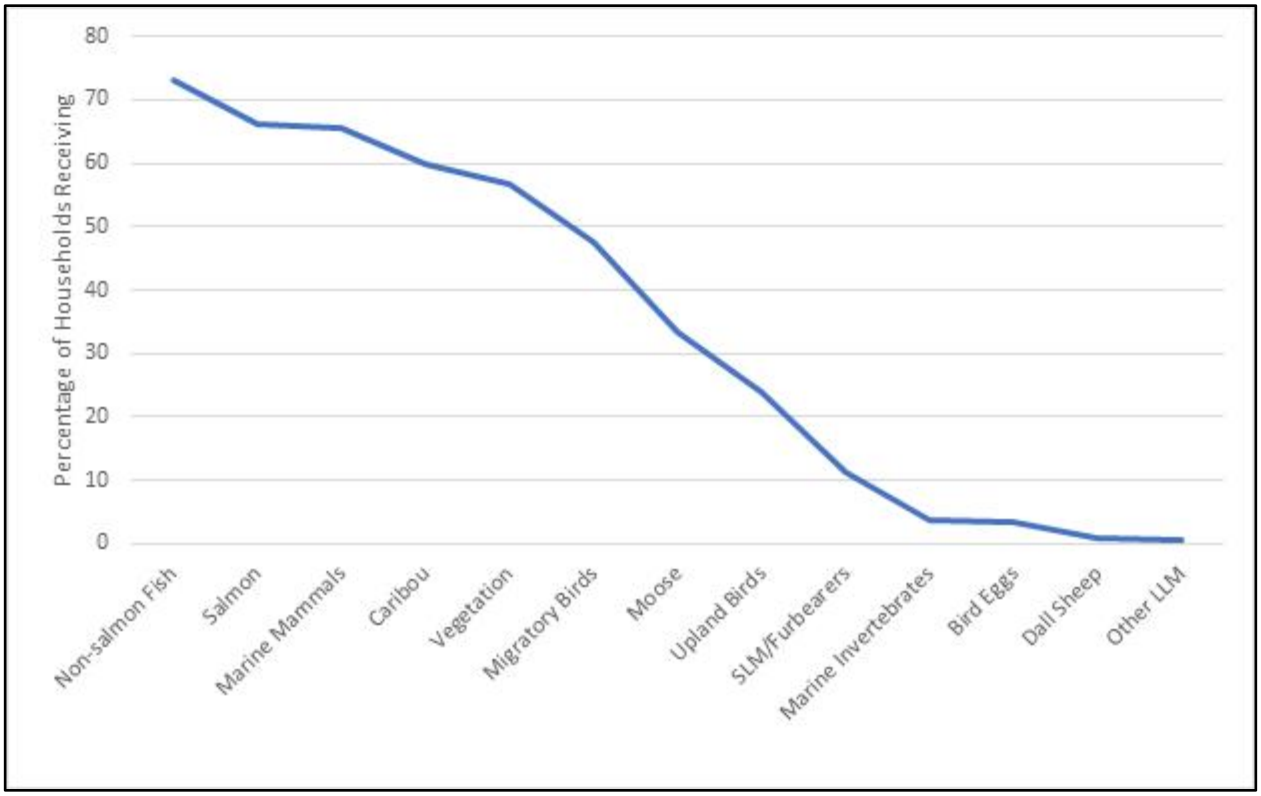

Figure 3. Percent of households receiving resources, Kobuk River region communities

Source: See Table 2 for citations, time period, and resources addressed.
Notes: Data represent the average percent of households across all available study years Available study years for each community are as follows: Ambler (1997; 2003; 2009-10; 2012; 2012-2014); Kiana (1993; 1994-2004; 1996; 1999; 2009-10; 2012-2014); Kobuk (1994-2004; 1996-1997; 2004; 2009-10; 2012; 2012-2014); Noorvik (1996; 2002; 2008-09; 2012; 2012-2014); Shungnak (1996; 2000; 2002; 2008-09; 2012; 2012-2014).

Table 5 shows average harvest and use data for the top five species harvested (in terms of average contribution toward the total subsistence harvest) by each of the Kobuk River Region study communities. Caribou is the top species in each of the study communities, contributing between 31.2 (Kiana) and 54.6 percent (Ambler) of the total subsistence harvest. Non-salmon fish species are also among the top five species for all study communities and include sheefish and whitefish (broad and humpback). Salmon – specifically chum salmon – are also among the top five species harvested in the study communities. Moose is among the top species harvested in Ambler, Kiana, and Kobuk. In addition, northern pike is a top species in the community of Noorvik. Data on the percentage of households using subsistence resources illustrates the heavy reliance of Kobuk River communities on resources such as caribou and fish, with between 88 percent and 95 percent of households in the individual communities using caribou; and between 76 and 94 percent of households using sheefish (Table 5). Across all study years, the percentages are likely higher.

Table 5. Average harvest and use data, top 5 species, Kobuk River region communities

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% total harvest
Ambler	Caribou	88	74	69	56	51	489	66,473	937	255	54.6
Ambler	Broad whitefish	62	38	37	25	48	9,321	23,473	317	88	17.1
Ambler	Sheefish	87	72	69	47	56	1,481	20,966	291	84	7.5
Ambler	Chum salmon	76	53	52	34	57	2,902	20,262	281	80	5.4
Ambler	Moose	36	21	13	14	26	10	5,231	74	20	4.5
Kiana	Caribou	89	70	66	53	65	403	54,755	559	144	31.2
Kiana	Chum salmon	86	62	58	37	79	3,298	19,199	199	48	20.7
Kiana	Whitefish	60	44	42	N/A	N/A	10,834	22,189	234	58	16.7
Kiana	Moose	29	16	13	9	14	13	7,054	72	19	6.5
Kiana	Sheefish	76	59	57	32	58	1,485	15,018	154	37	5.4
Kobuk	Caribou	89	78	66	57	63	154	20,976	655	147	31.8
Kobuk	Chum salmon	83	63	60	38	54	2,174	12,841	384	84	29.5
Kobuk	Sheefish	94	81	79	42	43	903	10,199	306	67	23.3
Kobuk	Moose	48	45	16	16	43	6	2,958	95	21	3.8
Kobuk	Broad whitefish	27	19	19	9	14	543	1,738	55	12	1.8
Noorvik	Caribou	95	67	67	48	60	869	118,140	818	184	32.8
Noorvik	Sheefish	82	56	54	36	54	4,054	45,697	348	80	19.0
Noorvik	Chum salmon	89	47	45	42	66	15,408	93,115	719	165	16.3
Noorvik	Broad whitefish	78	45	42	33	53	12,063	38,603	297	68	9.1
Noorvik	Northern pike	59	43	41	25	27	6,347	20,945	161	37	4.8
Shungnak	Caribou	97	66	64	48	60	441	60,044	1,055	237	44.7
Shungnak	Chum salmon	78	52	50	30	58	4,691	28,070	452	105	14.8
Shungnak	Humpback whitefish	37	29	28	19	22	7,367	15,470	270	60	14.0

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% total harvest
Shungnak	Sheefish	85	64	64	35	56	2,565	26,155	414	98	12.2
Shungnak	Broad whitefish	44	28	25	14	32	2,747	8,789	144	34	3.2

Source: See Table 2 for citations, time period, and resources addressed

Notes: HH = households; N/A = Not available

Data represent the average across all available study years. Available study years for each community are as follows: Ambler (1997; 2003; 2009-10; 2012; 2012-2014); Kiana (1993; 1994-2004; 1996; 1999; 2009-10; 2012-2014); Kobuk (1994-2004; 1996-1997; 2004; 2009-10; 2012; 2012-2014); Noorvik (1996; 2002; 2008-09; 2012; 2012-2014); Shungnak (1996; 2000; 2002; 2008-09; 2012; 2012-2014).

5.1.3 Timing of Subsistence Activities

Data on the timing of subsistence activities for Kobuk River study communities are provided in Table 6. This table shows the number of communities reporting subsistence activity or harvests within each month, based on the most recent data sources for each community. Overall, Kobuk River communities target the greatest number of resources during the month of October, with other periods of high activity also occurring in the earlier summer/fall months of August/September and in the spring months of April/May.

Early spring (March/April) is primarily spent on hunting and trapping of small land mammals, including hunting of upland birds. While residents no longer use spring muskrat camps regularly, some hunting of muskrats and beaver continues to occur. Geese and duck hunting peaks in April and May and remains an important spring activity with residents accessing harvest areas by boat and snowmachine depending on conditions (Braem et al. 2015). When available, residents may hunt WAH caribou during their spring migration north. Spring carnivals are important regional events, particularly for Kobuk and Koyukuk River communities, which center on the harvest and sharing of subsistence foods (Watson 2018).

Immediately after breakup, residents set nets for various non-salmon fish such as whitefish, graying, and northern pike (Braem et al. 2015). Harvesting of sheefish during their summer runs are a key summer activity for Kobuk River communities. Residents also harvest chum salmon and whitefish during the summer, sometimes staying at traditional fish camps, with harvesting of vegetation and hunting of large land mammals also occurring during this time. Hunting of large land mammals also occurs in summer but peaks during fall, when residents hunt for caribou, moose, and bear.

Fall is a major subsistence season for the Kobuk River region. Caribou hunting generally peaks in the fall months of September and October, and residents also resume hunting waterfowl as they migrate south. Residents also hunt other large land mammals such as moose and black bear. Residents continue to seine and set gillnets for fish into the fall, with whitefish replacing salmon and sheefish as the primary resource harvested during this time. Fall is also an important time for berry picking.

Hunting and fishing (through the ice) continues at somewhat lower levels into winter. Some individuals trap and hunt for beaver and other furbearers (e.g., wolf, wolverine, hare, and fox) in winter as well. When available during winter, hunters from the Kobuk River region may travel by snowmachine—sometimes great distances—to harvest caribou (Watson 2018). Residents also harvest ptarmigan during winter when they are available.

Table 6. Kobuk River region timing of subsistence activities, number of communities reporting subsistence activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon	2	2	2	5	5	5	5	5	5	5	5	5
Marine non-salmon fish	N/A	N/A	N/A	N/A	3	3	5	2	2	2	N/A	N/A
Caribou	5	5	5	5	5	3	3	5	5	5	5	5
Moose	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	5	3	N/A	N/A
Bear	N/A	N/A	N/A	3	5	N/A	N/A	5	5	3	N/A	N/A
Furbearers	3	3	3	3	3	N/A	N/A	N/A	N/A	3	3	3
Small land mammals	5	5	5	5	5	N/A	N/A	N/A	N/A	2	5	5
Upland birds	5	5	5	5	N/A	N/A	N/A	N/A	N/A	2	5	5
Waterfowl	N/A	N/A	N/A	3	5	5	5	5	5	5	N/A	N/A
Plants and berries	N/A	N/A	N/A	N/A	N/A	5	5	5	5	5	2	N/A
Wood	5	5	5	5	5	3	N/A	2	2	2	5	5
Total number of resources per month	**6**	**6**	**6**	**8**	**8**	**6**	**5**	**8**	**8**	**11**	**7**	**6**

Source: Anderson et al. 1998; Braem 2012a; Braem et al. 2017

Notes: Apr = April; Aug = August; Dec = December; Feb = February; Mar = March; Jan = January; Jul = July; Jun = June; N/A = Not applicable (no or limited subsistence activity); Nov = November; Oct = October; Sep = September

Kobuk River region communities = 5 (Ambler, Kiana, Kobuk, Noorvik, and Shungnak)

Each cell contains the number of communities reporting subsistence activity or harvests during each month, based on the most recent data source for each community. Months with only one community report harvests or activity are not included in the table. Resources with no subsistence activity data available are not included in the table.

5.1.4 Travel Method

While systematic, quantitative data on travel methods are not available for Kobuk River subsistence study communities, several studies provide qualitative information on travel methods and routes in the Kobuk River region. Braem et al. (2015) note that boat and snowmachine are the primary used by residents to travel to subsistence harvesting areas and to and from other communities within the region. To a lesser extent, residents use ATVs to access overland areas during the snow-free season. However, while still not a primary mode of transportation, use of ATVs has increased over time. As stated in Braem et al. (2015), residents of Ambler use ATVs to “reach country that may be inaccessible by boat” and to save on gas by opting for short ATV trips over longer boating trips. Snowmachine travel can extend into mid-May assuming snow conditions allow. In recent years, residents have noted changes in snow conditions which affect certain subsistence activities generally carried out by snowmachine (e.g., furbearer harvesting, wood-gathering, and inter-community travel). Breakup generally occurs in mid- to late May when residents switch from snowmachine travel to boat travel along local rivers. Erosion has also affected river channels, and subsequently boat travel, for Kobuk River communities. Freeze-up generally occurs in mid-October and residents shortly thereafter begin traveling by snowmachine again which opens up larger overland areas for subsistence uses. For the study communities, the Kobuk River is a major transportation corridor throughout the year.

5.1.5 Resource Importance

While all subsistence activities and resources are of high importance to a community, the importance of individual resources relative to one another varies according to various material and cultural measures used in this analysis. This section provides an analysis of the relative importance of resources to each Kobuk River Region study community, based on selected measures of harvest (percentage of total harvest), harvest effort (percentage of households attempting harvests) and sharing (percentage of households receiving). The relative importance of subsistence resources to the individual Kobuk River study communities, based on selected variables, is provided in Table 7 through Table 11.

Based on this analysis, caribou, non-salmon fish, salmon, and vegetation are resources of high importance in all five Kobuk River Region study communities. In addition, marine mammals are a resource of high importance in four of the five study communities (Ambler, Kobuk, Noorvik, and Shungnak), and migratory birds are a resource of high importance in one study community (Shungnak). Resources of moderate importance in the study communities include moose (five study communities), small land mammals/furbearers (three study communities), migratory birds (four study communities), and upland birds (three study communities).

Table 7. Relative importance of subsistence resources based on selected variables, Ambler

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	21	26	5	M
2	Caribou	74	51	55	H
3	Dall sheep	2	2	0.1	L
4	Bear	N/A	N/A	0.2	L
5	Other large land mammals	N/A	1	N/A	L
6	Small land mammals/furbearers	19	9	2	M
7	Marine mammals	2	60	0.3	H

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
8	Migratory birds	40	30	1	M
9	Upland birds	40	26	0.2	M
10	Bird eggs	2	4	N/A	L
11	Salmon	55	62	6	H
12	Non-salmon fish	77	68	29	H
13	Marine invertebrates	2	2	0.1	L
14	Vegetation	85	51	2	H

Source: See Table 2
Notes: H = High; HH = Households; L = Low; M = Moderate; N/A = Not Available

Table 8. Relative importance of subsistence resources based on selected variables, Kiana

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	16	14	6	M
2	Caribou	70	65	31	H
3	Dall sheep	1	N/A	N/A	L
4	Bear	N/A	N/A	N/A	I
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	16	2	1	L
7	Marine mammals	10	N/A	2	M
8	Migratory birds	38	N/A	1	M
9	Upland birds	8	N/A	0.03	L
10	Bird eggs	1	N/A	N/A	L
11	Salmon	64	82	24	H
12	Non-salmon fish	68	N/A	29	H
13	Marine invertebrates	4	N/A	1	L
14	Vegetation	73	N/A	4	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 9. Relative importance of subsistence resources based on selected variables, Kobuk

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	45	43	4	M
2	Caribou	78	63	32	H
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	0.2	L

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	26	14	1	L
7	Marine mammals	N/A	63	N/A	H
8	Migratory birds	40	57	3	M
9	Upland birds	50	33	0.3	M
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	63	57	30	H
12	Non-salmon fish	85	71	27	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	87	80	2	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 10. Relative importance of subsistence resources based on selected variables, Noorvik

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	28	43	4	M
2	Caribou	67	60	33	H
3	Dall sheep	0.4	1	N/A	L
4	Bear	N/A	N/A	0.2	L
5	Other large land mammals	N/A	0.4	N/A	L
6	Small land mammals/furbearers	20	10	1	L
7	Marine mammals	11	67	3	H
8	Migratory birds	54	53	2	M
9	Upland birds	29	12	0.1	M
10	Bird eggs	20	5	0.1	L
11	Salmon	47	69	17	H
12	Non-salmon fish	70	81	38	H
13	Marine invertebrates	1	7	0.003	L
14	Vegetation	86	54	2	H

Source: See Table 2

Notes: H = High; HH = Households; L = Low; M = Moderate; N/A = Not Available

Table 11. Relative importance of subsistence resources based on selected variables, Shungnak

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	27	41	3	M

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
2	Caribou	66	60	45	H
3	Dall sheep	N/A	1	N/A	L
4	Bear	N/A	N/A	0.1	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	35	22	1	M
7	Marine mammals	2	71	0.1	H
8	Migratory birds	47	51	2	H
9	Upland birds	29	24	0.1	L
10	Bird eggs	N/A	2	N/A	L
11	Salmon	54	62	15	H
12	Non-salmon fish	69	72	32	H
13	Marine invertebrates	1	2	N/A	L
14	Vegetation	94	42	2	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

5.2. Kotzebue Sound

The Kotzebue Sound region includes the communities of Buckland, Kotzebue, Noatak, and Selawik. These communities are located to the west of the project corridors in Kotzebue Sound and along tributaries of Kotzebue Sound.

5.2.1 Subsistence Use Areas

Subsistence use areas for the Kotzebue Sound region study communities are focused around Kotzebue Sound, the Chukchi Sea coast, and lands and rivers surrounding Kotzebue Sound including the Brooks Range and the Noatak, Kobuk, Selawik, and Buckland rivers. More recently documented subsistence use areas for these study communities (Satterthwaite-Phillips et al. 2016) indicate a smaller extent of overland travel. Subsistence use areas for Kotzebue Sound region study communities do not overlap with the project alternatives but occur downriver from the alternatives or approach the project alternatives in overland areas from the west and north.

As shown on Map 7, Buckland subsistence use areas for all available time periods (Lifetime ca. 1925-1985; Lifetime to 2014) occur in a large overland area to the south and east of the community; along the Kobuk River to the community of Ambler; into Kotzebue Sound and along the coast near Kivalina; and north along the Noatak River. While recent subsistence use areas documented for Buckland (Satterthwaite-Phillips et al. 2016) indicate a shift in contemporary subsistence uses to the south, an even more recent 1-year harvest study conducted by ADF&G shows subsistence use continuing to occur along the Kobuk River nearly to the community of Ambler. In addition, a single non-salmon fish use area was reported on the Kobuk River upriver from the community of Kobuk (Mikow and Cunningham 2020). Marine mammal hunting by Buckland residents occurs in Kotzebue Sound primarily near the mouth of the Buckland River and near Deering. Bird hunting and egg harvesting is also focused around the Buckland River with coastal hunting in Kotzebue Sound as well. Fishing occurs along the Buckland River, in Kotzebue Sound, and in Selawik Lake, with the greatest amount of overlap occurring In Kotzebue Sound near the mouth of Selawik Lake, in the southern portion of Selawik Lake, and near the community of Buckland on the Buckland River. Large game hunting focuses to the south and east of the community, both along the Buckland River and in larger overland areas that extend south and east paralleling the Selawik River, with small game hunting and trapping occurring in similar overland areas. Finally, plant gathering in Buckland occurs most commonly along the Buckland River and in coastal areas near the mouth of the river (Satterthwaite-Phillips et al. 2016).

Map 8 shows Kotzebue subsistence use areas for all available time periods (Lifetime to 2014; 2014) occurring throughout Kotzebue Sound and along the Chukchi Sea coast, along the Kobuk and Noatak rivers, and in overland areas which extend to the southwest, north, east and southeast of the community. More recently documented subsistence use areas documented in Satterthwaite-Phillips et al. (2016) show Kotzebue residents using similar areas for subsistence throughout Kotzebue Sound and along the Noatak River and Kobuk River drainages. In addition, more recently documented use areas extend as far as Point Hope in the north and in areas surrounding the Kivalina and Wulik rivers. Based on the data in Satterthwaite-Phillips et al. (2016), contemporary marine mammal use areas occur throughout Kotzebue Sound and along the Chukchi Sea coast to Point Hope. Bird hunting focuses on the lands near Kotzebue, around the mouth of the Kobuk River, along the Noatak River, and along the coast extending from the Delong Mountain Transportation System (DMTS), Cape to Cape Krusenstern, Sheshalik, and the mouth of the Noatak River. Kotzebue use areas for fish are most concentrated around the mouth of the Kobuk River, in various areas of Kotzebue Sound and along the Noatak River. Large and small game hunting game hunting by Kotzebue residents focuses on coastal areas of Kotzebue Sound, along the Kobuk and Noatak rivers, and in overland areas to the northeast of the community in the Brooks Range. Plant gathering activities are focused on coastal areas in Kotzebue Sound and along the Noatak River, with some plant harvesting also occurring near the mouth of the Kobuk River (Satterthwaite-Phillips et al. 2016).

Noatak use areas for all available time periods (Lifetime ca. 1925-1985; Lifetime to 2014; 1998-2007; 2007) (Map 9) occur along the entire lower and upper Noatak River drainage, north onto the North slope, west to the Chukchi Sea coast and in marine waters of the Chukchi Sea, and south into Kotzebue Sound, along Kobuk river, and around the Selawik River drainage. More recently documented use areas occur in similar areas surrounding the Noatak River drainage but with less extensive use to the north of Brooks Range and south of the community along the Selawik River drainage. Marine mammal hunting by Noatak residents occurs throughout Kotzebue Sound and in marine waters off the Chukchi Sea coast as far as Point Hope. Bird hunting primarily occurs in overland areas surrounding the Noatak River, while fishing is focused along the Noatak River drainage with some fishing also occurring in coastal areas of Kotzebue Sound, particularly near Sheshalik. Contemporary large game and small game hunting in Noatak is focused heavily along the Noatak River drainage and in various overland areas surrounding the Noatak River. Plant gathering in Noatak is also focused around the Noatak River, with some coastal use areas identified as well (Satterthwaite-Phillips et al. 2016).

As shown on Map 10, Selawik subsistence use areas for all available time periods (Lifetime ca. 1925-1985; Lifetime to 2014; 2010-11) occur in an area surrounding the Selawik Lake and river, extending east toward the upper Kobuk and Koyukuk river drainages, north into the Brooks Range and as far as the upper Colville River, and west into Kotzebue Sound and along the Chukchi Sea coast to Kivalina. More recently documented subsistence use areas (Satterthwaite-Phillips et al. 2016) are focused primarily to the south of the Kobuk River drainage, with a majority of subsistence harvesting activities occurring around Selawik Lake, Selawik River, and in overland areas to the south of the community. Bird hunting is focused to the east of Selawik Lake along Inland Lake, Selawik River, and Tagagawik River. Fishing occurs with the greatest concentrations in Selawik Lake and along Selawik River, with lesser use of Kotzebue Sound and in several locations along the Kobuk River. Large game hunting focuses along local lakes and waterways in addition to extending across larger overland areas both north and south of the community of Selawik. Small game hunting and trapping occurs in similar overland areas but focused to the east of Selawik Lake. Residents also have reported a couple of isolated hunting areas for large and small game along the Kobuk River. Plant gathering by Selawik residents is more concentrated near the community and around river and lakesides.

5.2.2 Harvest Data

Harvest data for the Kotzebue Sound study communities are provided on Figure 4 through Figure 6 and in Table 12. As shown on Figure 4, based on an average of available data, non-salmon fish is the primary resource harvested among the study communities in terms of percentage of usable pounds (32 percent), followed closely by caribou (31 percent). Marine mammals and salmon (both 14 percent) also contribute a substantial amount to Kotzebue Sound study communities. Other resources which contribute smaller amounts in terms of pounds include moose, vegetation, and migratory birds. Resource contribution varies by study community. Selawik shows a much higher reliance on non-salmon fish than other Kotzebue Sound study communities, at 68 percent of the total subsistence harvest. Noatak and Buckland show a higher reliance on caribou, while Kotzebue harvests are nearly evenly split between caribou, non-salmon fish, salmon, and marine mammals.

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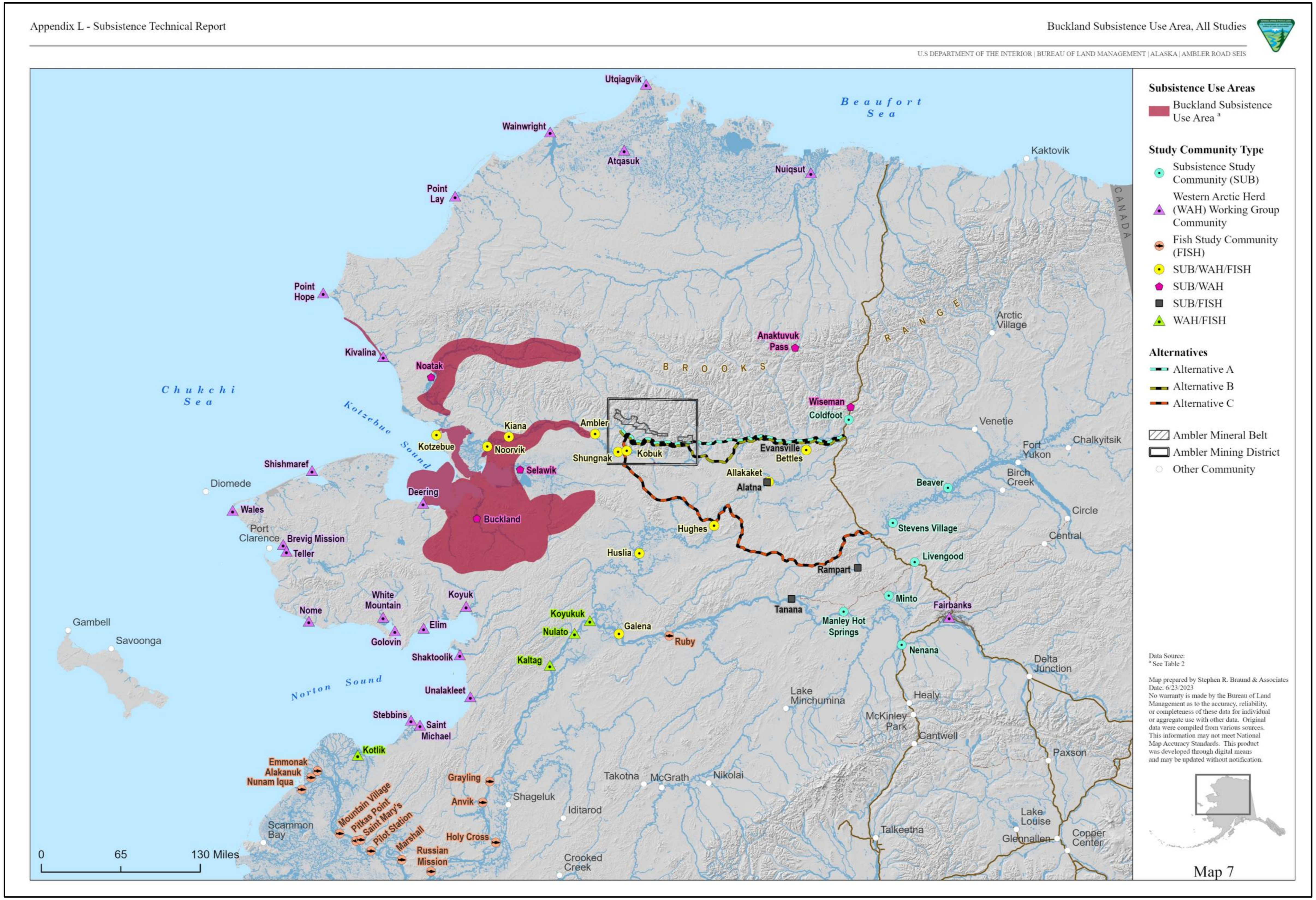

Map 7. Buckland subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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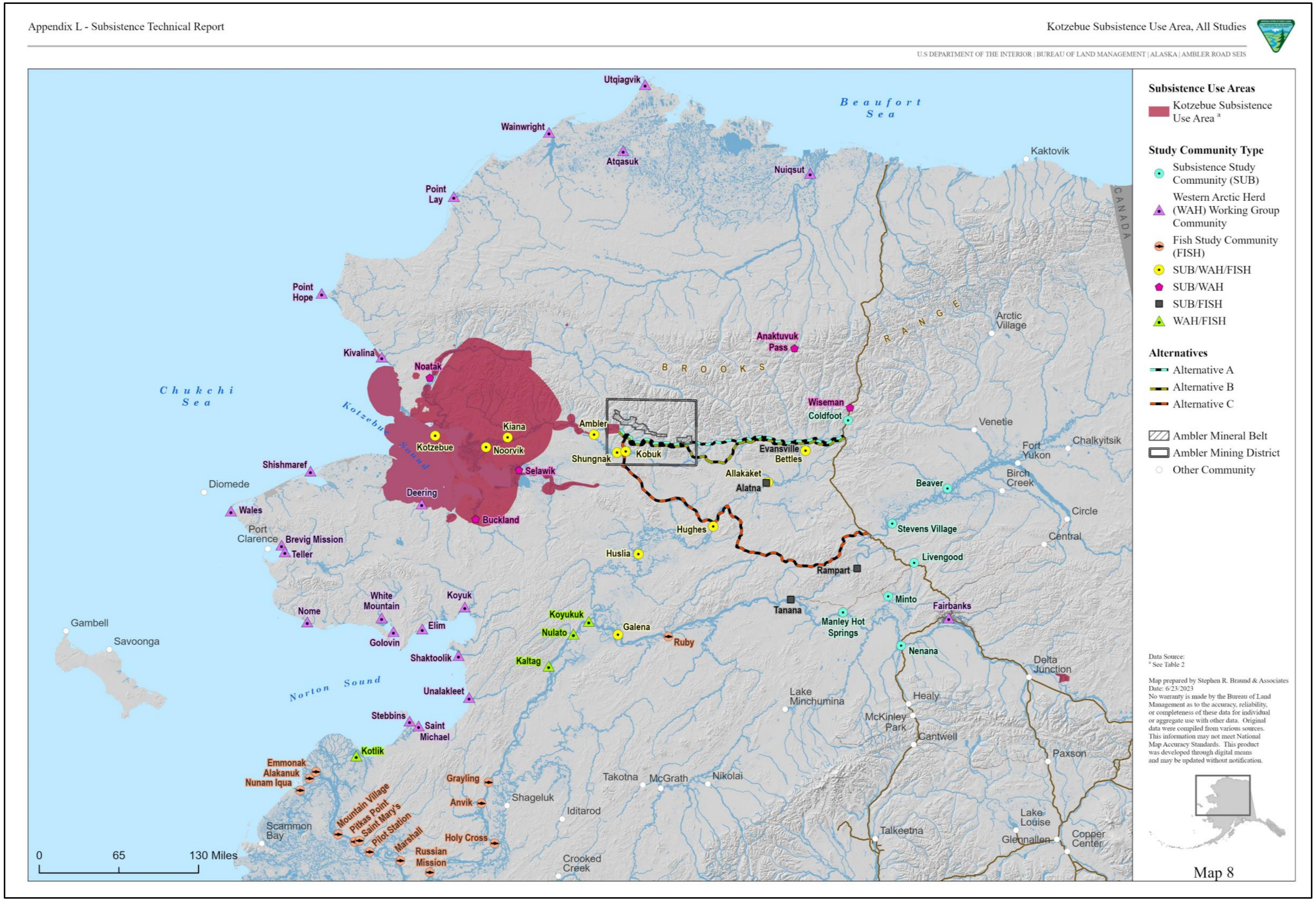

Map 8. Kotzebue subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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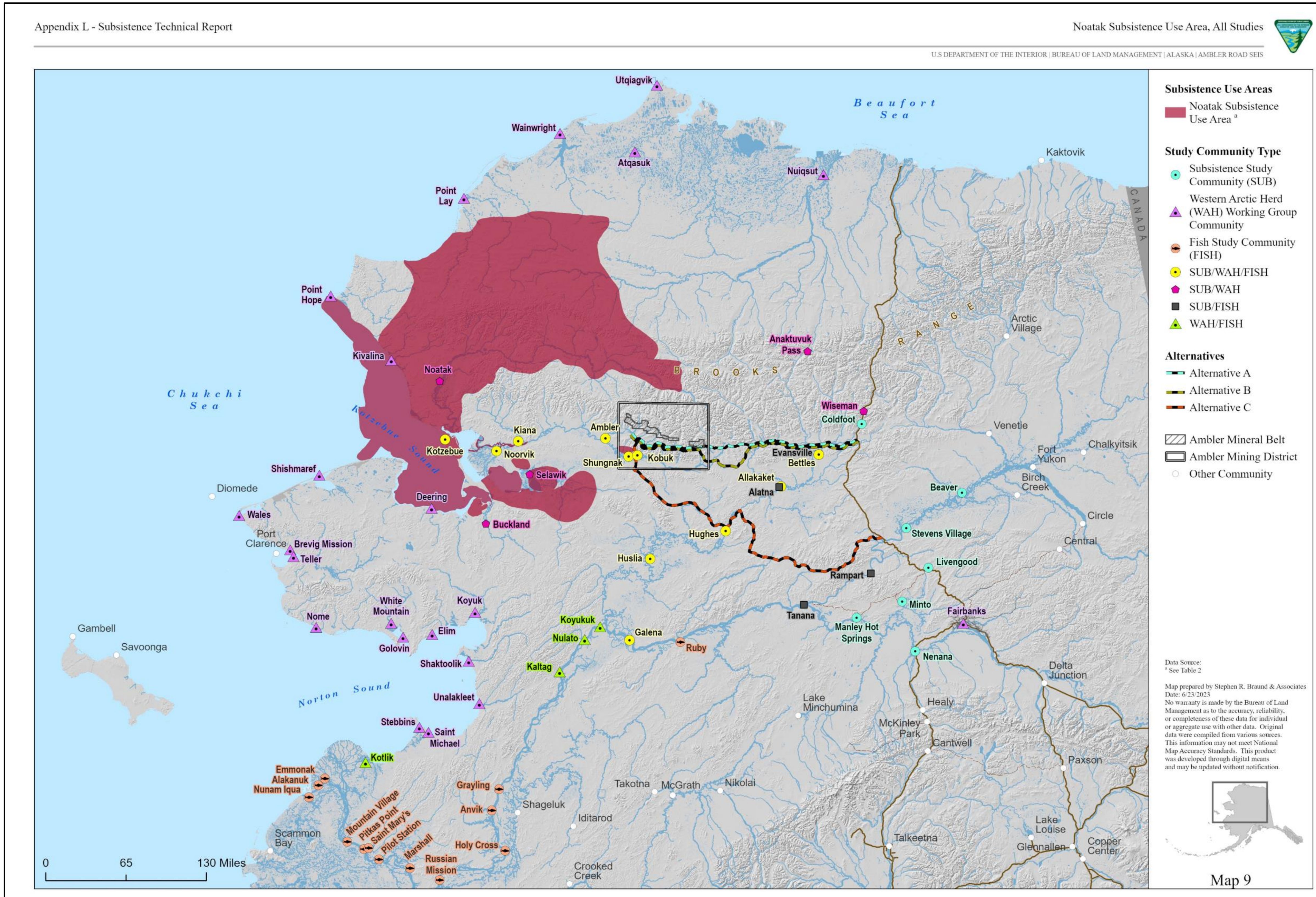

Map 9. Noatak subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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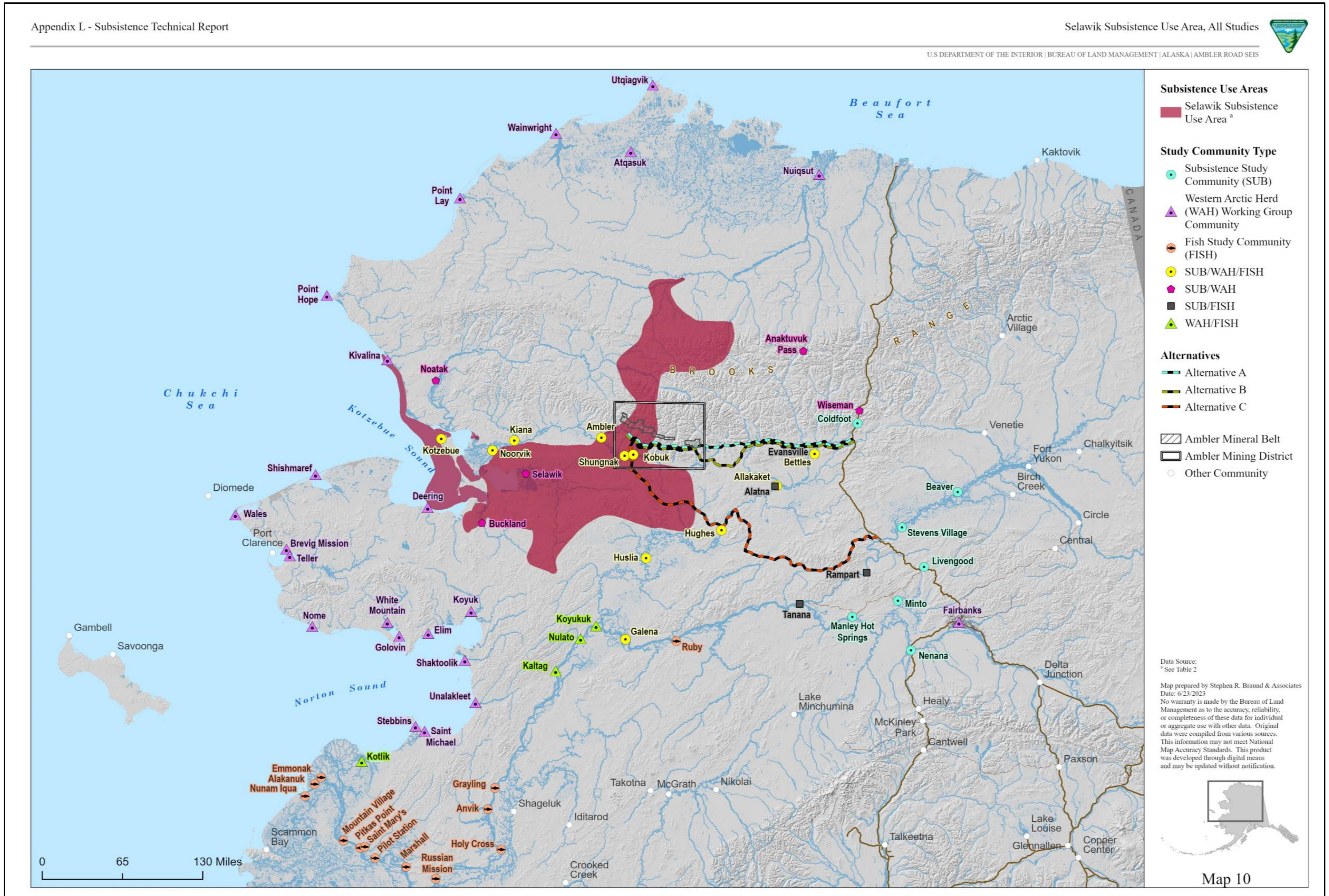

Map 10.Selawik subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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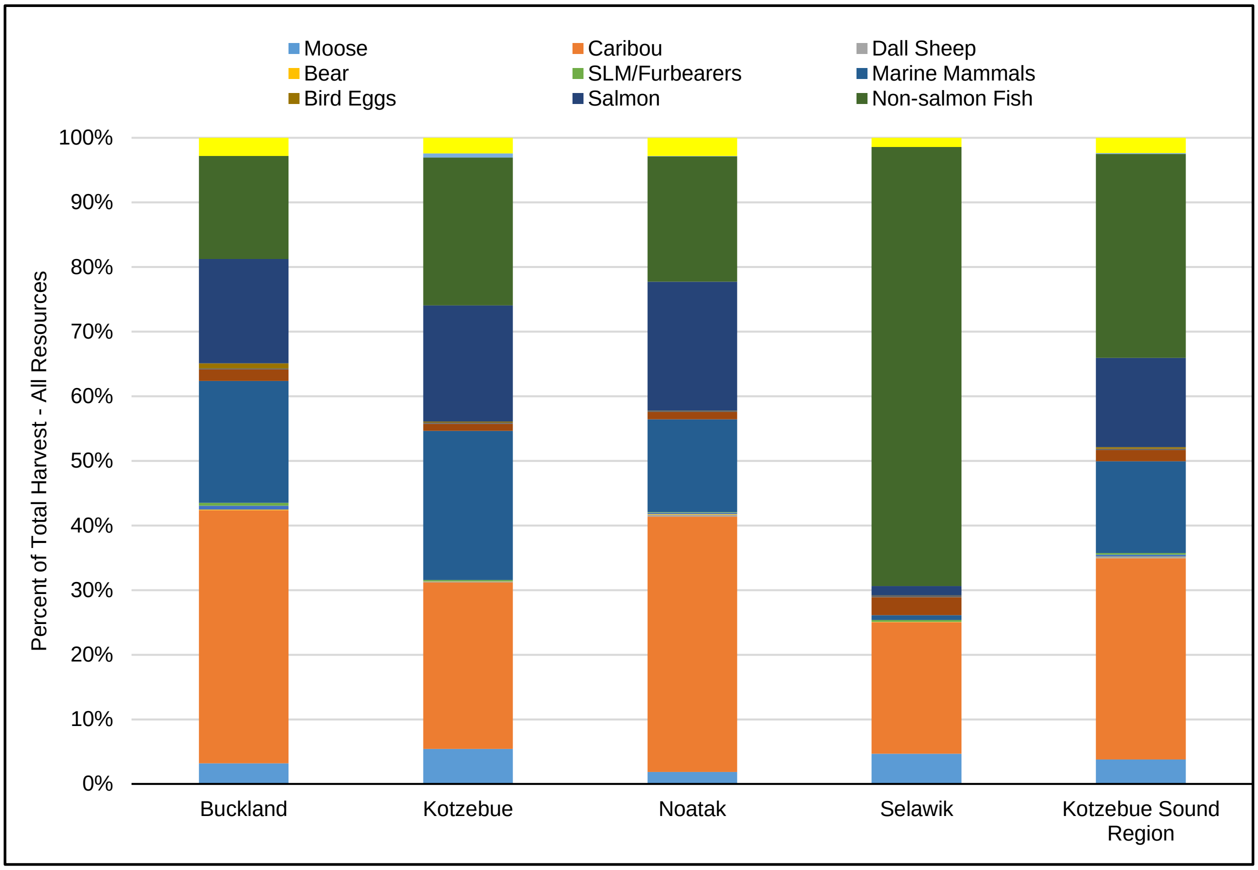

Figure 4. All resources percent of total harvest by Kotzebue Sound region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of harvest across all available study years for comprehensive (i.e., all resources) household harvest surveys. In many cases, averages represent only a single study year. Available study years for each community are as follows: Buckland (2003); Kotzebue (1986, 1991, 2002-2004, 2014); Noatak (1994, 2007); Selawik (2010-11).

Average participation rates among Kotzebue Sound study communities, in terms of the average percentage of households attempting harvests by resource during individual study years, are shown on Figure 5. These data are based on averages across available study years; it is likely that in some years (or across all years) a higher percentage of households participates in each resource activity. Across all Kotzebue Sound study communities, households most commonly participate in harvests of vegetation (81 percent of households), followed by non-salmon fish (74 percent), caribou (62 percent), salmon (48 percent), and migratory birds (43 percent). Fewer households participate in harvests of marine invertebrates, Dall sheep, other large land mammals, and small land mammals/furbearers. While an important resource in terms of harvest amounts, participation in marine mammal harvesting occurs among a smaller subset of households (26 percent). The average percentage of households receiving different resources is shown on Figure 6. Similar to the Kobuk River region, this figure shows that while certain resources are not as commonly harvested within a community, they may still be highly consumed through sharing. For example, while only 26 percent of households hunt marine mammals nearly 50 percent of households receive this resource. The most commonly shared resources in Kotzebue Sound communities (more than half of households receiving) include caribou, non-salmon fish, and salmon.

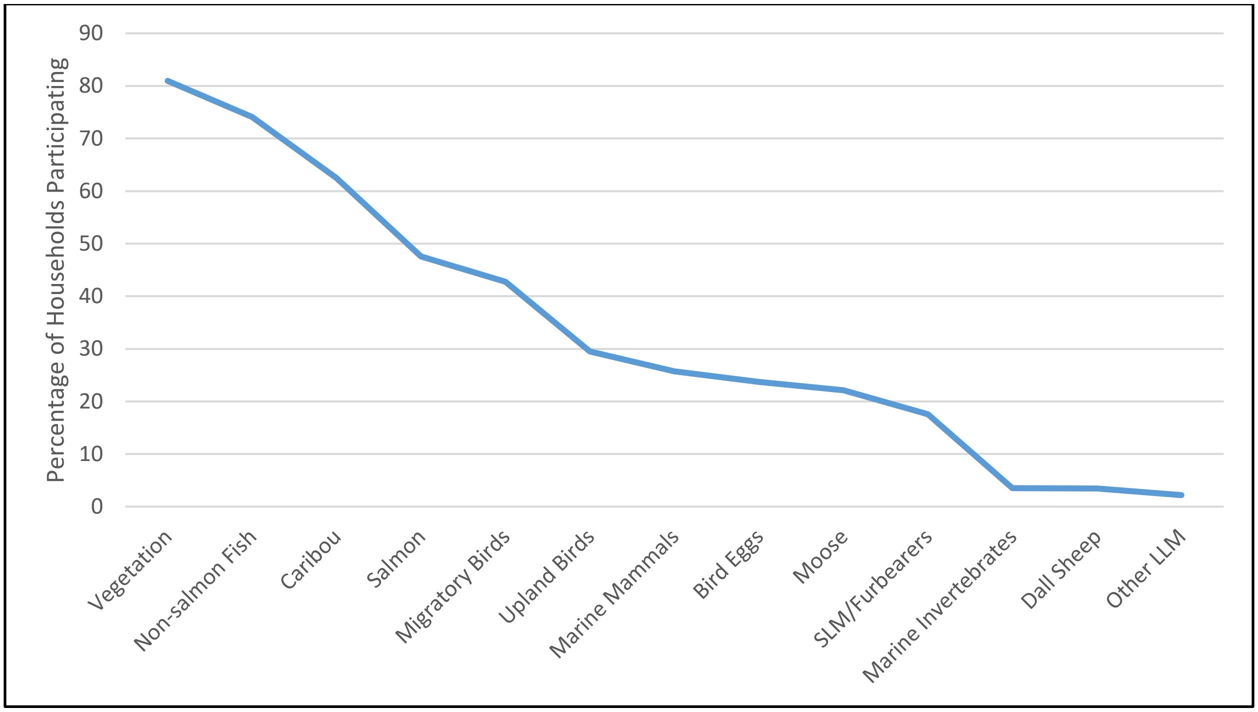

Figure 5. Percent of households attempting harvests of resources, Kotzebue Sound region communities

Source: See Table 2 for citations, time period, and resources addressed.
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows (available study years vary by resource): Buckland (1996, 2003, 2009-10, 2012-2014, 2016-17); Kotzebue (1986, 1991,1997, 2002-2004, 2012, 2012-2013, 2013-2014, 2014); Noatak (1994, 1997, 1999, 2002, 2007, 2010-11, 2011-12, 2012-2014); Selawik (1993, 1997-1998, 1998, 2006, 2010-11, 2013-2014).

Table 12 shows average harvest and use data for the top five species harvested (in terms of average contribution toward the total subsistence harvest) by each of the Kotzebue Sound Region study communities. Caribou is the top species in three of the four study communities (Buckland, Kotzebue, and Noatak), contributing between 25.7 percent and 39.6 percent of the total subsistence harvest. Broad whitefish is the top harvested resource in Selawik, at 33.2 percent of the harvest. Other non-salmon fish species are among the top five species in Kotzebue Sound study communities and include sheefish (Kotzebue and Selawik), smelt (Buckland), and Dolly Varden (locally called trout; Noatak). Salmon—specifically chum salmon—are among the top five species harvested in two of the study communities. Other top species in the Kotzebue Sound Region include moose (Buckland, Kotzebue), seal (spotted and bearded; Buckland, Kotzebue, and Noatak), and northern pike (Selawik). Data on the percentage of households using subsistence resources illustrates the heavy reliance of Kotzebue Sound communities on resources such as caribou and fish, with between 86 percent and 97 percent of households in the individual communities using caribou; and between 81 and 97 percent of households using fish (Table 5). Across all study years, these percentages are likely higher.

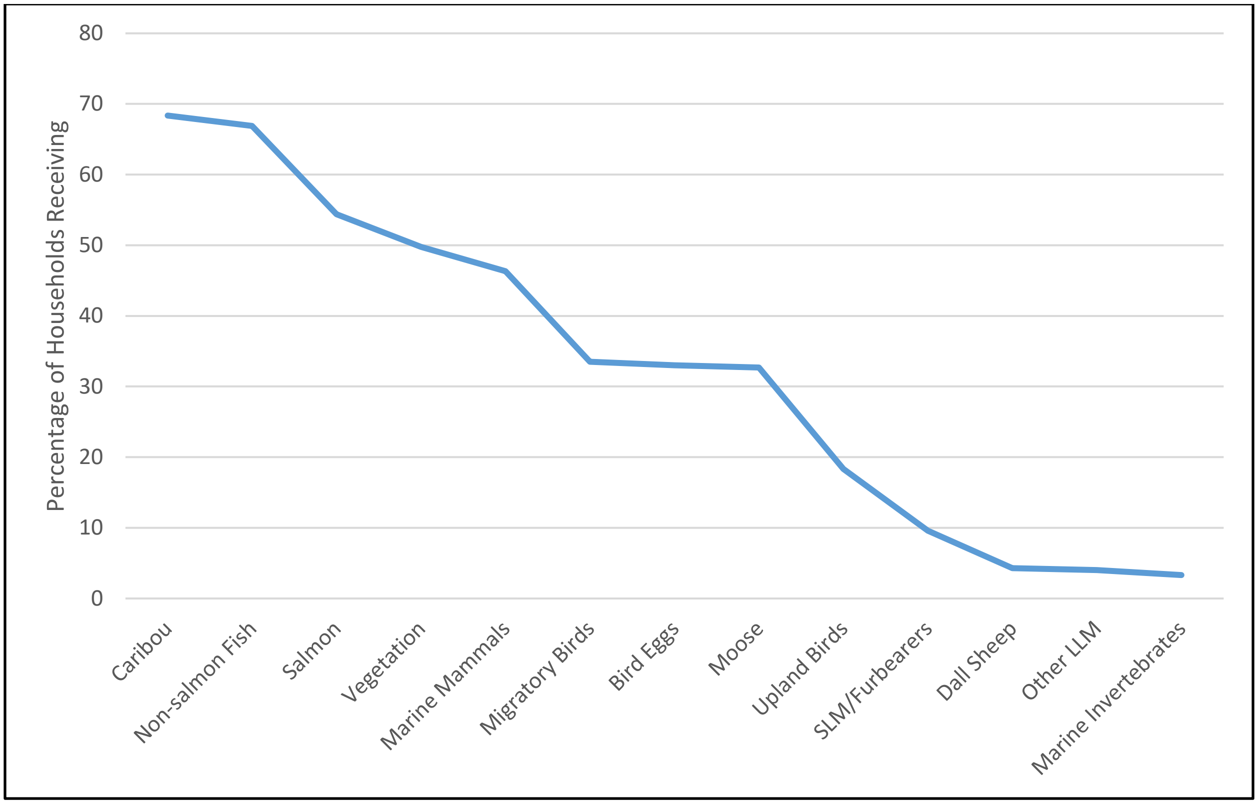

Figure 6. Percent of households receiving resources, Kotzebue Sound region communities

Source: See Table 2 for citations, time period, and resources addressed.
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows (available study years vary by resource): Buckland (1996, 2003, 2009-10, 2012-2014, 2016-17); Kotzebue (1986, 1991,1997, 2002-2004, 2012, 2012-2013, 2013-2014, 2014); Noatak (1994, 1997, 1999, 2002, 2007, 2010-11, 2011-12, 2012-2014); Selawik (1993, 1997-1998, 1998, 2006, 2010-11, 2013-2014).

5.2.3 Timing of Subsistence Activities

Data on the timing of subsistence activities for Kotzebue Sound study communities are provided in Table 13. This table shows the number of communities reporting subsistence activity or harvests within each month, based on the most recent data sources for each community. Overall, Kotzebue Sound communities target the greatest number of resources during the spring month of April, followed by the fall month of September.

In early spring (March/April), residents continue to trap and hunt for furbearers and small land mammals. Sheefish are also commonly harvested in the spring through the ice, while residents may also set nets to harvest whitefish and Dolly Varden (locally referred to as “trout”) during their spring runs. Geese and duck hunting peaks in May (Braem et al. 2017). When available, residents may also hunt WAH caribou during their spring migration north. Marine mammal hunting also begins during the spring months, as bearded seals begin migrating on the ice past Kotzebue Sound.

Salmon harvesting is a key summer activity which peaks in July and August. Harvesting of sheefish continues through summer as well. Harvesting of berries and wild plants begins in summer, as does hunting of large land mammals. Harvesting of marine mammals throughout the summer.

Table 12. Average harvest and use data, top 5 species, Kotzebue Sound region communities

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% Total harvest
Buckland	Caribou	87	70	66	56	59	704	95,692	1,006	195	39.0%
Buckland	Bearded seal	66	45	42	41	34	119	34,175	338	58	10.5%
Buckland	Smelt	83	70	69	50	39	80,817	19,068	203	40	7.2%
Buckland	Spotted seal	38	35	32	20	15	97	9,470	100	19	3.5%
Buckland	Moose	27	18	9	13	17	13	7,003	74	15	3.2%
Kotzebue	Caribou	86	49	42	47	64	2,094	284,711	353	90	25.7
Kotzebue	Chum salmon	84	47	45	41	60	32,714	199,009	244	59	17.0
Kotzebue	Sheefish	82	54	52	42	52	39,545	217,497	271	66	15.9
Kotzebue	Bearded seal	55	23	19	25	40	22,179	218,447	274	67	15.6
Kotzebue	Moose	47	23	12	16	38	105	56,591	70	18	5.4
Noatak	Caribou	88	66	60	54	67	416	44,761	12,355	124	39.6
Noatak	Chum salmon	85	75	74	57	58	6,282	28,800	8,869	74	18.8
Noatak	Dolly Varden	90	78	69	63	67	6,685	18,724	3,207	42	12.8
Noatak	Bearded seal	52	19	32	40	56	48	12,579	7,176	42	10.6
Noatak	Whitefish	61	39	38	37	54	6,778	14,234	120	27	7.4
Selawik	Broad whitefish	66	44	43	36	42	29,252	93,626	544	115	33.2
Selawik	Caribou	97	65	59	67	82	969	131,801	810	174	20.4
Selawik	Sheefish	72	56	53	39	42	6,011	43,712	256	55	15.1
Selawik	Northern pike	63	51	46	34	31	11,612	37,485	218	47	11.5
Selawik	Humpback whitefish	31	21	19	16	20	8,515	16,930	98	21	5.2

Source: See Table 2 for citations, time period, and resources addressed
Notes: HH = households; N/A = Not available

Table 13. Kotzebue Sound region timing of subsistence activities, number of communities reporting subsistence activity

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon fish	2	2	2	2	2	2	2	2	2	2	2	2
Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	2	N/A	N/A	N/A
Caribou	4	4	4	4	3	2	2	4	4	4	4	3
Moose	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	4	2	N/A	N/A
Bear	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	N/A
Other large land mammals	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A	2	N/A	N/A	N/A
Furbearers	3	3	2	2	N/A	N/A	N/A	N/A	N/A	N/A	2	3
Small land mammals	2	N/A	2	2	2	N/A	N/A	N/A	2	2	N/A	N/A
Marine mammals	N/A	N/A	N/A	5	4	6	4	3	4	3	2	N/A
Upland birds	2	2	2	2	N/A	N/A	N/A	N/A	N/A	N/A	2	2
Waterfowl	N/A	N/A	N/A	2	2	2	N/A	N/A	2	N/A	N/A	N/A
Plants and berries	N/A	N/A	N/A	N/A	N/A	2	2	2	2	N/A	N/A	N/A
Total number of resources per month	**5**	**4**	**5**	**8**	**5**	**5**	**4**	**6**	**10**	**5**	**5**	**4**

Source: Gonzalez et al. 2018; Georgette and Loon 1993; Braem et al. 2017; SRB&A 2009b; Mikow et al. 2014; Braem et al. 2013; Mikow and Cunningham 2020.

Notes: Apr = April; Aug = August; Dec = December; Feb = February; Mar = March; Jan = January; Jul = July; Jun = June; N/A = Not applicable (no or limited subsistence activity); Nov = November; Oct = October; Sep = September

Kotzebue Sound Region Communities = 4 (Buckland, Kotzebue, Noatak, and Selawik).

Each cell contains the number of communities reporting subsistence activity or harvests during each month, based on the most recent data source for each community. Months with only one community report harvests or activity are not included in the table. Resources with no subsistence activity data available are not included in the table

As with the Kobuk River region, subsistence harvesting in the Kotzebue Sound region peaks in fall. Caribou and moose hunting is most intense during the fall months of August through October, and residents also resume hunting waterfowl as they migrate south. Seal hunting continues into the fall as well during the open water months. Residents set nets for whitefish and trout as well during this time.

Hunting and fishing (through the ice) continues at somewhat lower levels into winter. For some residents, sheefish harvesting continues into the winter. Residents hunt caribou throughout the winter as they are available. Hunting and trapping of furbearers and small land mammals is most active during the winter and into the early spring.

5.2.4 Travel Method

While systematic, quantitative data on travel methods are not available for most Kotzebue Sound subsistence study communities, several studies provide qualitative and quantitative information on travel methods and routes in the Kotzebue Sound region. Primary travel corridors within the Kotzebue Sound region include the Noatak River, Kobuk River, and Kotzebue Sound, in addition to the Selawik and Buckland rivers. Similar to the Kobuk River region, snowmachines and boats are the primary mode of travel to subsistence harvesting areas, although ATVs are also present in the study communities as well (Satterthwaite-Phillips et al. 2016). A subsistence mapping and traditional knowledge study conducted in 2007 provides more quantitative data on travel methods for Noatak (SRB&A 2009). These data show Noatak residents traveling by boat primarily from May to September, with limited travel reported in April and October. Snowmachine travel generally occurs from November through April and dropping off in May. To a lesser extent, residents take four-wheelers during the summer months, primarily in July and August. Documented travel routes for the community of Noatak occur over a large area, with the Noatak River a primary travel corridor in addition to various overland snowmachine routes between Noatak and Kivalina, Kiana, Noorvik, Selawik, and Kotzebue.

5.2.5 Resource Importance

The relative importance of subsistence resources to the individual Kotzebue Sound study communities, based on selected variables, is provided in Table 14 through Table 17 (see Section 5.3.5, Resource Importance, for discussion of methods). Based on this analysis, caribou, non-salmon fish, and vegetation are resources of high importance in all four study Kotzebue Sound Region study communities. In addition, salmon are a resource of high importance in three of the four study communities (Buckland, Kotzebue, and Noatak). Resources of moderate importance in the study communities include moose (four study communities), other large land mammals (one study community), migratory birds (four study communities), upland birds (three study communities), and salmon (one study community).

5.3. Koyukuk River

The Koyukuk River region includes the communities of Alatna, Allakaket, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Huslia, and Wiseman. These communities are located along the Koyukuk River drainage which is crossed in multiple locations by the AMDIAR project alternatives. Bettles and Evansville are located directly along the northern project corridor alternatives, while Hughes is located directly along the southern project corridor alternative. Alatna and Allakaket are located on the Koyukuk River between the northern and southern alternatives; Anaktuvuk Pass, Wiseman, and Coldfoot are located north of all project alternatives; and Huslia is located south of all project alternatives.

Table 14. Relative importance of subsistence resources based on selected variables, Buckland

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	18	17	3	M
2	Caribou	87	70	39	H
3	Dall sheep	N/A	N/A	N/A	N/A
4	Bear	2	1	0.09	L
5	Other large land mammals	9	7	0.88	L
6	Small land mammals/furbearers	22	7	0.3	L
7	Marine mammals	47	46	19	M
8	Migratory birds	49	33	2	M
9	Upland birds	38	18	0.14	M
10	Bird eggs	55	33	0.80	M
11	Salmon	51	54	16	H
12	Non-salmon fish	79	67	16	H
13	Marine invertebrates	5	3	0.04	L
14	Vegetation	87	50	3	H

Source: See Table 2
Notes: H = High; HH = Households; L = Low; M = Moderate; N/A = Not Available

Table 15. Relative importance of subsistence resources based on selected variables, Kotzebue

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	23	38	5	M
2	Caribou	49	64	26	H
3	Dall sheep	3	4	0.1	L
4	Bear	N/A	N/A	0.1	L
5	Other large land mammals	1	6	0.05	L
6	Small land mammals/furbearers	11	11	0.2	L
7	Marine mammals	26	70	23	H
8	Migratory birds	31	23	1	M
9	Upland birds	31	13	0.2	M
10	Bird eggs	14	13	0.1	L
11	Salmon	50	60	18	H
12	Non-salmon fish	74	76	23	H
13	Marine invertebrates	5	24	1	L
14	Vegetation	72	50	2	H

Source: See Table 2
Notes: H = High; HH = Households; L = Low; M = Moderate; N/A = Not Available

Table 16. Relative importance of subsistence resources based on selected variables, Noatak

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	12	23	2	M
2	Caribou	66	67	40	H
3	Dall sheep	4	5	0.3	L
4	Bear	N/A	N/A	0.1	L
5	Other large land mammals	1	3	0.2	L
6	Small land mammals/furbearers	11	4	0.1	L
7	Marine mammals	20	72	14	H
8	Migratory birds	46	29	1	M
9	Upland birds	20	17	0.1	L
10	Bird eggs	20	9	0.1	L
11	Salmon	77	62	20	H
12	Non-salmon fish	79	78	19	H
13	Marine invertebrates	1	3	0.02	L
14	Vegetation	85	64	3	H

Source: See Table 2
Notes: H = High; HH = Households; L = Low; M = Moderate; N/A – Not Available

Table 17. Relative importance of subsistence resources based on selected variables, Selawik

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	36	53	5	M
2	Caribou	65	82	20	H
3	Dall sheep	N/A	N/A	N/A	N/A
4	Bear	N/A	N/A	0.04	L
5	Other large land mammal	N/A	N/A	N/A	N/A
6	Small land mammal/furbearers	19	9	0.3	L
7	Marine mammals	10	75	1	H
8	Migratory birds	44	41	3	M
9	Upland birds	30	17	0.3	M
10	Bird eggs	6	3	0.02	L
11	Salmon	12	45	1	M
12	Non-salmon fish	65	59	68	H
13	Marine invertebrates	2	7	0.001	L
14	Vegetation	80	53	1	H

Source: See Table 2
Notes: H = High; HH = Households; L = Low; M = Moderate; N/A = Not Available

5.3.1 Subsistence Use Areas

Subsistence use areas for the Koyukuk River region study communities are focused around the upper and lower Koyukuk river drainages and various tributaries of the Koyukuk River, the upper Kobuk River, and overland areas surrounding the Koyukuk River and into the Brooks Range. Use areas for the northernmost Koyukuk River region study community of Anaktuvuk Pass extend onto the North Slope of Alaska and as far north as Nuiqsut, while use areas for the southernmost community of Huslia extend west to Kotzebue Sound and south to the Yukon River. More recently documented subsistence use areas for the study communities (Watson 2018; SRB&A 2016a) indicate various changes to contemporary subsistence use areas compared to historic use areas, including certain changes brought about by establishment of the Gates of the Arctic National Park and Preserve (Watson 2018).

As shown on Map 11 and Map 12, Alatna and Allakaket subsistence use areas for all available time periods ("Traditional"; Lifetime to 2012; 1981-1985; 1981-83; 2006-2015; 2011) occur along the Koyukuk River between Huslia and the Dalton Highway, along the Alatna, Kanuti, and Hogatza rivers and various smaller tributaries of the Koyukuk River; and in various overland areas surrounding the Koyukuk River. Recent subsistence use areas documented for Alatna and Allakaket (Watson 2018; SRB&A 2016a) indicate similar subsistence uses, with the greatest concentration of use occurring along the Koyukuk, Alatna, and Kanuti rivers. Ristroph et al. (2019) also recently documented traditional subsistence use areas in addition to place names that show similar areas of importance to Alatna and Allakaket; these use areas are displayed on Map 11 and Map 12 along with place name areas as documented by Jones et al. (1997). Areas of high overlapping use along the Alatna River are crossed by the northern project alternatives. Comparison of more recent use area data to historic use areas indicate a shift away from overland use and toward riverine use. According to Watson (2018) contemporary large land mammal hunting by Alatna and Allakaket hunters, including hunting of Dall sheep and moose, occurs along the Koyukuk and Alatna rivers. Hunting of Dall sheep is focused on drainages that extend into the Brooks Range (Alatna and John rivers), while moose hunting occurs along a more extensive riverine area including the Koyukuk River drainage both upriver and downriver from Alatna and Allakaket, Henshaw Creek, Kanuti River, and Hogatza River. Furbearer trapping occurs along the Kanuti River and along the Koyukuk as far as the Dalton Highway; recent furbearer trapping areas are more concentrated along river corridors than historic trapping areas which may be a result of changes in transportation method (e.g., less plane travel) or an overall decline in the number of furbearer trappers (Watson 2018). Non-salmon fish harvesting is also focused along the Koyukuk River, Henshaw Creek, Alatna River, and Kanuti River, while salmon harvesting is limited primarily to the Alatna River and Henshaw Creek areas. Harvest of vegetation is also focused on the Alatna River and Henshaw Creek.

Map 13 shows use areas for Anaktuvuk Pass for all available time periods (Lifetime Pre-1979; 2001-2010; 2001-02, 2002-03, 2006-07, 2011, 2014) occurring throughout the Brooks Range and into the foothills of the Brooks Range on the North Slope. Use areas for this community extend into the John River which is a tributary of the Koyukuk River. In addition, community residents travel to the west and southwest of the community and have reported caribou and furbearer hunting areas which overlap with the terminus of the project alternatives. According to Brown et al. (2016), during the 2014 study year hunting for caribou, moose, and Dall sheep occurred in various drainages of the Brooks Range, including the John River, a tributary of the Koyukuk River. Caribou hunting also extended into the foothills of the Brooks Range on the North Slope. Various other resource activities extended into the John River drainage, including small land mammal hunting/trapping, non-salmon fish harvesting, and vegetation harvesting.

Use areas for Bettles and Evansville for all available time periods (Lifetime to 2016; 1981-82; 1981-83; 2006-2015; 2011) are shown on Map 14 and Map 15 and indicate use areas that extend along the foothills of the Brooks Range; along various drainages of the southern Brooks Range, including the Kobuk River, upper Koyukuk River, Alatna River, and John River; in an area surrounding Iniakuk Lake; and along the Dalton Highway north of Coldfoot and Wiseman. Some isolated use areas occur on the North Slope. Recent studies indicate somewhat disjointed subsistence use areas which may reflect the increased use of planes for accessing harvesting areas, in addition to the creation of the Gates of the Arctic National Park which limits residents' access and harvesting activities. In terms of specific resources, contemporary Dall sheep use areas occur along the Koyukuk River, including the Middle Fork Koyukuk parallel to the Dalton Highway. Moose hunting occurs in a large area surrounding the upper Alatna River in the Brooks Range, and in an area surrounding the community along the John, Wild, and Koyukuk rivers. Trapping also occurs in an area surrounding the Alatna River and Iniakuk Lake, in addition to the John and Koyukuk rivers. Caribou hunting occurs near the communities of Bettles and Evansville, near Iniakuk Lake, and in the foothills of the Brooks Range on the North Slope. Residents access fish in various lakes and rivers of the Brooks Range in addition to the upper Kobuk River, Iniakuk Lake, John River, and North Fork Koyukuk River. Contemporary vegetation harvesting occurs in several areas of the Brooks Range surrounding Walker Lake, Iniakuk Lake, and Evansville and Bettles.

Coldfoot and Wiseman use areas for all time periods (2005-2014; 2011) are depicted on Map 16 and Map 17 and indicate subsistence harvesting activities surrounding the Dalton Highway in the Brooks Range and at various locations to the west and southwest of the communities including along the Koyukuk River, Alatna River, Iniakuk Lake area, John River, and upper Kobuk River. Recently documented resource-specific use areas (SRB&A 2016a) for the 2005–2014 time period show moose, caribou, bear and small land mammal hunting occurring primarily along the Dalton Highway in addition to various mountain passes extending off of the Dalton Highway. Dall sheep hunting occurs in larger areas off of the highway into the mountains. Hunting of large and small land mammals, in addition to bird hunting occurs primarily to the north of the communities although some activities occur farther south in or near the upper Koyukuk River drainages. Harvesting of non-salmon fish occurs primarily south of the communities along the Dalton Highway where it crosses the South Fork Koyukuk and Jim rivers, in addition to various small lakes in the Brooks Range.

Subsistence use areas for Hughes for all available time periods (Lifetime to 2016; 1981-1985; 1981-83; 2014) are shown on Map 18. Use areas for this community are primarily focused along the Koyukuk River between Huslia and Evansville/Bettles and along the Alatna River into the Brooks Range. In addition, Hughes subsistence harvesting areas extend overland from the community both south and north of the Koyukuk River. The southern project alternative crosses through the heart of Hughes subsistence harvesting areas near the community, while the northern alternatives cross through subsistence harvesting areas along the Alatna and John rivers. According to Watson (2018), contemporary subsistence use areas occur over a more extensive riverine area, although this may be attributed to the lack of documentation of Dall sheep use areas in earlier studies. Contemporary Dall sheep use areas occur along the Koyukuk River upriver from the community and substantial distances into the Alatna and John rivers. Contemporary and historic moose hunting occur in similar areas both upriver and downriver from the community of Hughes. Furbearer hunting and trapping occurs overland both north and south of the community and along the Koyukuk River between Huslia and Alatna/Allakaket. Salmon and non-salmon fish harvesting both occur in the Koyukuk River near Hughes, while vegetation harvesting occurs primarily downriver from the community.

Huslia use areas (Map 19) for all available time periods (Lifetime to 2016; 1981-83) occur along the mid- to lower-Koyukuk River, the Yukon River, and in large overland areas which extend to the north and west toward Buckland, Selawik, and along the Kobuk River from Shungnak to Kotzebue Sound. Huslia use areas, including overland hunting areas to the north of the community and use areas along the Koyukuk River, are overlapped with the southern project corridor. Watson (2018) indicates that the community's primary hunting areas occur along the Yukon River toward Ruby, along the Koyukuk River to Hughes, and in an overland areas between the Koyukuk River and the Kobuk River. Other overland areas, such as those toward Buckland, Selawik, and Kotzebue are less commonly used. More recent contemporary use areas compared to historic use areas indicate an expansion of harvest areas over time, although this may be partly attributed to underreporting of use areas during earlier studies (Watson 2018), as respondents characterized their contemporary areas as “traditional” areas that were used by their elders. Moose hunting by Huslia residents occurs along the Yukon and Koyukuk rivers in addition to some overland use areas directly around the community. Caribou hunting extends over a larger overland area, including hunting areas between the Koyukuk River toward Selawik and Buckland, which is reflective of recent reports of changes in caribou distribution toward the Buckland area. Non-salmon fish harvesting occurs in various lake systems and creeks surrounding the Koyukuk River, including Clear Creek, Caribou Creek, and the Huslia River. Residents fish for salmon in various river systems including the Yukon, Koyukuk, and Kobuk rivers (Watson 2018).

5.3.2 Harvest Data

Harvest data for the Koyukuk River study communities are provided on Figure 7 through Figure 9 and in Table 18. As shown on Figure 7, based on an average of available data, salmon is the primary resource harvested among the study communities in terms of percentage of usable pounds (31 percent), followed closely by moose (28 percent) and caribou (26 percent). Non-salmon fish (12 percent) and vegetation (4 percent) also contribute a substantial amount to Koyukuk River Region study communities. Other resources which contribute smaller amounts in terms of pounds include Dall sheep, small land mammals, and migratory birds. Resource contribution varies widely among the Koyukuk River Region study communities, reflecting the large variation in geography and resource availability across the region. The communities of Anaktuvuk Pass and Coldfoot rely on caribou for a majority of their harvests, with caribou contributing over 80 percent of the harvest. Compared to the other subsistence study communities, these two communities have access to the Central Arctic Herd on the North Slope. Bettles, Evansville, and Wiseman rely primarily on moose for their subsistence harvests, while Alatna, Allakaket, Hughes, and Huslia rely primarily on non-salmon fish harvests.

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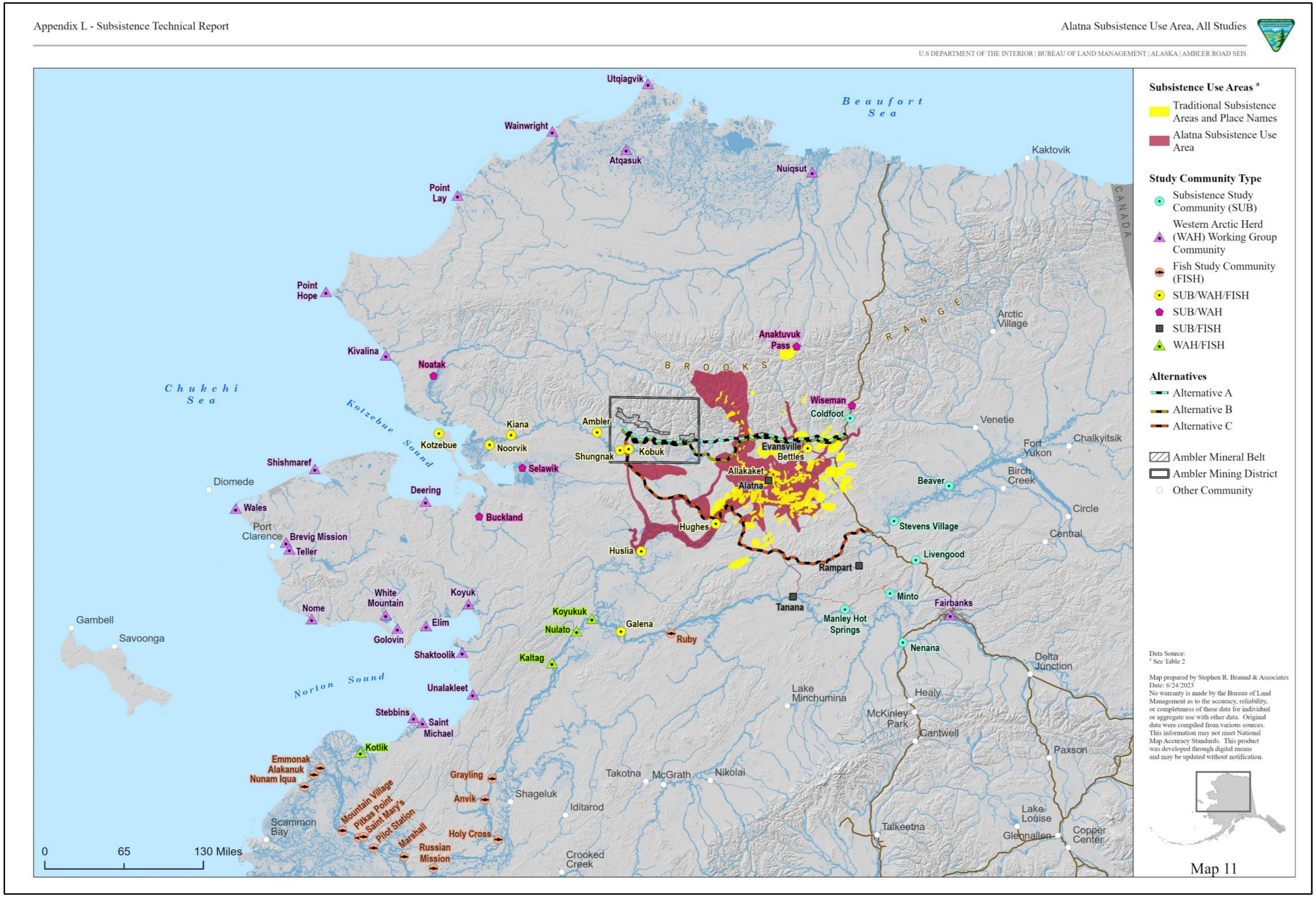

Map 11. Alatna subsistence use areas, all studies

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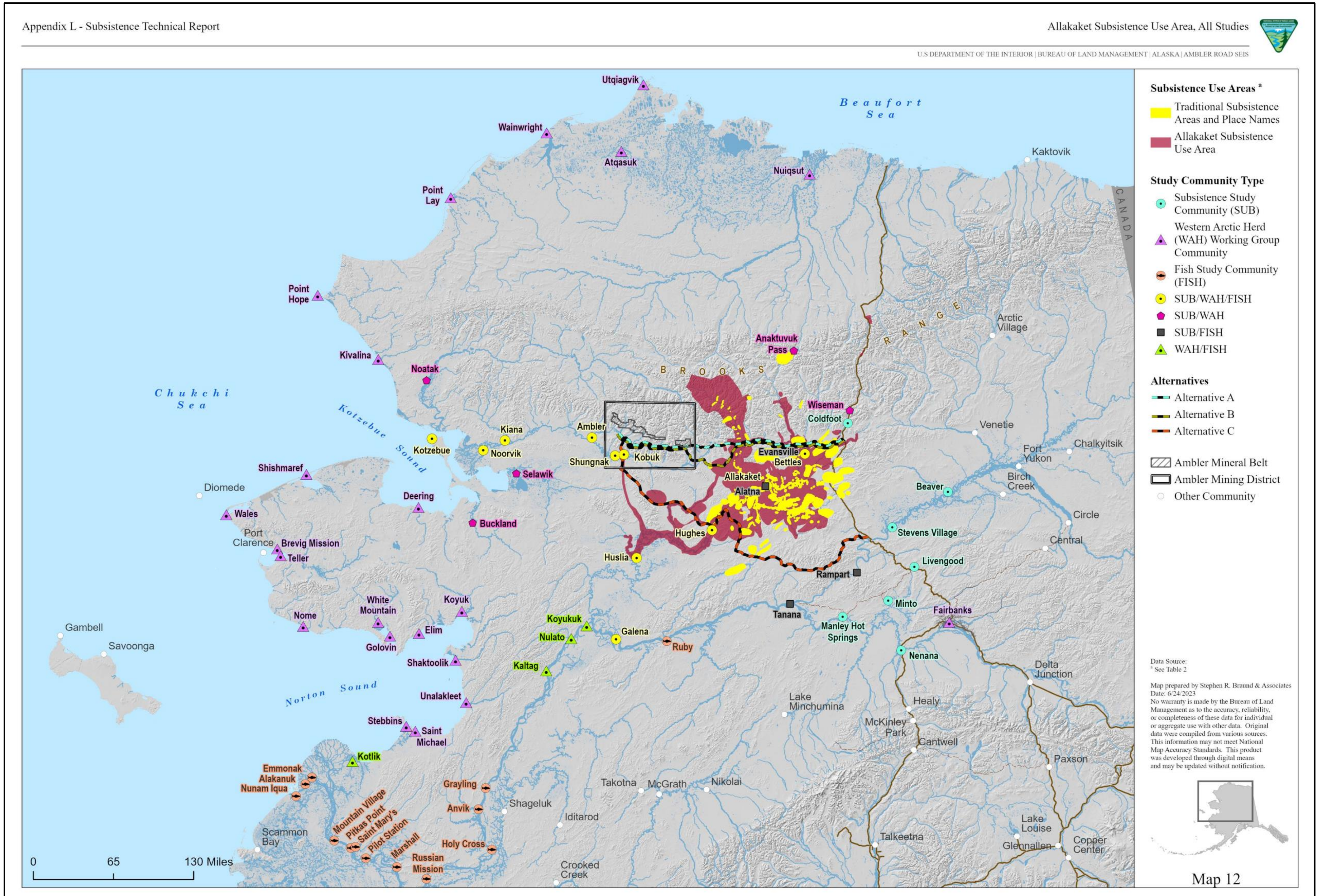

Map 12. Allakaket subsistence use areas, all studies

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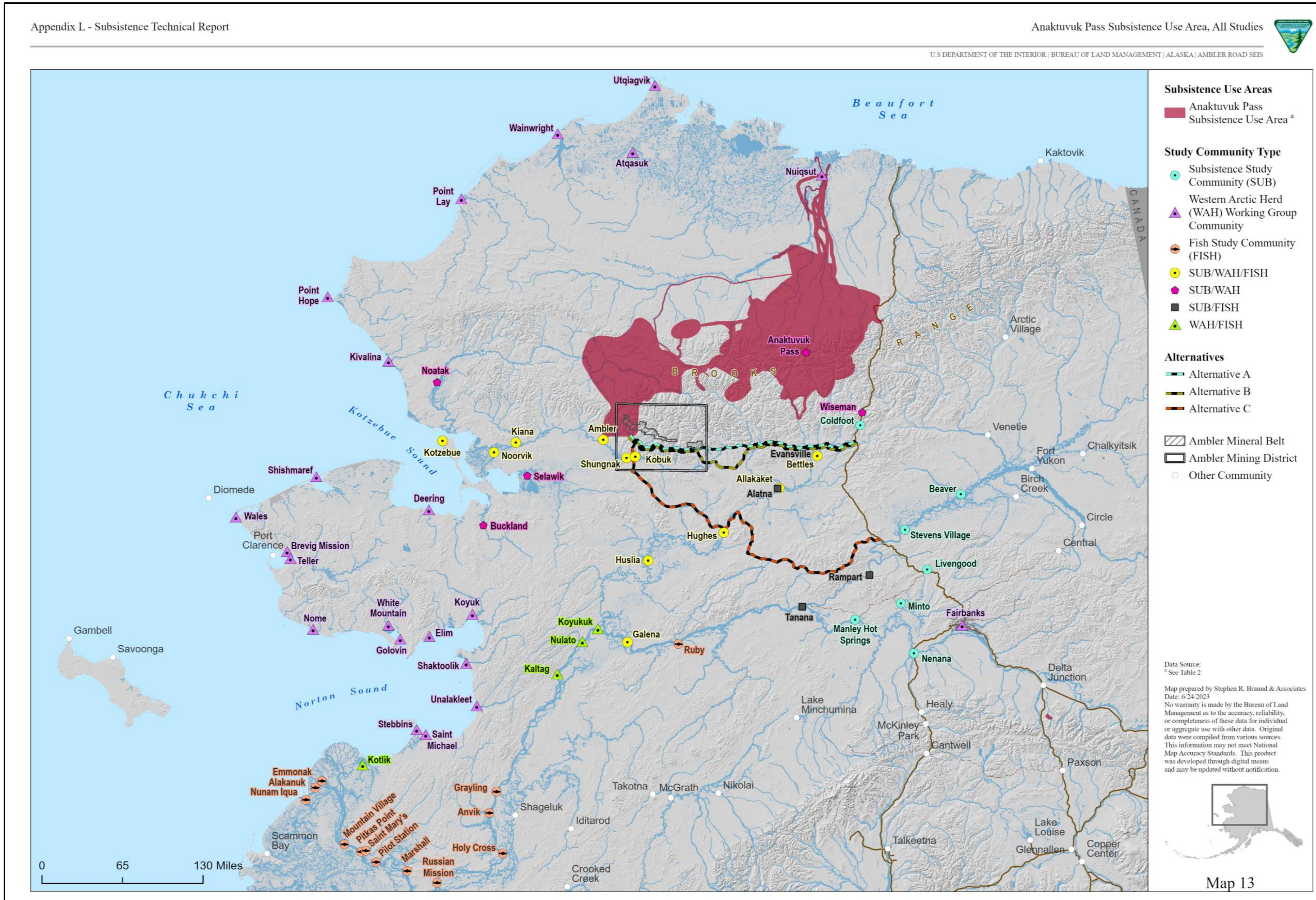

Map 13. Anaktuvuk Pass subsistence use areas, all studies

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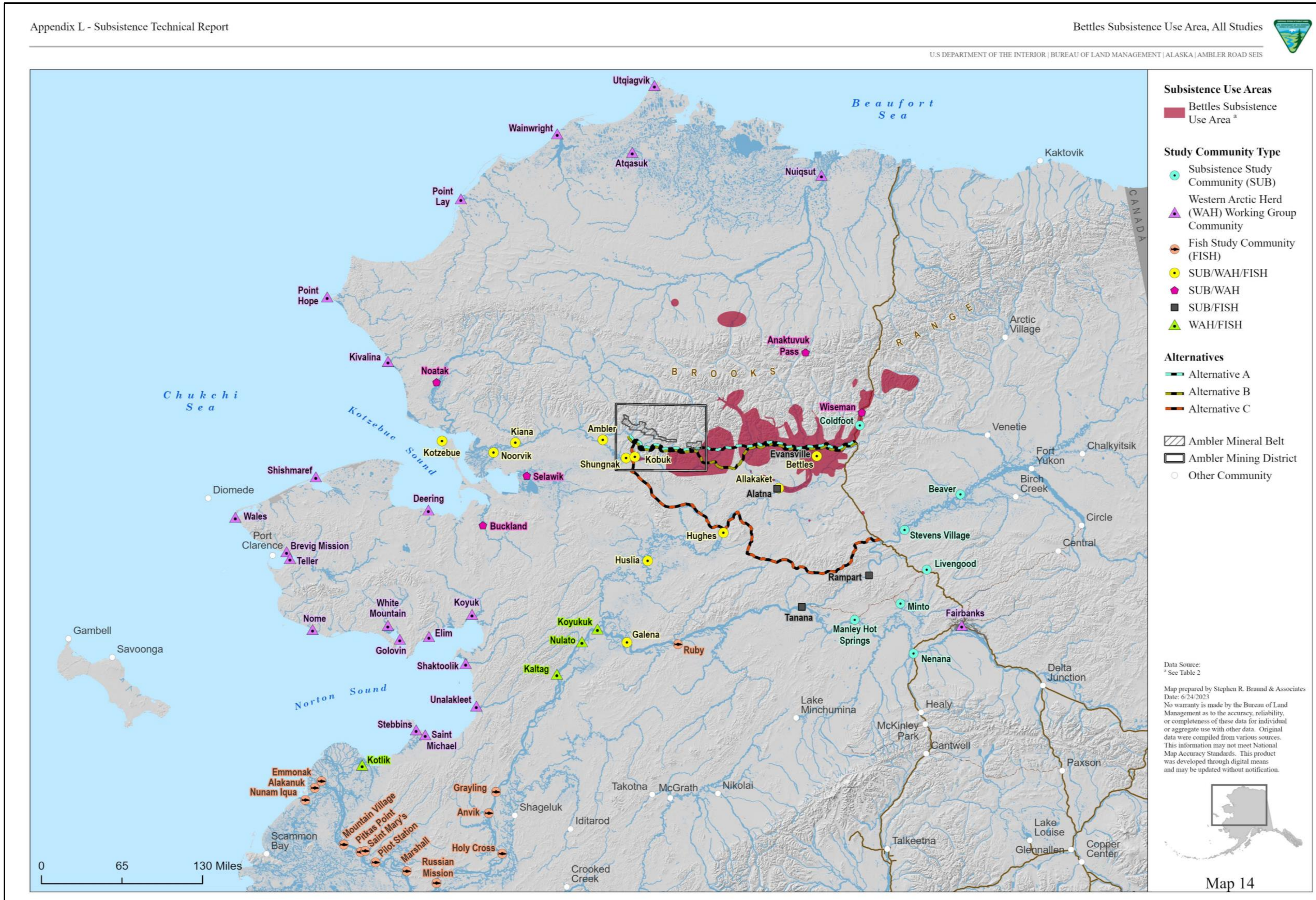

Map 14. Bettles subsistence use areas, all studies

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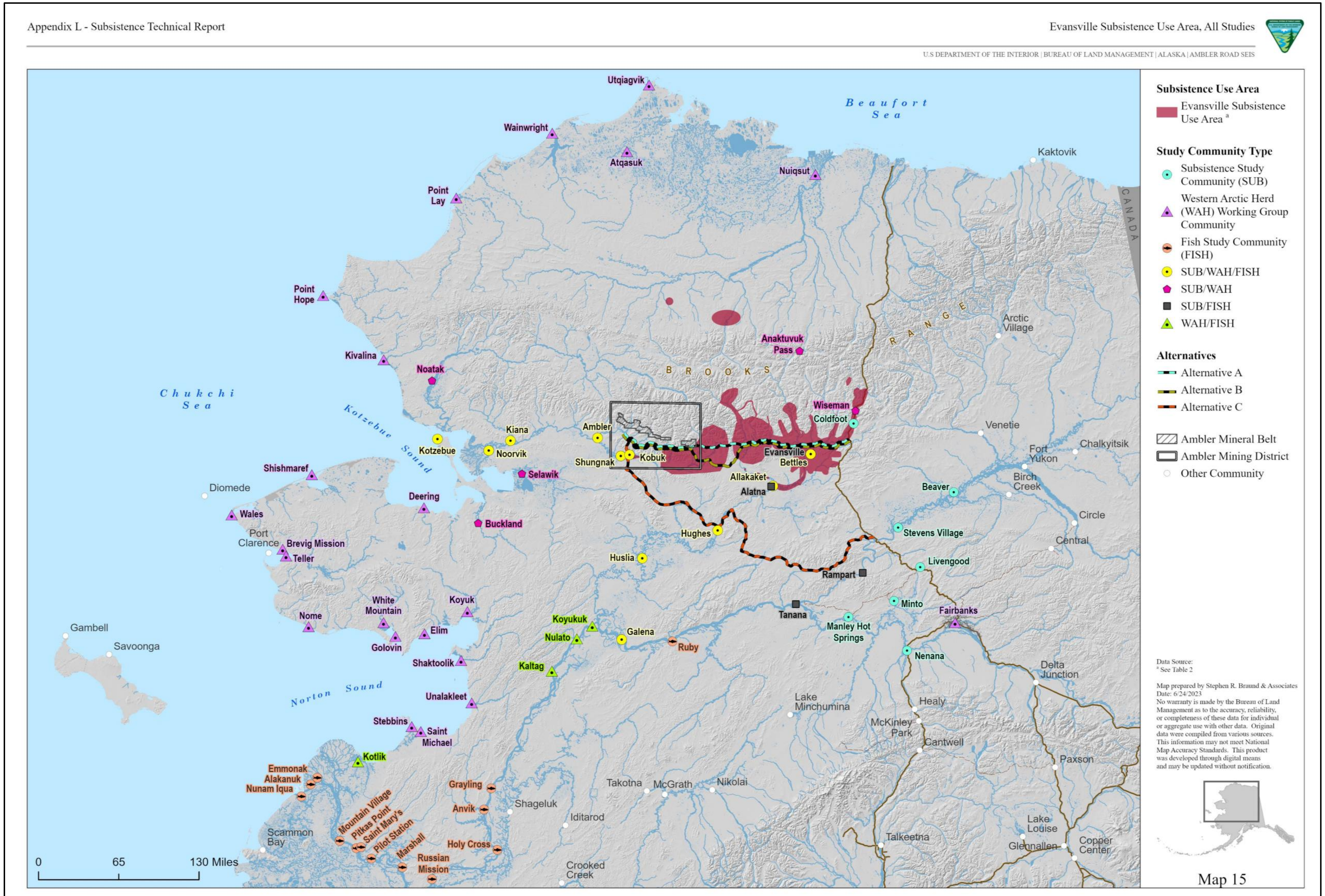

Map 15. Evansville subsistence use areas, all studies

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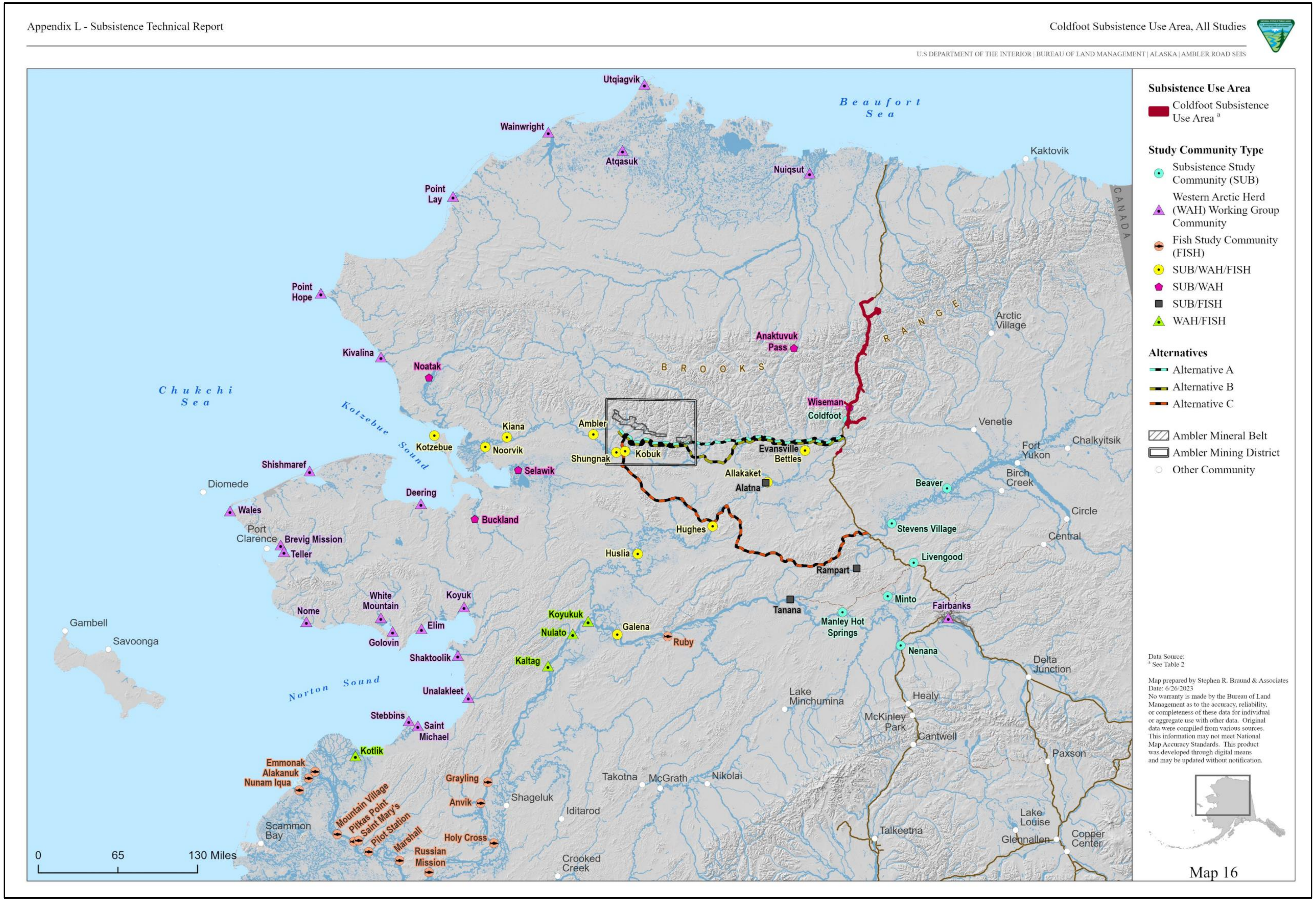

Map 16. Coldfoot subsistence use areas, all studies

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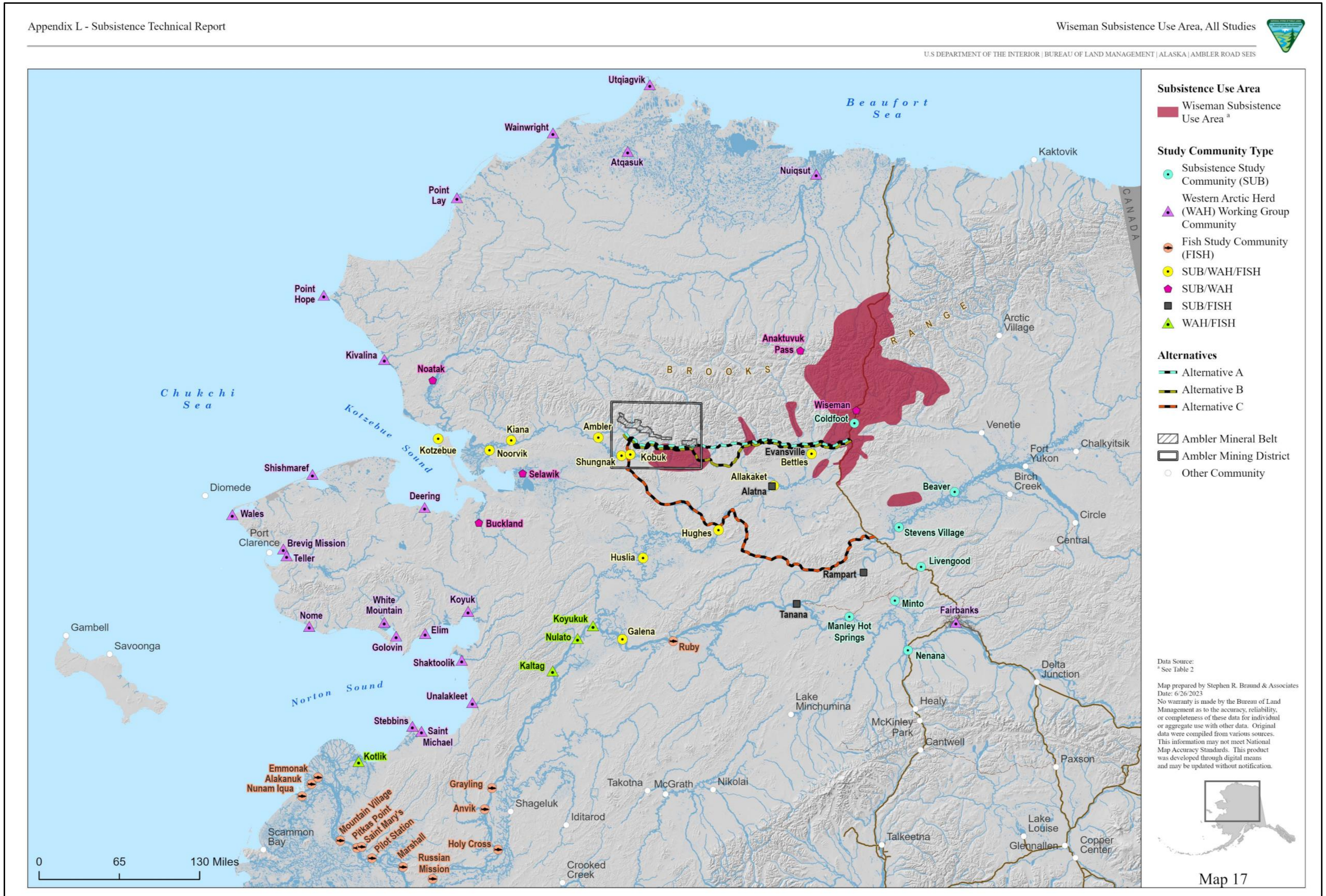

Map 17. Wiseman subsistence use areas, all studies

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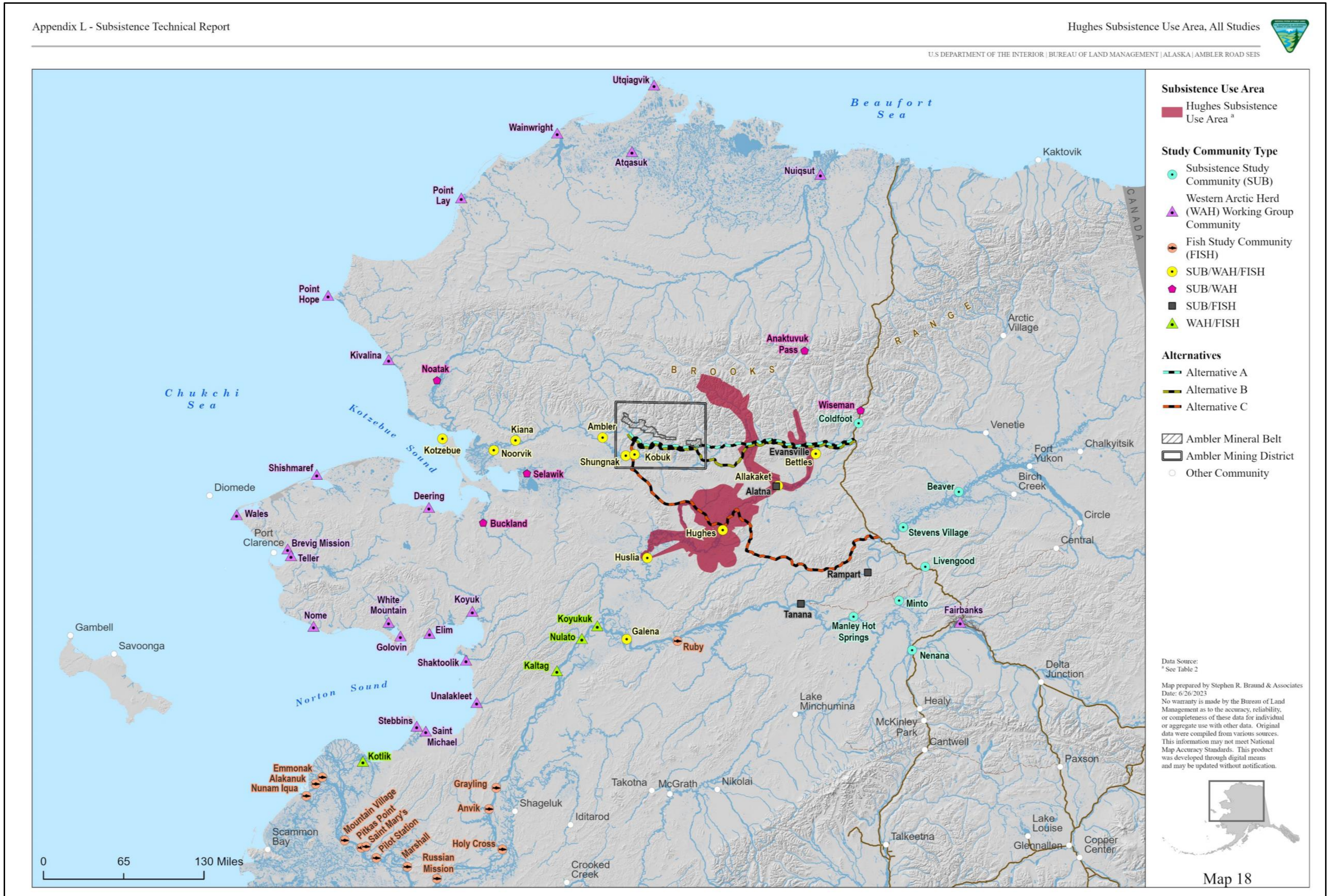

Map 18. Hughes subsistence use areas, all studies

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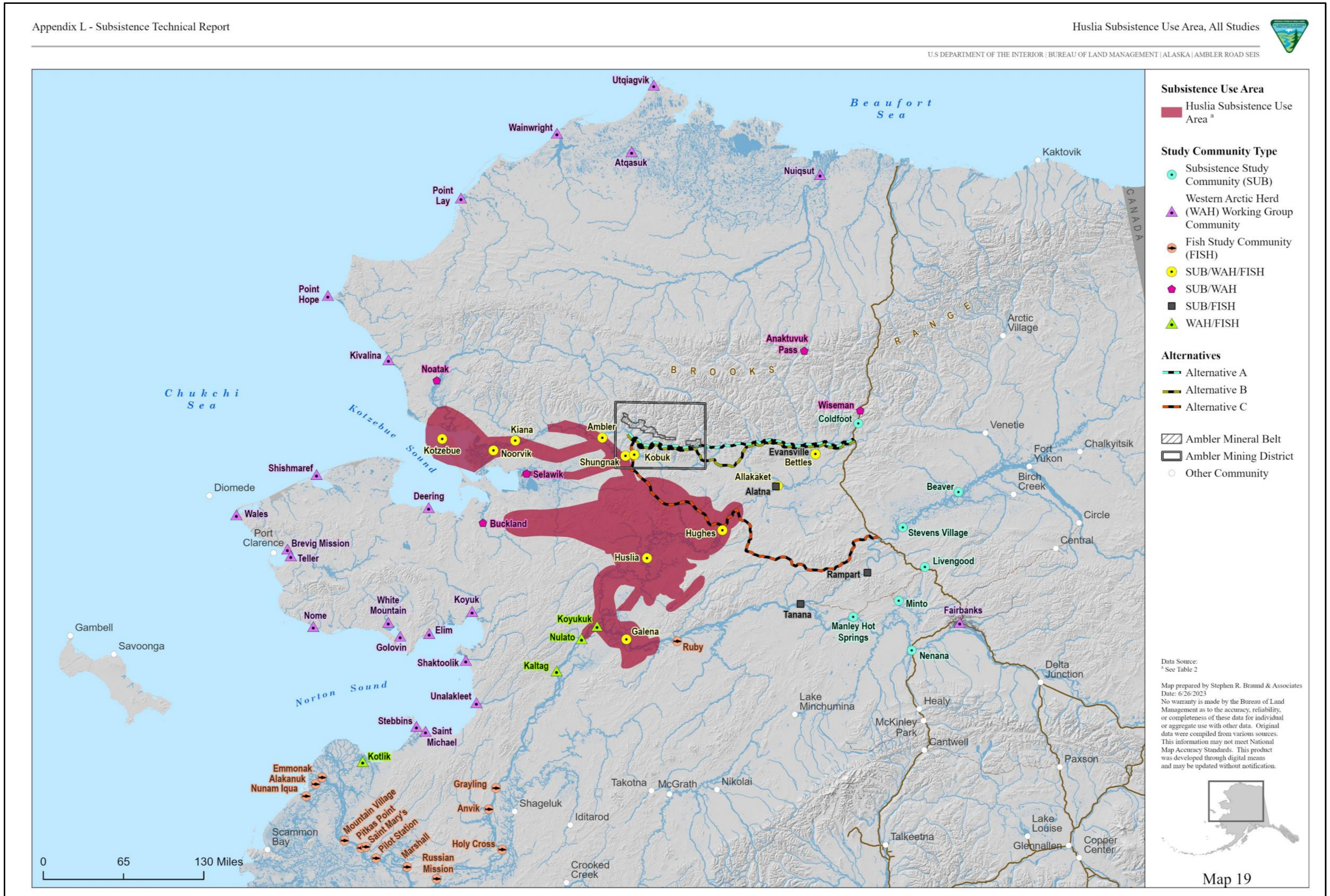

Map 19. Huslia subsistence use areas, all studies

Note: where the use overlays water, the shade is darker.

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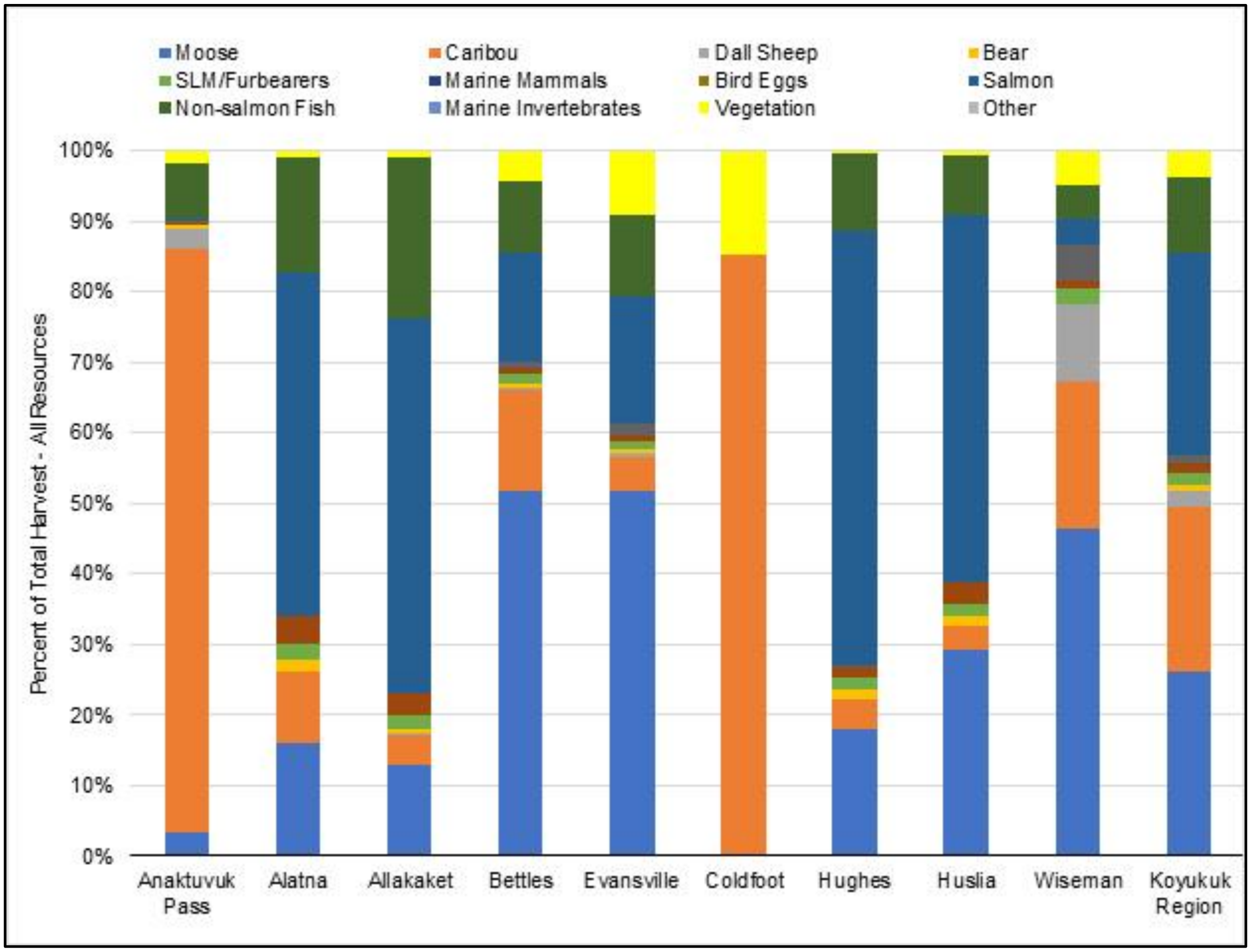


Figure 7. All resources percent of total harvest by Koyukuk River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of harvest across all available study years for comprehensive (i.e., all resources) household harvest surveys. In some cases, averages represent only a single study year. Available study years for each community are as follows: Anaktuvuk Pass (1992, 1994-95, 1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, 2011, 2014); Alatna (1982, 1983, 1984, 2011); Allakaket (1982, 1983, 1984, 2011); Bettles (1982, 1983, 1984, 2011); Evansville (1982, 1983, 1984, 2011); Coldfoot (2011); Hughes (1982, 2014); Huslia (1983); Wiseman (1991, 2011).

Average participation rates among Koyukuk River Region study communities, in terms of the average percentage of households attempting harvests by resource during individual study years, are shown on Figure 8. These data are based on averages across available study years; it is likely that in some years (or across all years) a higher percentage of households participates in each resource activity. Across all Koyukuk River Region study communities, households most commonly participate in harvests of vegetation (89 percent of households), followed by non-salmon fish (59 percent), moose (54 percent), upland birds (49 percent), migratory birds (43 percent), and caribou (45 percent). Fewer households participate in harvests of marine mammals, salmon, Dall sheep, and small land mammals. While all communities report high participation rates overall, participation in specific resource harvesting activities varies by community. For example, while Dall sheep hunting is not particularly common for the region as a whole, a substantial percentage of households in Wiseman (80 percent) and Anaktuvuk Pass (32 percent) engage in this activity. The average percentage of households receiving different resources is shown on Figure 9. Similar to the Kobuk River and Kotzebue Sound regions, some resources which are not regularly harvested by Koyukuk River Region study communities are still highly consumed through sharing with other regions. For example, while only 1 percent of households hunt marine mammals, nearly 50 percent of households receive this resource. In addition to marine mammals, the most commonly shared resources in Koyukuk River Region communities (more than half of households receiving) include non-salmon fish, moose, vegetation, and salmon.

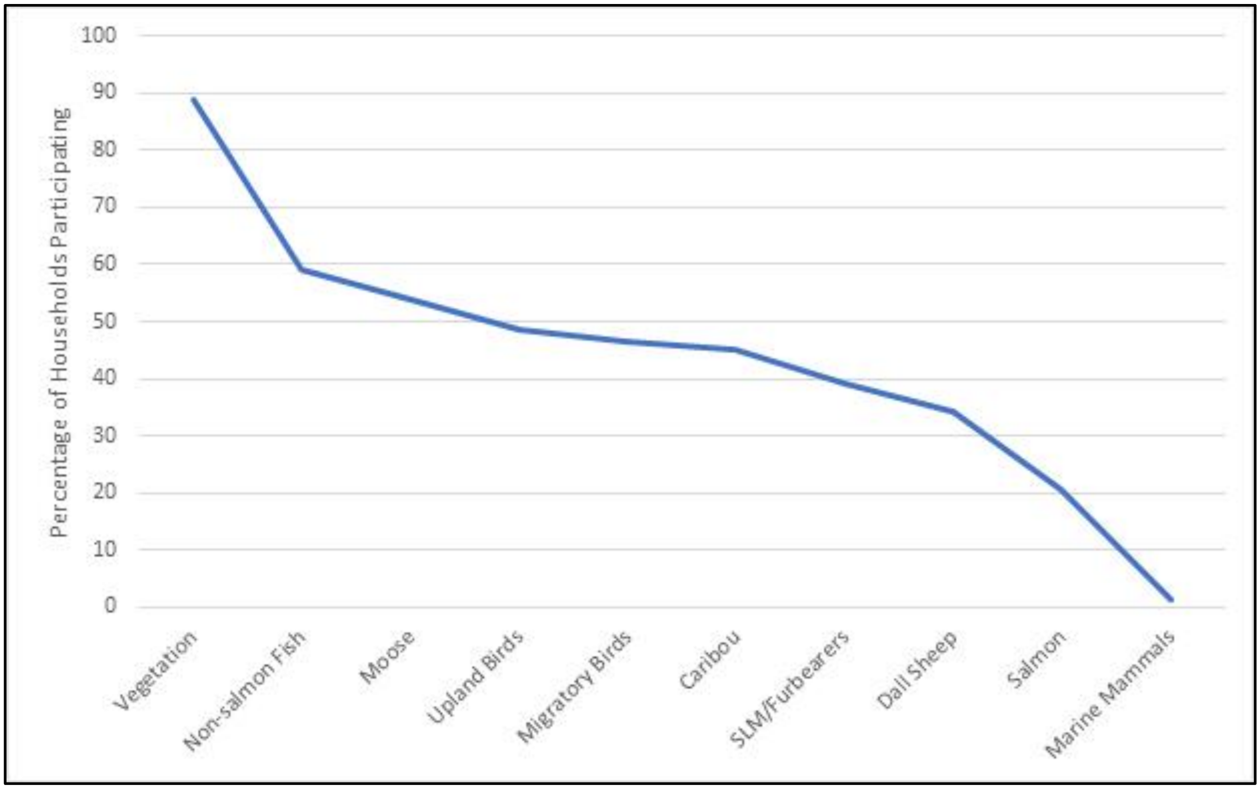


Figure 8. Percent of households attempting harvests of resources, Koyukuk River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Anaktuvuk Pass (1986-1991, 1990-91, 1991-92, 1992, 1993-94, 1994-95, 1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, 2006-07, 2011, 2014); Alatna (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Allakaket (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Bettles (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Evansville (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Coldfoot (2011); Hughes (1982, 1998, 1998-99, 2002, 2014); Huslia (1983, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03); Wiseman (1991, 2011).

Table 18 shows average harvest and use data for the top five species harvested (in terms of average contribution toward the total subsistence harvest) by each of the Koyukuk River Region study communities. Chum salmon is the top species in four of the nine study communities (Alatna, Allakaket, Hughes, and Huslia), contributing between 44 percent and 57 percent of the total subsistence harvest. Moose is the top harvested resource in three of the nine study communities (Bettles, Evansville, and Wiseman; between 46 and 52 percent), and caribou is the top harvested in two of the nine study communities (Anaktuvuk Pass and Coldfoot; 86 and 85 percent respectively). Other top species in the Kotzebue Sound Region include sheefish (Alatna, Allakaket, and Huslia), whitefish (Alatna, Allakaket, and Hughes), other salmon species (Chinook and sockeye; Allakaket and Evansville), Dall sheep (Anaktuvuk Pass, Wiseman), black bear (Huslia), and berries (Anaktuvuk Pass, Bettles, Coldfoot, Evansville, and Wiseman).

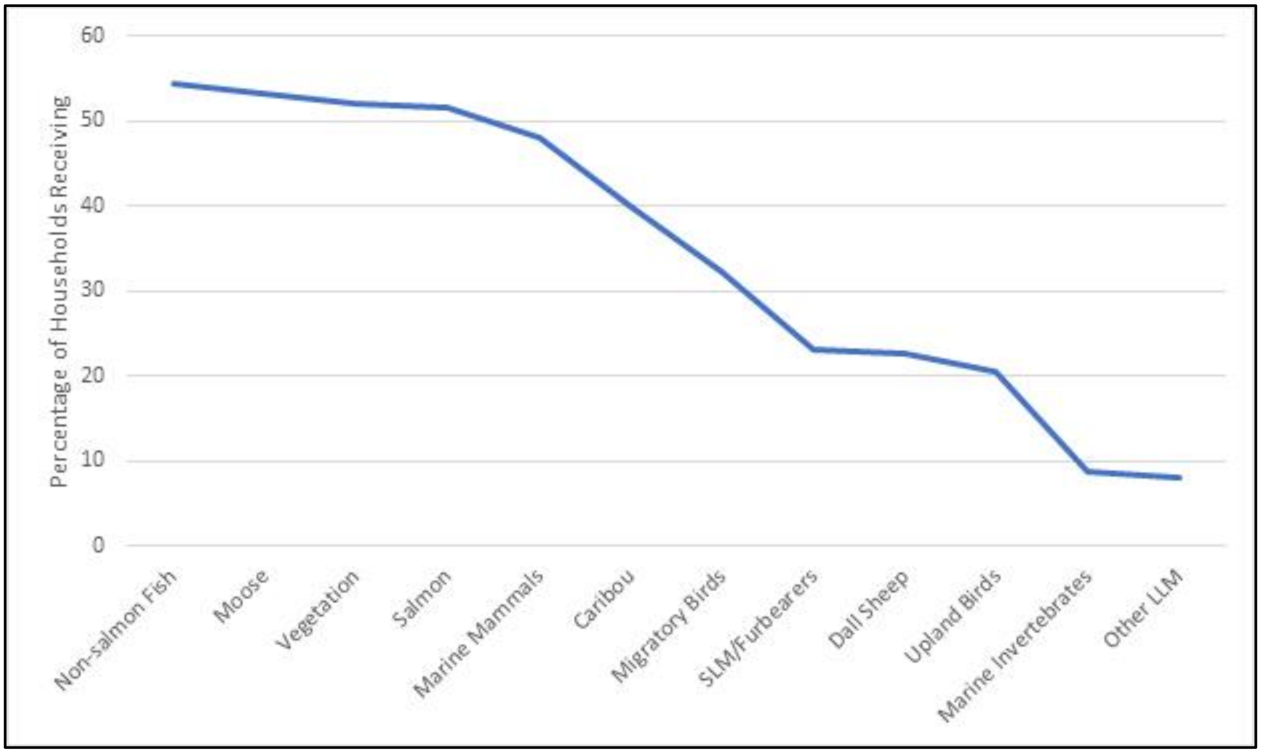


Figure 9. Percent of households receiving resources, Koyukuk River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Anaktuvuk Pass (1986-1991, 1990-91, 1991-92, 1992, 1993-94, 1994-95, 1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, 2006-07, 2011, 2014); Alatna (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Allakaket (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Bettles (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Evansville (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Coldfoot (2011); Hughes (1982, 1998, 1998-99, 2002, 2014); Huslia (1983, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03); Wiseman (1991, 2011).

5.3.3 Timing of Subsistence Activities

Data on the timing of subsistence activities for Koyukuk River study communities are provided in Table 19. This table shows the number of communities reporting subsistence activity or harvests within each month, based on the most recent data sources for each community. Overall, Koyukuk River communities target the greatest number of resources during the spring months of April and the summer/fall months of August and September.

Spring (April-May) in the Koyukuk River Region is characterized by warming temperatures, breakup on the rivers, and lengthening days. Spring marks a decrease in seasonal harvests of furbearers, upland birds, and small land mammals; however, it also marks the beginning of the waterfowl hunting season, as ducks and geese arrive in the area. Koyukuk River Region residents occasionally harvest small land mammals, including marten, hare, and beaver, in the springtime, but harvest by month data show harvests more commonly occurring over the winter months (Van Lanen et al. 2012, Holen et al. 2012). Fishing for non-salmon fish occurs in the region during the springtime, either through the ice or after breakup in the open water. Harvests of caribou, bear, and sheep may also occur in the springtime in a number of communities.

Table 18. Average harvest and use data, top 5 species, Koyukuk River region communities

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% total harvest
Alatna	Chum salmon	50	33	42	33	33	8,865	54,036	1,157	321	44
Alatna	Moose	98	75	50	41	74	15	7,905	355	117	16
Alatna	Caribou	83	57	27	34	60	12	1,498	133	46	10
Alatna	Sheefish	67	67	47	29	33	1,335	9,340	203	56	10
Alatna	Whitefish	N/A	N/A	56		14	7,512	6,761	140	38	5
Allakaket	Chum salmon	50	38	42	31	19	9,723	58,398	1,216	346	48
Allakaket	Moose	97	73	52	45	65	34	17,676	332	98	13
Allakaket	Sheefish	72	53	55	34	27	1,968	13,111	266	80	12
Allakaket	Humpback whitefish	44	30	27	17	25	1,611	4,817	86	31	7
Allakaket	Chinook salmon	48	29	39	24	33	317	5,374	111	32	4
Anaktuvuk Pass	Caribou	92	61	49	49	68	514	65,678	784	222	86.2
Anaktuvuk Pass	Moose	29	10	6	9	24	4	2,230	25	7	3.2
Anaktuvuk Pass	Dall sheep	48	24	16	19	36	22	2,249	26	8	2.9
Anaktuvuk Pass	Berries	84	76	76	42	44	728	1,978	22	6	2.0
Anaktuvuk Pass	Grayling	70	68	50	43	29	1,715	1,471	17	5	2.0
Bettles	Moose	88	35	24	40	62	8	3,792	193	72	51.5
Bettles	Chum salmon	13	13	13		0	338	2,057	79	29	14.3
Bettles	Caribou	62	29	18	32	32	11	1,387	106	38	14.1
Bettles	Char	38	8	8	8	38	264	429	16	6	5.4
Bettles	Berries	N/A	N/A	43	N/A	N/A	160	638	23	8	4.7
Coldfoot	Caribou	75	50	25	50	50	2	325	65	33	85.3
Coldfoot	Blueberry	100	100	100	0	0	14	40	8	4	10.5

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% total harvest
Coldfoot	Low bush cranberry	25	25	25	0	0	4	15	3	2	3.9
Evansville	Moose	78	33	20	39	68	7	3,201	133	55	51.4
Evansville	Chum salmon	N/A	N/A	21	N/A	5	447	2,725	103	38	13.7
Evansville	Sockeye salmon	46	8	8	31	46	18	91	7	5	8.6
Evansville	Low bush cranberry	77	69	69	54	46	22	89	7	4	8.4
Evansville	Blueberry	85	85	85	46	46	21	84	6	4	8.0
Hughes	Chum salmon	46	19	19	15	39	15,195	56,895	2,474	603	56.8
Hughes	Moose	96	62	57	35	69	26	13,083	538	140	17.6
Hughes	Caribou	31	27	6	4	18	10	1,360	40	15	4.2
Hughes	Chinook salmon	N/A	N/A	68		16	586	10,603	482	112	7.5
Hughes	Humpback whitefish	51	29	29	14	27	1,959	5,877	219	86	5.0
Huslia	Chum salmon	N/A	N/A	43	14	41	22,583	102,603	1,800	533	49.3
Huslia	Moose	99	66	58	36	52	79	44,774	608	198	28.8
Huslia	Caribou	75	40	33	23	38	107	13,880	182	60	3.3
Huslia	Sheefish	60	31	34	20	37	896	5,815	85	27	3.0
Huslia	Black bear	60	34	23	18	37	29	3,240	47	15	2.9
Wiseman	Moose	100	80	60	60	40	4	1,890	432	166	46.4
Wiseman	Caribou	80	80	60	60	20	7	890	104	40	20.9
Wiseman	Dall sheep	75	80	40	25	25	5	468	42	16	10.8
Wiseman	Low bush cranberry	100	100	100	40	20	42	169	34	13	4.4
Wiseman	Ptarmigan	80	80	80	40	N/A	229	151	46	18	3.8

Source: See Table 2 for citations, time period, and resources addressed

Notes: HH = Households; N/A = Not Available

Data represent the average across all available study years. Available study years for each community are as follows: Anaktuvuk Pass (1986-1991, 1990-91, 1991-92, 1992, 1993-94, 1994-95, 1996-97, 1998-99, 1999-00, 2000-01, 2001-02, 2002-03, 2006-07, 2011, 2014); Alatna (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Allakaket (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03, 2011); Bettles (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Evansville (1982, 1983, 1984, 1997-98, 1998-99, 1999-00, 2002, 2002-03, 2011); Coldfoot (2011); Hughes (1982, 1998, 1998-99, 2002, 2014); Huslia (1983, 1997-98, 1998-99, 1999-00, 2001-02, 2002, 2002-03); Wiseman (1991, 2011).

Table 19. Koyukuk River region timing of subsistence activities, number of communities reporting subsistence activity

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon fish	5	7	6	4	7	8	8	8	8	5	4	6
Marine non-salmon fish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Salmon	N/A	N/A	N/A	N/A	2	6	4	4	4	2	N/A	N/A
Caribou	8	9	8	9	5	N/A	3	6	6	6	8	8
Moose	5	4	5	3	N/A	N/A	N/A	6	9	7	4	4
Bear	3	4	5	6	9	4	8	9	6	6	5	2
Sheep	3	3	3	3	N/A	3	3	7	6	4	3	3
Furbearers	2	2	2	2	N/A	N/A	N/A	N/A	N/A	N/A	2	2
Small land mammals	9	9	9	8	7	3	4	6	6	6	9	9
Upland birds	9	9	9	7	6	4	4	8	9	9	9	9
Waterfowl	N/A	N/A	N/A	6	8	6	2	3	3	N/A	N/A	N/A
Eggs	N/A	N/A	N/A	N/A	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plants and berries	2	2	2	2	3	6	8	8	8	3	2	2
Wood	6	6	6	6	6	6	6	6	6	6	6	6
Total number of resources per month	10	10	10	11	10	9	10	11	11	10	10	10

Source: Holen et al. 2012; SRB&A 2016a; SRB&A 2013a; Brown et al. 2016; Marcotte and Haynes 1985; Wilson and Kostick 2016; Andersen et al. 2004b; Marcotte 1986

Notes: Apr = April; Aug = August; Dec = December; Feb = February; Mar = March; Jan = January; Jul = July; Jun = June; N/A = Not applicable (no or limited subsistence activity); Nov = November; Oct = October; Sep = September

Koyukuk River Region Communities = 9 (Alatna, Allakaket, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Huslia, and Wiseman)

Each cell contains the number of communities reporting subsistence activity or harvests during each month, based on the most recent data source for each community. Months with only one community report harvests or activity are not included in the table. Resources with no subsistence activity data available are not included in the table.

While non-salmon fish and plants and berries are harvested year round in the Koyukuk River Region, during summer (June-August) residents begin to focus on fishing and collecting plants and berries. Salmon abundances vary throughout the region and therefore harvesting salmon is a strong focus of some communities, including Allakaket and Alatna, while other communities located further from the major salmon rivers (i.e., Bettles and Evansville) focus their fishing endeavors on non-salmon fish. Berries are a particularly important resource in the region; they are among the highest- used resources (in terms of the percentage of households using) in many of the communities (Holen et al. 2012). Most large land mammal subsistence activity, more commonly a fall activity, occurs at the end of the summer in August. However, communities hunt bear year round and may also take a caribou in July. Harvests of waterfowl occur during the summer months, although harvest activities decrease during the July nesting and rearing period

Many subsistence activities which occur over the summer, including fishing, waterfowl hunting, and large land mammal hunting, continue or amplify during the fall (September-October). Caribou and moose are particularly important resources for the northern communities in the Koyukuk River Region (i.e., Wiseman, Coldfoot, Evansville, and Bettles), and by weight make up the majority of the annual subsistence harvest in these communities. Moose harvests most commonly occur in the month of September and residents harvest caribou during the fall and into the winter months. Dall sheep and bear harvests continue in early fall and berry picking may also continue from the summer into fall. Fall in the Koyukuk River Region marks the end of waterfowl subsistence activity and an increase of harvests of upland birds, such as grouse and ptarmigan. Wood is collected year-round and in the fall is a particularly important resource to prepare for heating through the upcoming winter.

During the winter season (November-March), focus shifts to harvests of small land mammals and furbearers as watersheds freeze over creating conditions for travel to trapping grounds. Pelts of the small mammals and furbearers are prime over the winter season and residents of the region hunt or trap for the pelts and/or meat of small mammals for subsistence purposes. Large land mammal harvests, including caribou, moose, bears, and sheep, occur over the winter months although moose, bear, and sheep harvests occur with more frequency during other seasons. Ice fishing for non-salmon fish occurs over winter months. In Bettles and Evansville changing ice conditions have decreased winter non-salmon fishing subsistence activities in recent years (Holen et al. 2012). Residents of the Koyukuk River Region harvest upland birds throughout the winter and into the spring as the annual cycle of subsistence activities begins again.

5.3.4 Travel Method

A recent subsistence mapping study (SRB&A 2016a) collected data on travel methods for a majority of Koyukuk River study communities. The data show that a majority of use areas in the study communities are accessed by boat and, to a lesser extent, snowmachine. Other methods used to access subsistence use areas include truck/car, plane, ATV, and foot. Primary travel methods used to search for resources within use areas are boat, snowmachine, and foot (SRB&A 2016a). Access and search methods vary by community. For example, the communities of Bettles and Evansville rely more heavily on plane travel to access subsistence use areas, although Watson (2018) indicates that access to airplanes may decrease with the newer generations. In addition, Wiseman and Coldfoot report much heavier use of trucks/cars to access their harvesting areas, given their proximity to the Dalton Highway. The communities of Alatna and Allakaket are much more likely to use boats to access their harvesting areas than other Koyukuk River study communities. Data on travel methods for Anaktuvuk Pass (SRB&A 2013b) indicate a heavy reliance on ATVs and snowmachines rather than boats, which reflects the lack of access to navigable rivers near that community. Travel routes documented for Anaktuvuk Pass show various overland travel routes which follow mountain passes to the south toward Bettles and Evansville and to the southwest as far as Ambler. Finally, travel method data for the community of Hughes are available in Wilson and

Kostick (2016) and indicate that boat is the primary method used by community households, followed closely by snowmachine and to a lesser extent, ATV. Watson (2018), who mapped contemporary subsistence use areas for a number of the Koyukuk River study communities (Allakaket, Alatna, Bettles, Evansville, Hughes, and Huslia) included access routes to subsistence use areas within the use areas mapped in that study; thus many of the use areas shown on Map 11 through Map 19 include travel routes as well.

5.3.5 Resource Importance

The relative importance of subsistence resources to the individual Koyukuk River Region study communities, based on selected variables, is provided in Table 20 through Table 28 (see Section 4.3, Resource Importance Data, for discussion of methods). Based on this analysis, vegetation is of high importance in the largest number of Koyukuk River study communities (eight communities), followed by moose and non-salmon fish (seven communities), salmon (six communities), and caribou (five communities). Other resources of high importance in the Koyukuk River Region study communities include marine mammals (three communities), upland birds (two communities), and migratory birds and Dall sheep (one community each).

Table 20. Relative importance of subsistence resources based on selected variables, Alatna

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	75	74	16	H
2	Caribou	57	34	10	M
3	Dall Sheep	N/A	9	0.1	L
4	Bear	N/A	N/A	1	L
5	Other LLM	N/A	N/A	N/A	I
6	SLM/Furbearers	67	67	2	M
7	Marine mammals	N/A	100	N/A	H
8	Migratory birds	83	83	4	H
9	Upland birds	83	50	0.2	H
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	33	50	48	H
12	Non-salmon fish	71	58	16	M
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	100	100	1	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M - Moderate; N/A = Not Available; LLM = Large land mammals; SLM = Small land mammals

Table 21. Relative importance of subsistence resources based on selected variables, Allakaket

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	73	65	13	H

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
2	Caribou	38	52	4	H
3	Dall sheep	12	9	0.2	L
4	Bear	-	-	1	L
5	Other large land mammals	-	2	-	L
6	Small land mammals/ furbearers	40	38	2	M
7	Marine mammals	-	55	-	H
8	Migratory birds	55	40	3	M
9	Upland birds	43	10	0.2	M
10	Bird eggs	-	-	-	-
11	Salmon	40	60	53	H
12	Non-salmon fish	64	55	23	H
13	Marine invertebrates	-	2	-	L
14	Vegetation	83	57	1	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 22. Relative importance of subsistence resources based on selected variables, Anaktuvuk Pass

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	6	26	3	M
2	Caribou	66	68	84	H
3	Dall sheep	32	42	3	M
4	Bear	N/A	N/A	0.4	L
5	Other large land mammals	N/A	2	N/A	L
6	Small land mammals/ furbearers	18	8	0.03	L
7	Marine mammals	1	60	N/A	H
8	Migratory birds	23	21	0.3	L
9	Upland birds	18	18	0.2	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	11	40	0.4	M
12	Non-salmon fish	74	61	8	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	79	47	2	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 23. Relative importance of subsistence resources based on selected variables, Bettles

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	35	62	51	H
2	Caribou	29	32	14	M
3	Dall sheep	13	19	0.4	L
4	Bear	N/A	N/A	1	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	50	13	1	M
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	13	N/A	1	L
9	Upland birds	25	13	1	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	13	25	15	M
12	Non-salmon fish	38	46	10	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	88	63	4	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 24. Relative importance of subsistence resources based on selected variables, Evansville

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	33	68	51	H
2	Caribou	18	50	5	H
3	Dall sheep	N/A	33	0.4	M
4	Bear	N/A	N/A	0.6	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	8	8	1.3	L
7	Marine mammals	N/A	23	N/A	L
8	Migratory birds	N/A	15	1	L
9	Upland birds	46	38	1.5	M
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	8	62	18	H
12	Non-salmon fish	38	60	12	H
13	Marine invertebrates	N/A	15	N/A	L
14	Vegetation	100	62	9	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 25. Relative importance of subsistence resources based on selected variables, Coldfoot

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	N/A	25	N/A	L
2	Caribou	50	50	85	H
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	N/A	I
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	N/A	N/A	N/A	I
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	N/A	N/A	N/A	I
9	Upland birds	N/A	25	N/A	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	N/A	25	N/A	L
12	Non-salmon fish	N/A	N/A	N/A	I
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	100	N/A	15	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 26. Relative importance of subsistence resources based on selected variables, Hughes

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	62	69	18	H
2	Caribou	27	18	4	M
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	1	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	31	12	2	M
7	Marine mammals	N/A	31	N/A	M
8	Migratory birds	46	19	1	M
9	Upland birds	46	4	0.2	M
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	19	50	61	H
12	Non-salmon fish	51	39	11	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	62	23	1	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 27. Relative importance of subsistence resources based on selected variables, Huslia

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	66	52	29	H
2	Caribou	40	38	3	M
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	1	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	N/A	18	2	M
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	N/A	27	3	M
9	Upland birds	N/A	7	0.1	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	N/A	52	51	H
12	Non-salmon fish	58	55	8	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	N/A	5	1	L

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 28. Relative importance of subsistence resources based on selected variables, Wiseman

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	80	40	46	H
2	Caribou	80	20	21	H
3	Dall sheep	80	25	11	H
4	Bear	N/A	N/A	N/A	I
5	Other large land mammals	N/A	20	N/A	L
6	Small land mammals/ furbearers	60	N/A	2	M
7	Marine mammals	N/A	20	N/A	I
8	Migratory birds	60	20	1	M
9	Upland birds	80	20	5	H
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	20	100	4	H
12	Non-salmon fish	80	60	5	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	100	60	5	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

5.4. Tanana River

The Tanana River region includes the communities of Manley Hot Springs, Minto, Nenana, and Tanana. Tanana use areas are overlapped with the southern corridor alternative, while the three other Tanana River region communities have uses which occur within 30 miles of (but do not overlap with) the southern corridor. Three of four of the Tanana River region communities (Manley Hot Springs, Minto, and Nenana) are road-connected.

5.4.1 Subsistence Use Areas

Subsistence use areas for the Tanana River region study communities are focused around the Tanana River, Yukon River, Nenana River, and Minto Flats. For road-connected communities (e.g., Manley Hot Springs, Minto, and Nenana) use areas also occur along the Parks, Elliot, Steese, and/or Dalton highways. In the case of Nenana, documented use areas occur as far west as the Koyukuk River.

Manley Hot Springs subsistence use areas for all available time periods (1975-1995; 2012) are shown on Map 20. The community's harvesting activities occur in an area surrounding the community, along the Tanana River to its mouth, and upriver into the Minto Flats. In addition, use areas occur at several locations along the Yukon River. Use areas recently documented by the ADF&G (Brown et al. 2014) show salmon and non-salmon fish harvesting areas for the community occurring along the Tanana River and on the Yukon River at a location referred to as The Rapids. Additional non-salmon fish harvesting areas occur at various lakes and sloughs near the community. Large land mammal hunting for bears and moose occur along the Tanana River in addition to areas accessed along the local road system and several overland areas south and north of the community. Small land mammal hunting and trapping areas in addition to bird hunting and vegetation harvesting also occur in various overland areas north and south of the community and along the nearby road system. Vegetation harvesting areas also occur to the north of the community along the Yukon River.

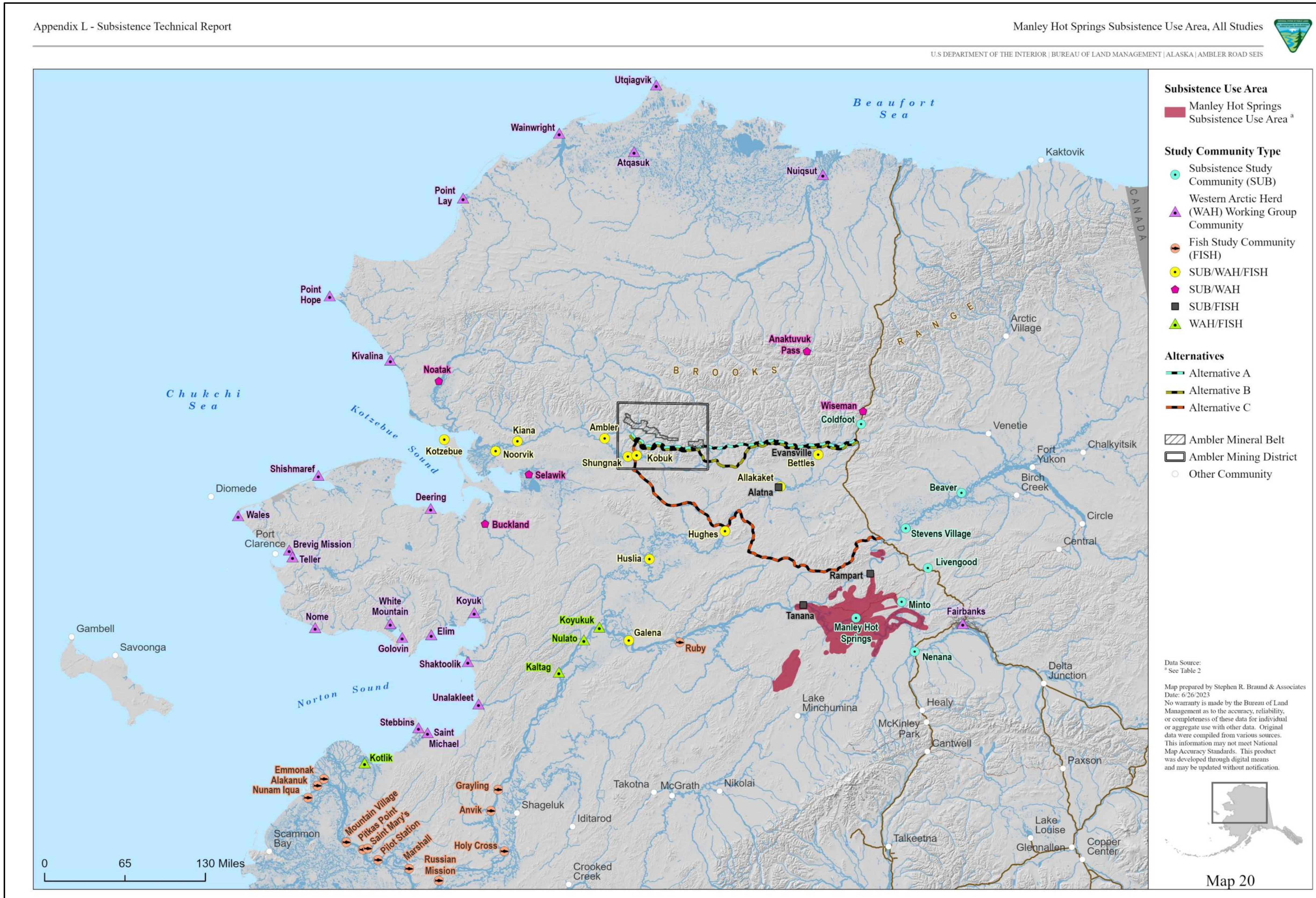
Minto subsistence use areas (Map 21) for all available time periods (1960-84; 1960-85; 2006-2015; 2012) occur throughout the Minto Flats, along the Elliot Highway, and along the Tanana, Kantishna, and Yukon rivers. Recent use areas documented for Minto (SRB&A 2016a) show large land mammal (moose and bear) hunting concentrated in the Minto Flats including the Tolovana and Chatanika Rivers and Sawmill Slough. Small land mammal hunting and trapping is focused on the Chatanika and Tanana Rivers in addition to various overland areas within the Minto Flats, to the north near the Elliot Highway, and at an isolated area long the Yukon River near Stevens Village. Waterfowl hunting is also concentrated within the Minto Flats close to the community and near Sawmill Slough, while upland bird hunting occurs most commonly along the road system out of Minto and along the Elliot Highway. Fishing for Minto residents occurs within the Minto Flats but with a majority of activity in the Tanana River and at various locations along the Yukon River. Non-salmon fish harvesting generally occurs closer to the community than salmon harvesting. Harvesting of berries and vegetation occur within the Minto Flats and to a lesser extent along the Elliot Highway.

As shown on Map 22, Nenana use areas for all available time periods (1981-1982; 2006-2015; 2015) occur primarily along the Tanana, Nenana, and Kantishna rivers, portions of the Minto Flats, and along the highway system north and south of the community. Recent use areas documented for Nenana (SRB&A 2016a) show large land mammal hunting for moose and bear occurring primarily along the Parks Highway south of the community and along the Tanana River and Minto Flats; waterfowl hunting occurs in a similar area. Caribou hunting by Nenana residents was reported primarily to the northeast of the community along the Steese Highway, while small land mammal and upland game hunting occur closer to the community and in overland areas extending north to the Elliot Highway. Salmon fishing by Nenana residents is focused along the Tanana River near the community, while non-salmon fish harvesting extends farther from the community into the Tanana River and Minto Flats. Vegetation harvesting occurs along the road system near to and south of the community of Nenana, in addition to various spots along the Tanana River and in the Minto Flats.

Of the four Tanana Region study communities, Tanana has uses closest to the AMDIAR project corridors, with subsistence use areas overlapping with the southern corridor alternative north of the Yukon River. Map 23 shows Tanana use areas for all available time periods (1968-1988; 2006; 2014) extending along the Tanana and Yukon rivers and in overland areas both north and south of the Yukon River. Recently documented use areas for the 2014 time period (Brown et al. 2016) show moose hunting occur along the Yukon River downriver from their community, along the Tanana-Allakaket Winter Trail extending north of their community toward Allakaket, and along the Koyukuk River to Huslia. Small land mammal hunting and trapping occurs north of the community along the Tanana-Allakaket Winter Trail to its crossing with the Tozlina River, in addition to locations along the Yukon River and overland to the south of the community. Several caribou hunting areas were documented to the east and north of their community, including in the Ray Mountains. Fishing for salmon and non-salmon fish occurs on the Yukon River primarily in front of or upriver from the community of Tanana. Waterfowl hunting took place along the Yukon and Tanana rivers including the lake system surrounding Fish Creek and Fish Lake to the southeast of the community, while upland bird hunting occurred primarily in overland areas to the north and west of the community. Vegetation harvesting by Tanana residents took place in overland areas to the north of the community in addition to the Fish Creek/Fish Lake area southeast from the community.

5.4.2 Harvest Data

Harvest data for the Tanana River study communities are provided on Figure 10 through Figure 12 and in Table 29. As shown on Figure 10, based on an average of available data, salmon is the primary resource harvested among the study communities in terms of percentage of usable pounds (70 percent), followed by non-salmon fish (12 percent) and moose (11 percent). Other resources which contribute smaller amounts in terms of pounds include vegetation, small land mammals, migratory birds, and caribou. Resource contribution is relatively similar among the Tanana River Region study communities, although Minto relies more heavily on moose harvests than the other study communities, at 22 percent of the total harvest. Data on resource contribution are not available for the community of Nenana, for which there are no comprehensive (i.e., all resources) harvest studies.



Map 20. Manley Hot Springs subsistence use areas, all studies

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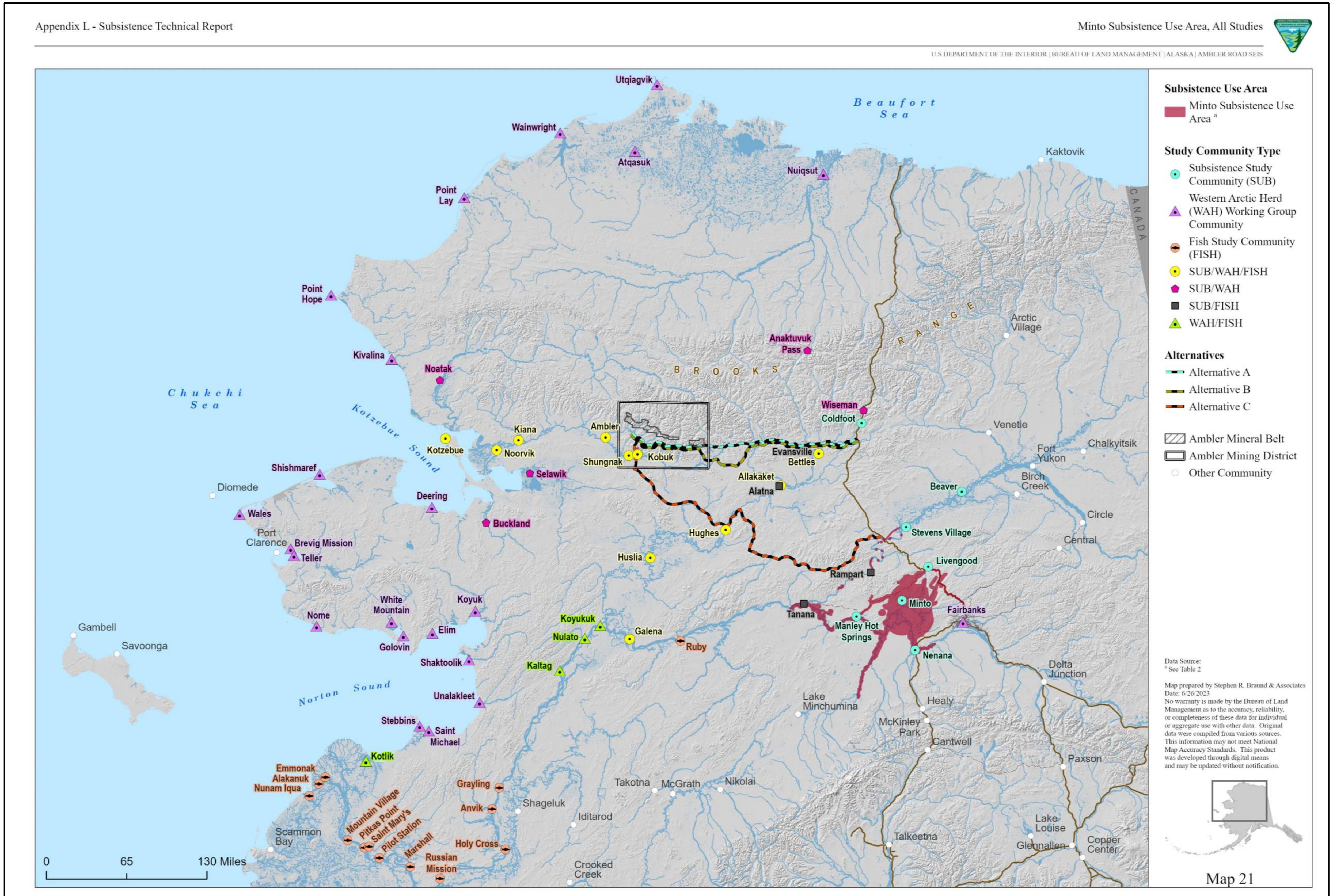

Map 21. Minto subsistence use areas, all studies

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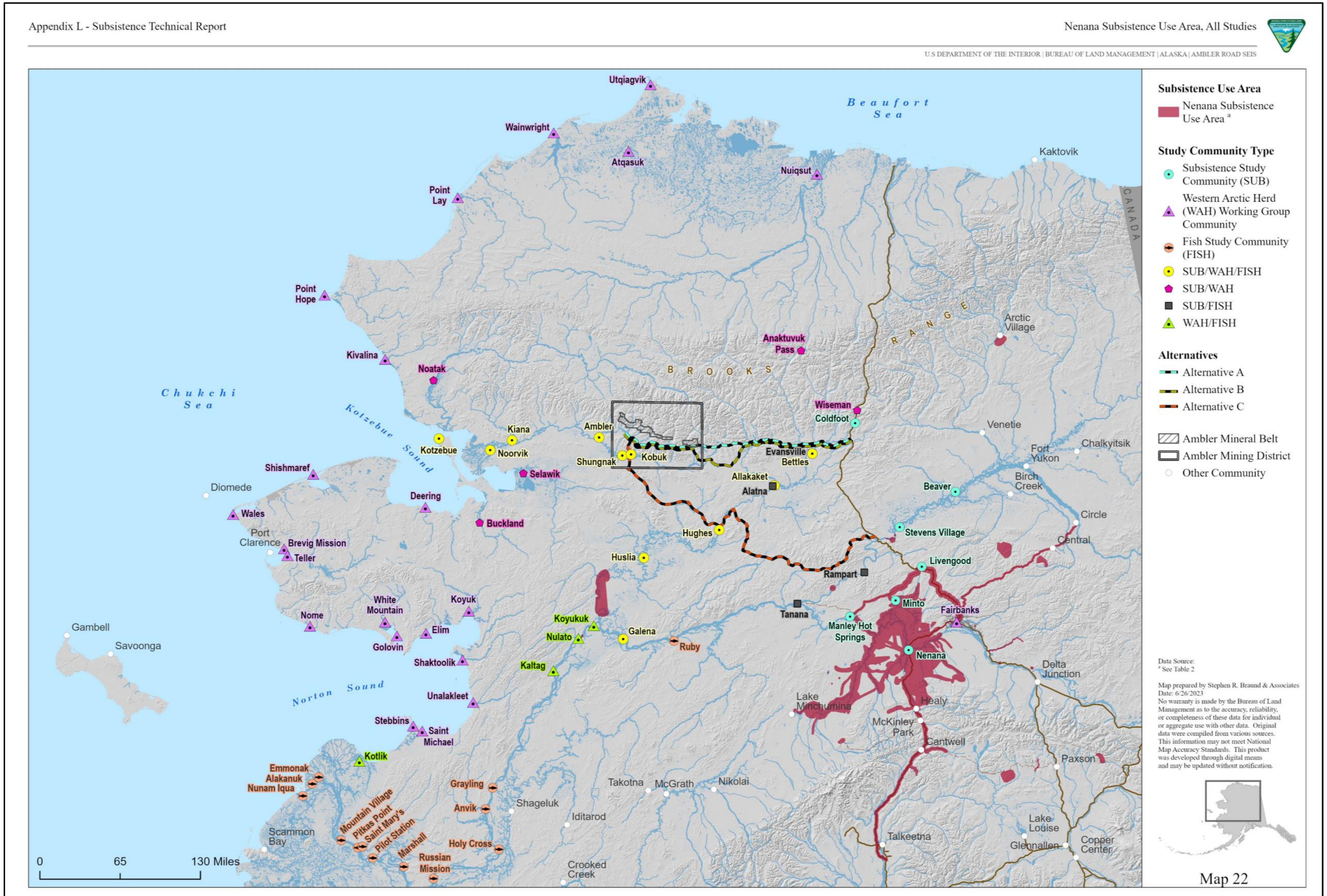

Map 22. Nenana subsistence use areas, all studies

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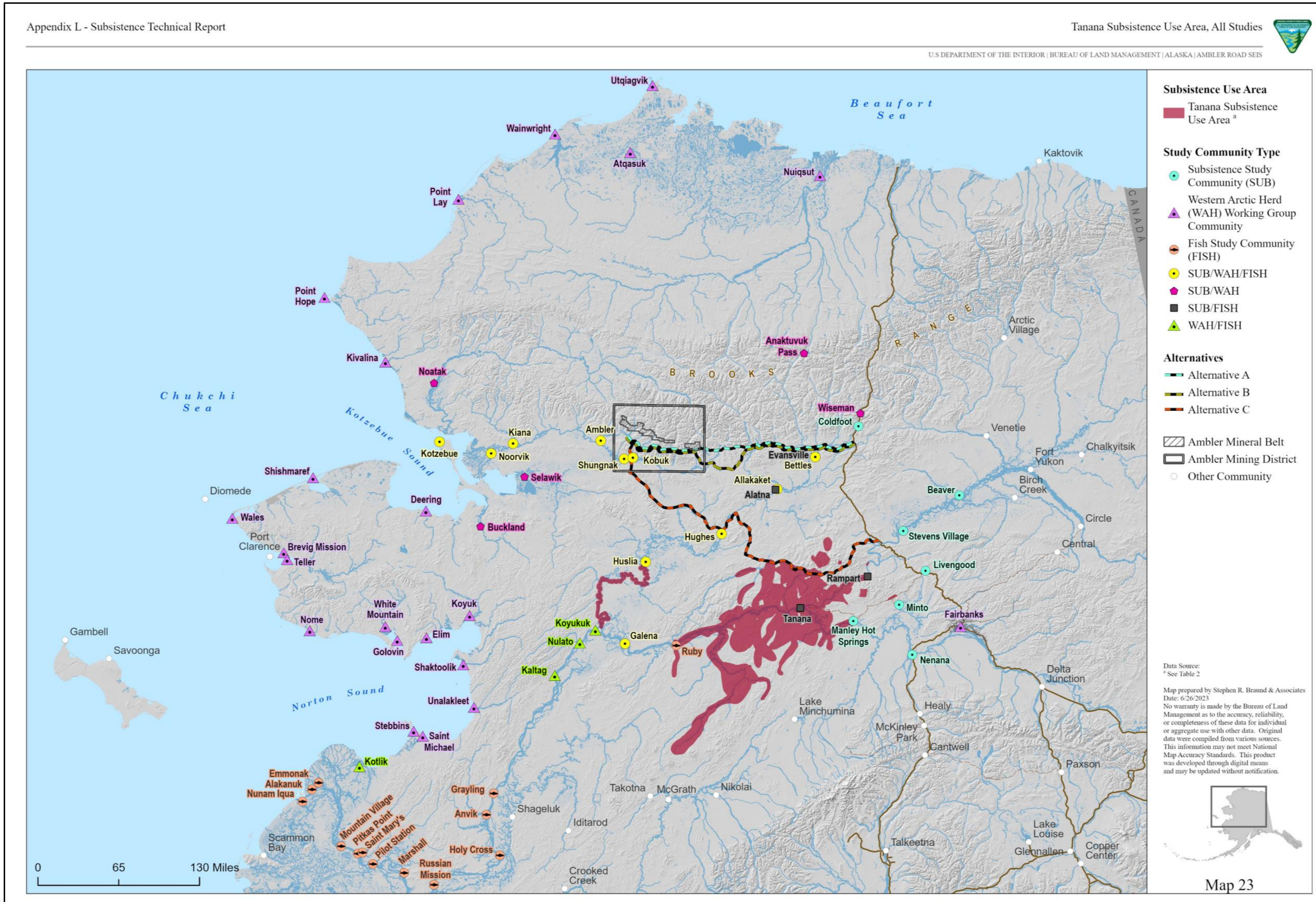

Map 23. Tanana subsistence use areas, all studies

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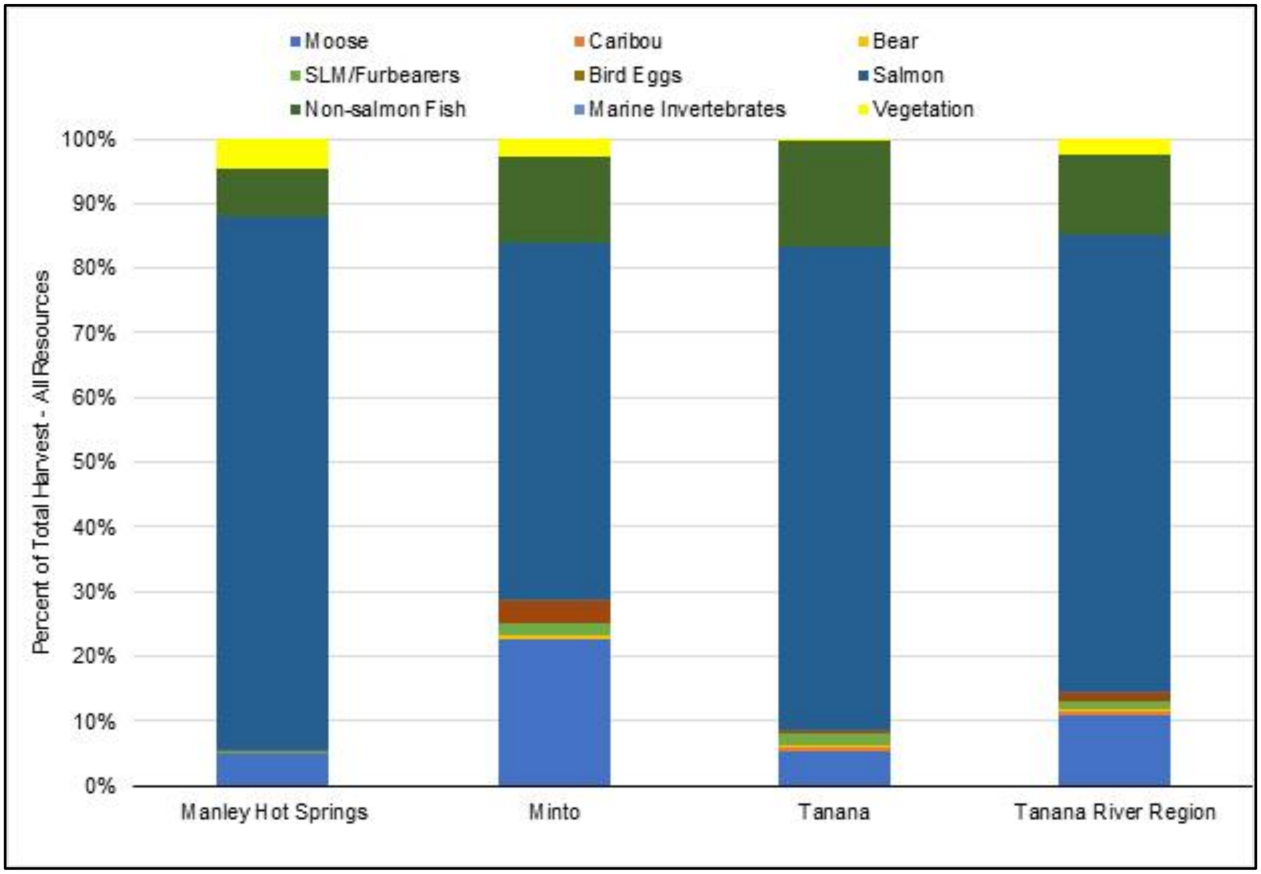


Figure 10. All resources percent of total harvest by Tanana River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of harvest across all available study years for comprehensive (i.e., all resources) household harvest surveys. In some cases, averages represent only a single study year. Available study years for each community are as follows: Manley Hot Springs (2012); Minto (1983-84, 2012); Tanana (1987, 2008, 2014).

Average participation rates among Tanana River Region study communities, in terms of the average percentage of households attempting harvests by resource during individual study years, are shown on Figure 11. These data are based on averages across available study years; it is likely that in some years (or across all years) a higher percentage of households participates in each resource activity. Across all Tanana River Region study communities, households most commonly participate in harvests of vegetation (86 percent of households), followed by moose (64 percent), salmon (56 percent), upland birds (55 percent), and non-salmon fish (53 percent). A smaller percentage of households participate in harvests of migratory birds and small land mammals, while participation in caribou hunting, bird egg harvesting, marine invertebrate harvesting, and Dall sheep hunting is minimal. The average percentage of households receiving different resources is shown on Figure 12. The most widely received resources in the region are also the most widely harvested. Salmon is the most commonly received resource among Tanana River Region study communities, followed by moose, vegetation, non-salmon fish, and migratory birds.

Table 29 shows average harvest and use data for the top five species harvested (in terms of average contribution toward the total subsistence harvest) by each of the Tanana River Region study communities. Data for Nenana are for selected land mammal and non-salmon fish species and are based on per capita harvests of these resources. For the three communities where data are available (Manley Hot Springs, Minto, and Tanana), chum salmon is the top species harvested, contributing between 34 percent and 54 percent of the total subsistence harvest. Chinook and coho salmon are also among the top species harvested in these communities, as is moose. Northern pike is among the top species harvested in Minto, whereas whitefish is a top species harvested in Tanana. Although limited data are available, data show Nenana residents harvesting an average of 83 pounds of moose per capita, and approximately two per capita pounds of humpback whitefish, beaver, and pike.

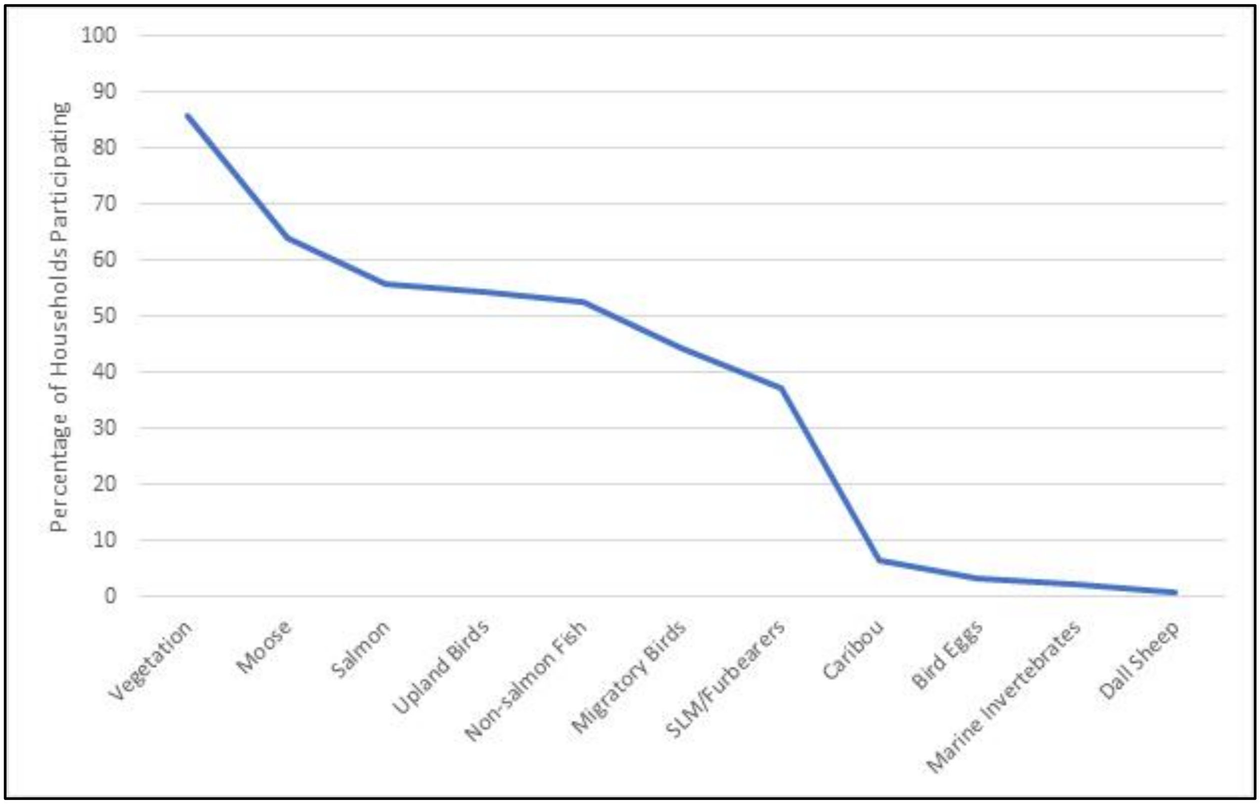


Figure 11. Percent of households attempting harvests of resources, Tanana River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Manley Hot Springs (2004, 2012); Minto (1983-84, 1994, 2004, 2012); Tanana (1987, 1997-98, 1998-99, 1999-00, 2002-03, 2006, 2008, 2014)

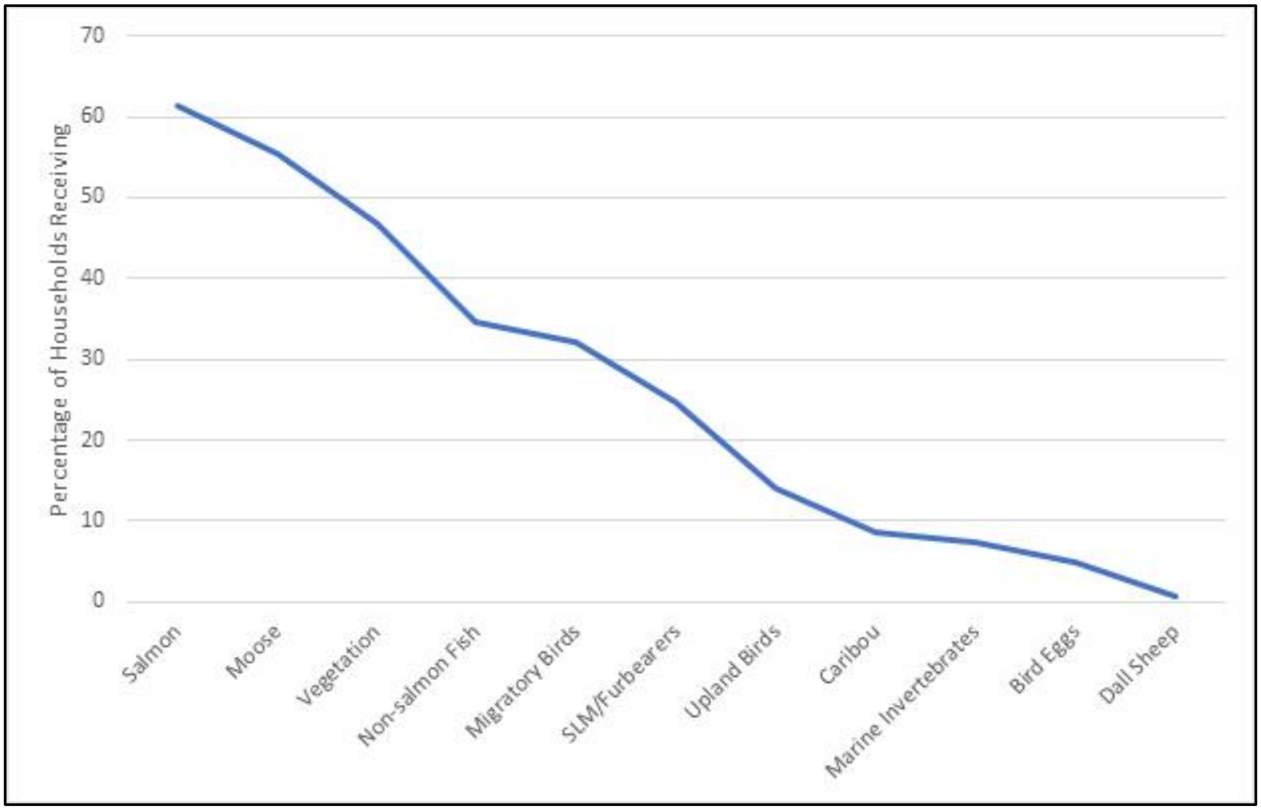


Figure 12. Percent of households receiving resources, Tanana River region communities

Source: See Table 2 for citations, time period, and resources addressed.
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Manley Hot Springs (2004, 2012); Minto (1983-84, 1994, 2004, 2012); Tanana (1987, 1997-98, 1998-99, 1999-00, 2002-03, 2006, 2008, 2014)

Table 29. Average harvest and use data, top 5 species, Tanana River region communities

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HHs receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% total harvest
Manley Hot Springs	Chum salmon	32	15	12	15	20	3,586	17,992	310	146	34.3
Manley Hot Springs	Chinook salmon	80	29	20	29	68	979	12,958	223	105	24.7
Manley Hot Springs	Coho salmon	39	12	12	10	27	1,835	11,858	204	96	22.6
Manley Hot Springs	Moose	59	50	11	25	49	8	4,498	123	55	4.9
Manley Hot Springs	Northern pike	39	29	29	7	17	364	1,018	18	8	1.9
Minto	Chum salmon	41	44	44	11	24	12,578	62,903	1,294	336	40.4
Minto	Moose	90	70	39	34	74	32	18,732	309	96	22.5
Minto	Coho salmon	35	11	11	9	26	690	4,457	73	25	11.2
Minto	Chinook salmon	61	37	37	22	43	485	7,044	139	38	7.2
Minto	Northern pike	61	44	47	22	25	1,740	5,639	113	30	5.7
Nenana	Moose	65	58	16	15	39	50	30,351	154	59	31.5
Nenana	Coho salmon	28	12	10	9	20	1,788	9,629	40	16	14.8
Nenana	Chum salmon	33	10	8	12	28	8,039	8,039	33	14	12.4
Nenana	Sockeye salmon	30	10	10	10	25	954	4,588	19	8	7.1
Nenana	Chinook salmon	31	10	10	14	27	564	4,466	18	8	6.9
Tanana	Chum salmon	70	66	62	28	27	67,411	400,317	3,127	1,158	53.7
Tanana	Whitefish	49	33	33	23	18	16,598	54,489	435	136	11.7
Tanana	Chinook salmon	92	53	52	46	47	4,769	81,079	633	270	10.9
Tanana	Coho salmon	35	30	27	7	10	14,374	71,870	561	106	9.6
Tanana	Moose	94	67	38	42	70	48	27,253	258	105	5.4

Source: See Table 2 for citations, time period, and resources addressed

Notes: HH = households; N/A = Not available

Data represent the average across all available study years. Available study years for each community are as follows: Manley Hot Springs (2004, 2012); Minto (1983-84, 1994, 2004, 2012); Tanana (1987, 1997-98, 1998-99, 1999-00, 2002-03, 2006, 2008, 2014)

5.4.3 Timing of Subsistence Activities

Data on the timing of subsistence activities for Tanana River study communities are provided in Table 30. This table shows the number of communities reporting subsistence activity or harvests within each month, based on the most recent data sources for each community. Overall, Tanana River communities target the greatest number of resources during August and September. In general, subsistence activities are at their highest between the months of April through October, with less activity in winter.

Spring (April–May) in the Tanana River Region is a transitional time when winter subsistence activities wane and activities that will occur throughout the summer begin. Subsistence activity for upland birds and furbearers declines in early spring as residents of the region shift focus to non-salmon fish and waterfowl as they migrate through the area. However, communities continue to harvest upland birds throughout the year except in the month of June, during the nesting and rearing period. Spring is a primary harvest time for bear in the region, although bear can be taken year round. Spring marks a decline of small land mammal harvests in general, though beaver and porcupine subsistence activity continues.

Summer (June–August) in the Tanana River Region is characterized by intensified fishing activities. Salmon fishing begins in June and continues through the fall as different species navigate the watersheds of the region. Non-salmon fish harvests, including whitefish and sheefish harvests, occur along with the summer salmon fishing. Waterfowl subsistence activity continues through the summer as well as harvests of small land mammals, namely squirrel. Residents of the region may target moose in late summer; however, harvests at that time are only occasional. The emergence and ripening of vegetation in the region allows for increased harvests of plants and berries.

The focus on fishing continues into the fall (September–October) with harvests of coho salmon and non-salmon fish; moose harvests begin to intensify at this time. Moose subsistence activity occurs year round, but is primarily in September-March. Bear subsistence activity continues and is particularly common in the fall in Tanana and Minto. Moose and bear are the most common large land mammal resources harvested in the region. Waterfowl subsistence activity intensifies to peak activity with the fall migration, particularly in Manley Hot Springs and Tanana. Ripe berries are collected into early fall and wood collection begins at the end of fall.

The focus of subsistence activity shifts in the winter (November–March), with the end of salmon fishing and the slowing of non-salmon fishing. Residents primarily harvest small land mammals and upland birds for fresh meat over the winter season. Furbearer pelts are in prime condition over the winter and residents report peak activity during this time. Moose subsistence activity may occur during December and wood collection continues to maintain a fuel supply.

Table 30. Tanana River region timing of subsistence activities, number of communities reporting subsistence activity

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon fish	3	3	4	4	4	4	4	4	4	4	4	4
Salmon	N/A	N/A	N/A	N/A	N/A	4	4	4	4	4	N/A	N/A
Caribou	N/A	2	2	2	N/A	N/A	N/A	2	2	N/A	2	N/A
Moose	4	4	4	2	2	3	3	2	4	4	3	4
Bear	2	2	4	3	4	4	4	4	4	3	2	2
Furbearers	2	2	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	2
Small land mammals	4	4	4	4	3	3	2	3	4	4	4	4
Upland birds	4	4	4	4	3	N/A	2	4	4	4	4	4
Waterfowl	N/A	N/A	N/A	4	3	4	3	4	4	2	N/A	N/A
Eggs	N/A	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plants and berries	N/A	N/A	N/A	2	2	3	4	4	4	2	N/A	N/A
Wood	3	3	3	3	3	3	3	3	3	3	3	3
Total number of resources per month	**7**	**8**	**8**	**9**	**9**	**8**	**9**	**10**	**10**	**9**	**8**	**7**

Source: Case and Halpin 1990; Brown et al. 2010; Brown et al. 2016; Betts 1997; Brown et al. 2014; SRB&A 2016a

Notes: Apr = April; Aug = August; Dec = December; Feb = February; Mar = March; Jan = January; Jul = July; Jun = June; N/A = Not applicable (no or limited subsistence activity); Nov = November; Oct = October; Sep = September

Tanana River Region Communities = 4 (Manley Hot Springs, Minto, Nenana, and Tanana)

Each cell contains the number of communities reporting subsistence activity or harvests during each month, based on the most recent data source for each community. Months with only one community report harvests or activity are not included in the table. Resources with no subsistence activity data available are not included in the table.

5.4.4 Travel Method

A recent subsistence mapping study (SRB&A 2016a) collected data on travel methods for a two of the four of Tanana River study communities (Minto and Nenana). The data show that a majority of use areas in the study communities are accessed by boat and, to a lesser extent, truck/car and snowmachine. Many use areas are accessible directly from the community. Other methods used to access subsistence use areas include truck/car and ATV. Both of these study communities have road access. Primary travel methods used to search for resources within use areas are boat, foot, and snowmachine (SRB&A 2016a). Access and search methods vary by community. Nenana residents are more likely to use road vehicles to access subsistence harvesting areas, while Minto residents are more likely to use boats to access and search within their harvesting areas. Unlike many other rural communities who have abandoned the use of dog teams in winter for snowmachines, some individuals in the community of Tanana continue to run dog teams and use their teams to access winter harvesting areas (Brown et al. 2016).

5.4.5 Resource Importance

The relative importance of subsistence resources to the individual Tanana River Region study communities, based on selected variables, is provided in Table 31 through Table 34 (see Section 4.3, Resource Importance Data, for discussion of methods). Based on this analysis, salmon and vegetation are of high importance in all communities where data are available, while moose is of high importance in three out of the four Tanana River Region study communities (Minto, Nenana, and Tanana). Other resources of high importance in the Tanana River Region study communities include upland birds (one community), migratory birds (one community), non-salmon fish (one community), and small land mammals (one community).

5.5. Yukon River

The Yukon River region includes the communities of Beaver, Galena, Livengood, Rampart, and Stevens Village. Stevens Village use areas are overlapped with the eastern end of the southern corridor alternative, while the three Yukon River region communities of Beaver, Galena, and Rampart have uses which occur within 30 miles of (but do not overlap with) the southern corridor. Subsistence data are not available for Livengood.

5.5.1 Subsistence Use Areas

Subsistence use areas for the Yukon River region study communities (Map 24 through Map 27) are focused around the Yukon River system, extending from the Chalkyitsik area to the mouth of the Koyukuk River, in addition to along the Koyukuk River toward the southern corridor alternative near Hughes. A majority of use areas for the Yukon River region study communities are located to the east and south of the AMDIAR project alternatives.

Table 31. Relative importance of subsistence resources based on selected variables, Manley Hot Springs

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	58	39	32	H
2	Caribou	4	7	2	M
3	Dall sheep	0	2	0	L
4	Bear	3	1	0.15	L

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
5	Other large land mammals	-	-	-	L
6	Small land mammals/ furbearers	17	7	2	M
7	Marine mammals	0	13	0	L
8	Migratory birds	47	14	5	M
9	Upland birds	32	5	1	L
10	Bird eggs	2	0	0	L
11	Salmon	51	47	41	H
12	Non-salmon fish	54	36	12	H
13	Marine invertebrates	2	6	0.1	L
14	Vegetation	77	43	5	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 32. Relative importance of subsistence resources based on selected variables, Minto

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	70	74	22	H
2	Caribou	N/A	8	N/A	L
3	Dall sheep	1	N/A	N/A	L
4	Bear	N/A	N/A	1	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	48	35	2	M
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	69	46	3	H
9	Upland birds	48	7	0.3	M
10	Bird eggs	2	N/A	0.01	L
11	Salmon	54	80	55	H
12	Non-salmon fish	54	40	13	M
13	Marine invertebrates	2	N/A	0.001	L
14	Vegetation	87	35	3	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 33. Relative importance of subsistence resources based on selected variables, Nenana

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	69	29	N/A	H
2	Caribou	4	1	N/A	L
3	Dall sheep	1	1	N/A	L
4	Bear	N/A	N/A	N/A	I
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	15	5	N/A	L
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	N/A	N/A	N/A	I
9	Upland birds	73	N/A	N/A	H
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	73	26	N/A	H
12	Non-salmon fish	61	26	N/A	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	N/A	N/A	N/A	I

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 34. Relative importance of subsistence resources based on selected variables, Tanana

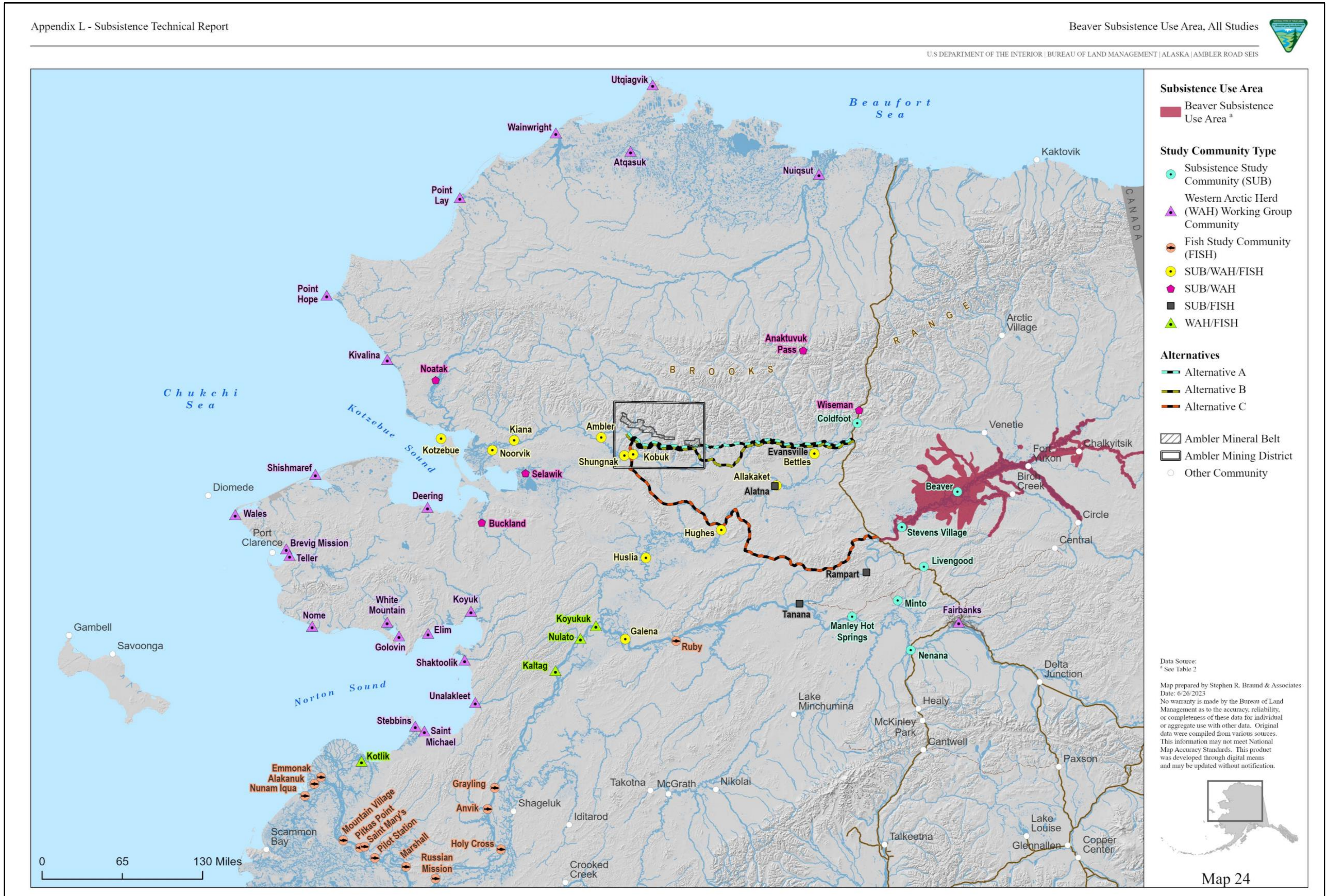
Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	67	70	5	H
2	Caribou	10	10	1	L
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	0.3	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/ furbearers	54	44	2	H
7	Marine mammals	N/A	N/A	N/A	I
8	Migratory birds	49	34	0.5	M
9	Upland birds	55	21	0.3	H
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	62	59	74	H
12	Non-salmon fish	50	26	17	M
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	73	45	0.1	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Beaver subsistence use areas for all available time periods (1930-86; 1997-2006; 2010; 2011) are shown on Map 24. The community's use areas cover an extensive river system with residents traveling along various drainages of the Yukon River between the Circle and the Dalton Highway; other primary river drainages used for subsistence harvesting activities include the Porcupine River, Black River, Beaver Creek, and Birch Creek. As shown in SRB&A (2007) Beaver use areas for moose and bear are most focused along the Yukon River between the mouths of Birch Creek and Stevens Village, while furbearer and small land mammal use areas extend farther from the community along the river system and include various traplines that extend both north and south of the community. Fishing areas are located in relatively close proximity to the community of Beaver on the Yukon River while waterfowl hunting and egg harvesting occur along the Yukon River to the Dalton Highway but with the greatest concentration in the sloughs and lakes surrounding the community.

Galena use areas (Map 25) for all available time periods (1986; 2006; 2010) occur farther downriver on the Yukon River and include large areas surrounding both the Yukon and Koyukuk rivers. Isolated harvesting areas occur even farther north toward Selawik, and Hughes, just south and west of the southern project corridor alternative. According to Brown et al. (2015), for the 2014 study year, salmon harvesting by Galena residents took place primarily along the Yukon River upriver from their community and downriver past the mouth of the Koyukuk River to Nulato. Non-salmon fish harvesting occurred on the Yukon River but also in various sloughs and lakes alongside the Yukon River and at a location on the Koyukuk River. Moose harvesting extended along the Yukon and Koyukuk rivers and in overland areas surrounding these drainages; small land mammal harvesting was focused primarily to the north of the community in overland areas between the Yukon River, Koyukuk River, and the community of Huslia. Waterfowl and bird harvesting generally occurred closer to the community of Galena with some isolated search areas reported farther to the north (along the Koyukuk River) and east of the community. Similarly, vegetation harvesting occurred close to the community with isolated harvesting areas reported along the Koyukuk River and near Huslia.

Rampart use areas for all available time periods (1975-1995; 2014) are shown on Map 25 and show subsistence use areas focused relatively close to the community along the Yukon River downriver from the Dalton Highway, in addition to overland harvesting areas to the north and south of the community. Documented use areas for the 2014 time period (Brown et al. 2016) indicate a much smaller extent of harvesting areas for Rampart community residents in that year compared to previously documented use areas, in addition to increased use of the Stevens Village area for subsistence (Betts 1997). Brown et al. (2016) indicate the changes could be a result of the declining population of Rampart in addition to strong social and familial ties with Stevens Village which may have altered harvesting patterns to focus in that area. Use areas in 2014 were concentrated along the Yukon River directly near the community in addition to near Stevens Village. In addition, a couple of isolated harvesting areas were reported at greater distances from the community. Fishing occurred directly in front of the community of Rampart in addition to several locations upriver toward Stevens Village. Moose harvesting occurred at several isolated locations along Hess Creek, Tolovana River, and in a small area north of the Yukon River, while small land mammal and bird harvesting occurred directly near Rampart as well as at Stevens Village. Vegetation harvesting by Rampart households in 2014 occurred directly around the community.



Map 24. Beaver subsistence use areas, all studies

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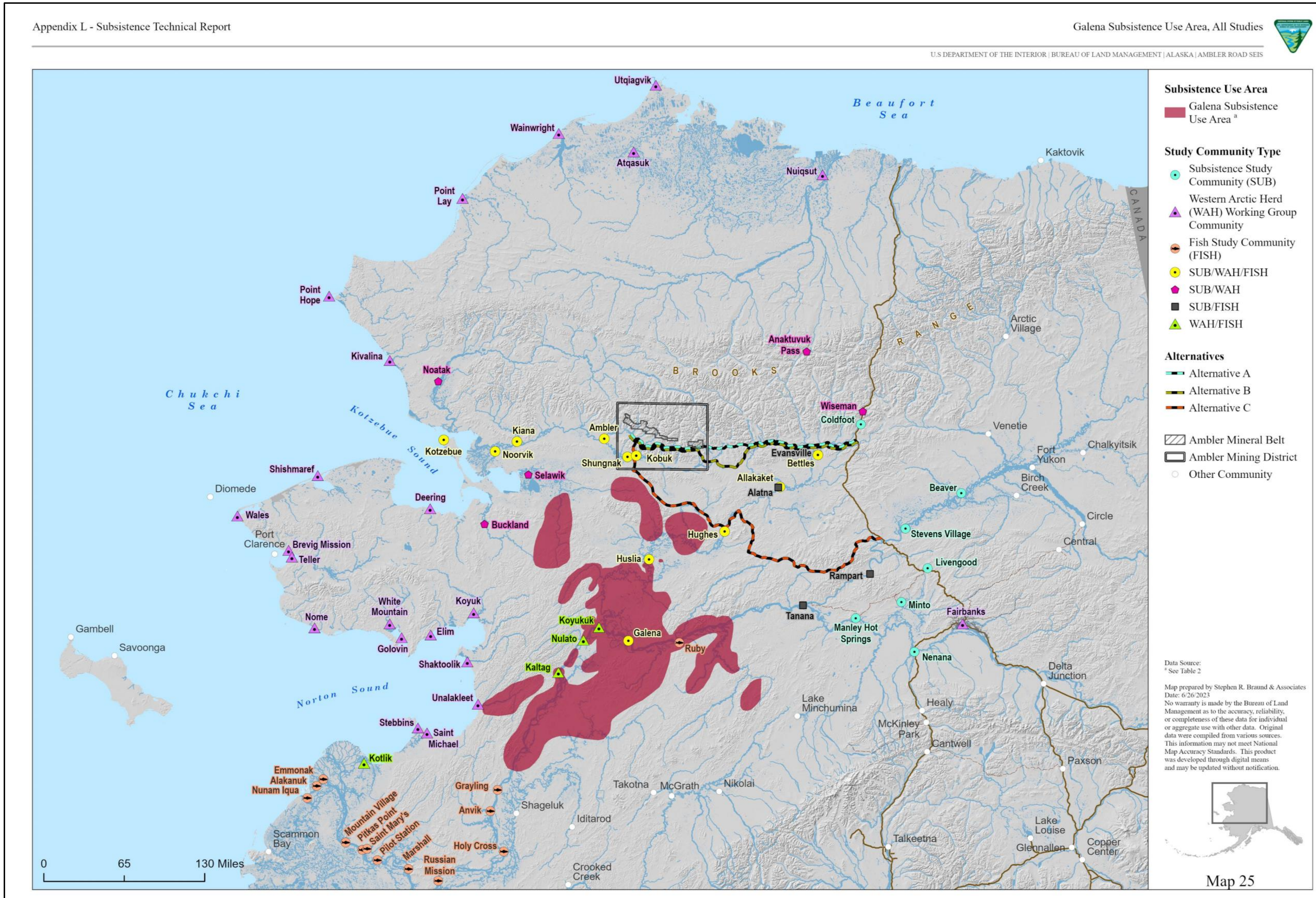

Map 25. Galena subsistence use areas, all studies

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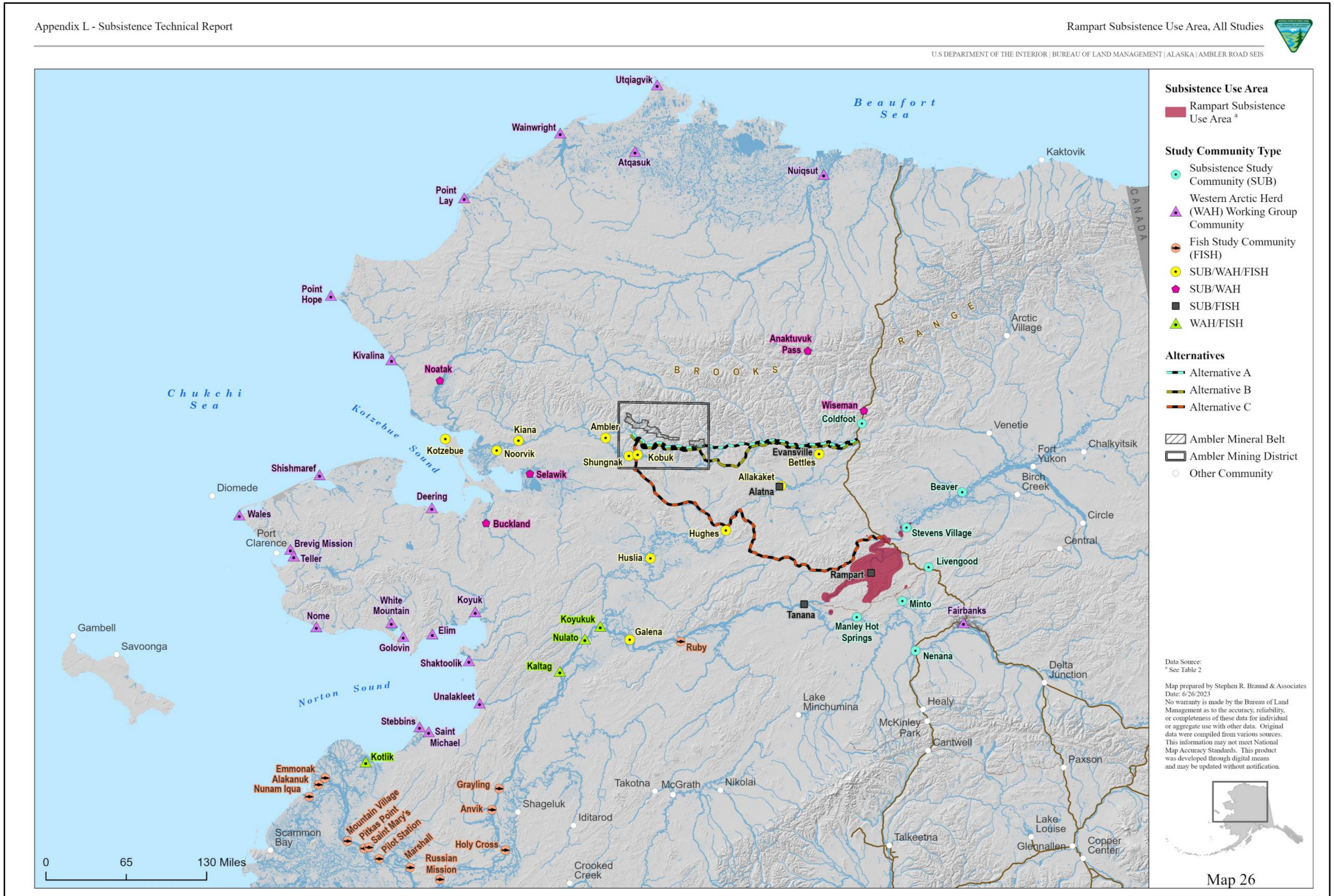

Map 26. Rampart subsistence use areas, all studies

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Stevens Village use areas (Map 27) for all available time periods (1974-1984; 2006-2015) extend along the Yukon River from the mouth of Birch Creek downriver to Rampart, in addition to larger overland use areas primarily to the north of the river. While most Stevens Village use areas remain to the east of the Dalton highway, certain overland and riverine uses cross to the west of the highway and overlap with the eastern portion of the southern corridor alternative. The population of Stevens Village has declined in recent years and an ADF&G comprehensive survey in 2015 found four eligible households. While many have moved away from the community to Fairbanks and other communities, residents continue to return to the community seasonally to engage in subsistence activities. Based on a recent mapping study with community seasonal and permanent residents (SRB&A 2016a), contemporary use areas for the community are similar to historic use areas and are concentrated along the Yukon River between the Dalton Highway and Hodzana River, and in overland areas north and south of the Yukon River. The more recent research shows a greater extent of use areas extending downriver beyond the Dalton Highway with a high concentration of use areas near the mouth of the Ray River. Resource-specific use areas for the more recent mapping study are not available.

5.5.2 Harvest Data

Harvest data for the Yukon River study communities are provided on Figure 13 through Figure 15 and in Table 35. As shown on Figure 13, based on an average of available data, salmon is the primary resource harvested among the study communities in terms of percentage of usable pounds (63 percent), followed by moose (20 percent) and non-salmon fish (nine percent). Other resources which contribute smaller amounts in terms of pounds include small land mammals, migratory birds, vegetation, bear, and caribou. Resource contribution is relatively similar among the Yukon River Region study communities, Stevens Village relies more heavily on salmon, at 81 percent of the total harvest, and less heavily on moose.

Average participation rates among Yukon River Region study communities, in terms of the average percentage of households attempting harvests by resource during individual study years, are shown on Figure 14. These data are based on averages across available study years; it is likely that in some years (or across all years) a higher percentage of households participates in each resource activity. Similar to other study regions, resources with the highest participation rates are not necessarily those that provide the greatest portion of the harvest. Across all Yukon River Region study communities, and similar to the other study regions, households most commonly participate in harvests of vegetation (74 percent of households). Other common subsistence activities across the study region include harvesting of non-salmon fish (60 percent of households participating), followed by migratory birds (56 percent), salmon (56 percent), moose (50 percent), and small land mammals/furbearers (50 percent)[1]. A smaller percentage of households participate in harvests of upland bird, while participation in bird egg harvesting, caribou hunting, marine invertebrate harvesting, and other large land mammal harvesting is minimal. The average percentage of households receiving different resources is shown on Figure 15. In the Yukon River Region, the most widely received resources in the region are also the most widely harvested. Salmon is the most commonly received resource among Yukon River Region study communities, followed by moose, non-salmon fish, and small land mammals.

[1] A Stevens Village commenter on the Draft EIS noted that the Stevens Village estimates for percentage of households using certain resources seemed low. The commenter indicated that 100 percent of Stevens Village households use chum salmon, Chinook salmon, whitefish, sheefish, and moose.

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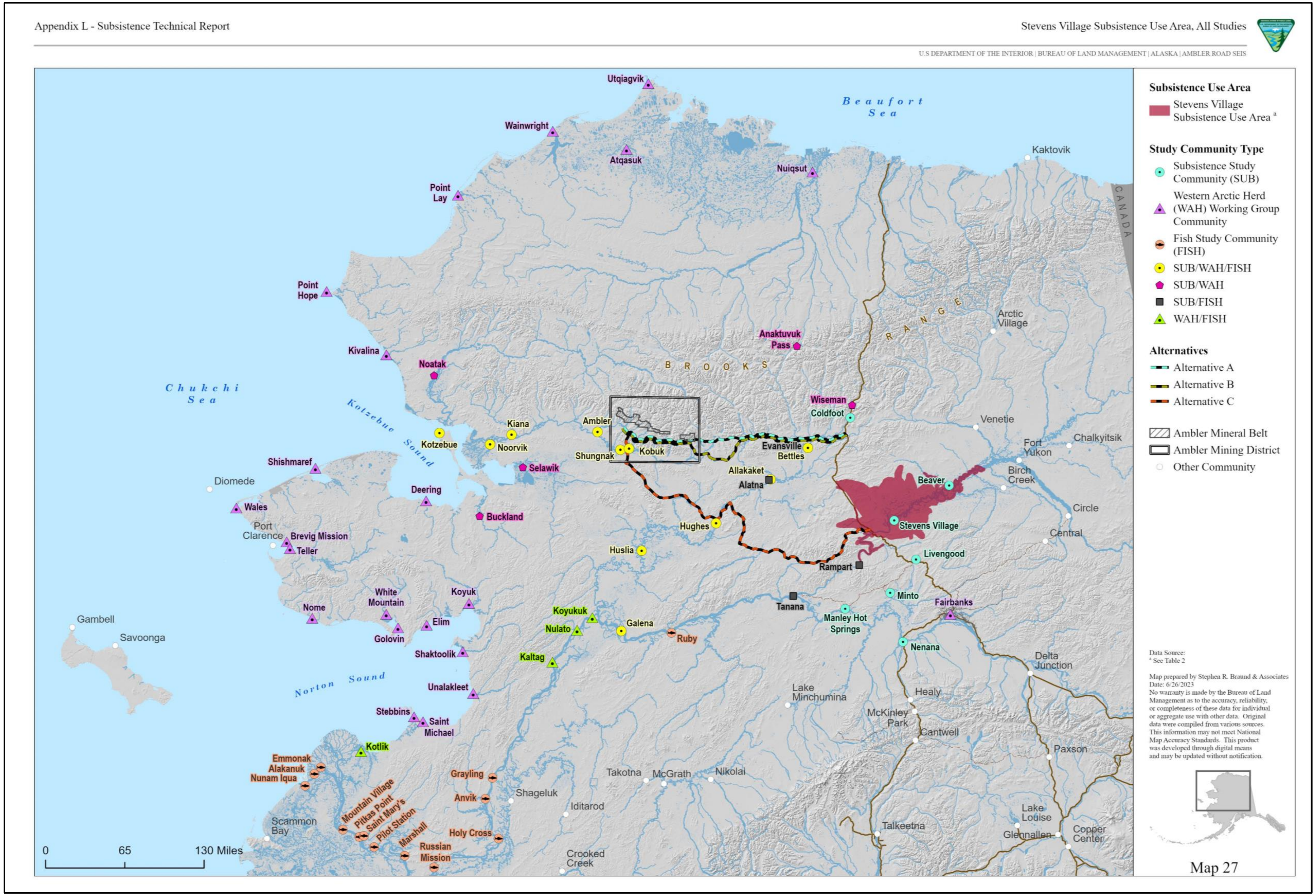

Map 27. Stevens Village subsistence use areas, all studies

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Table 35 shows average harvest and use data for the top five species harvested (in terms of average contribution toward the total subsistence harvest) by each of the Yukon River Region study communities. Chum salmon is the top species harvested among all study communities, contributing between 26 percent and 65 percent of the total subsistence harvest. Moose and other salmon species (coho and Chinook salmon) are also top species among all four study communities. Other top harvested species among the study communities include black bear (Beaver), white-fronted geese (Beaver), whitefish (Galena, Rampart, and Stevens Village), burbot (Rampart), and sheefish (Stevens Village).

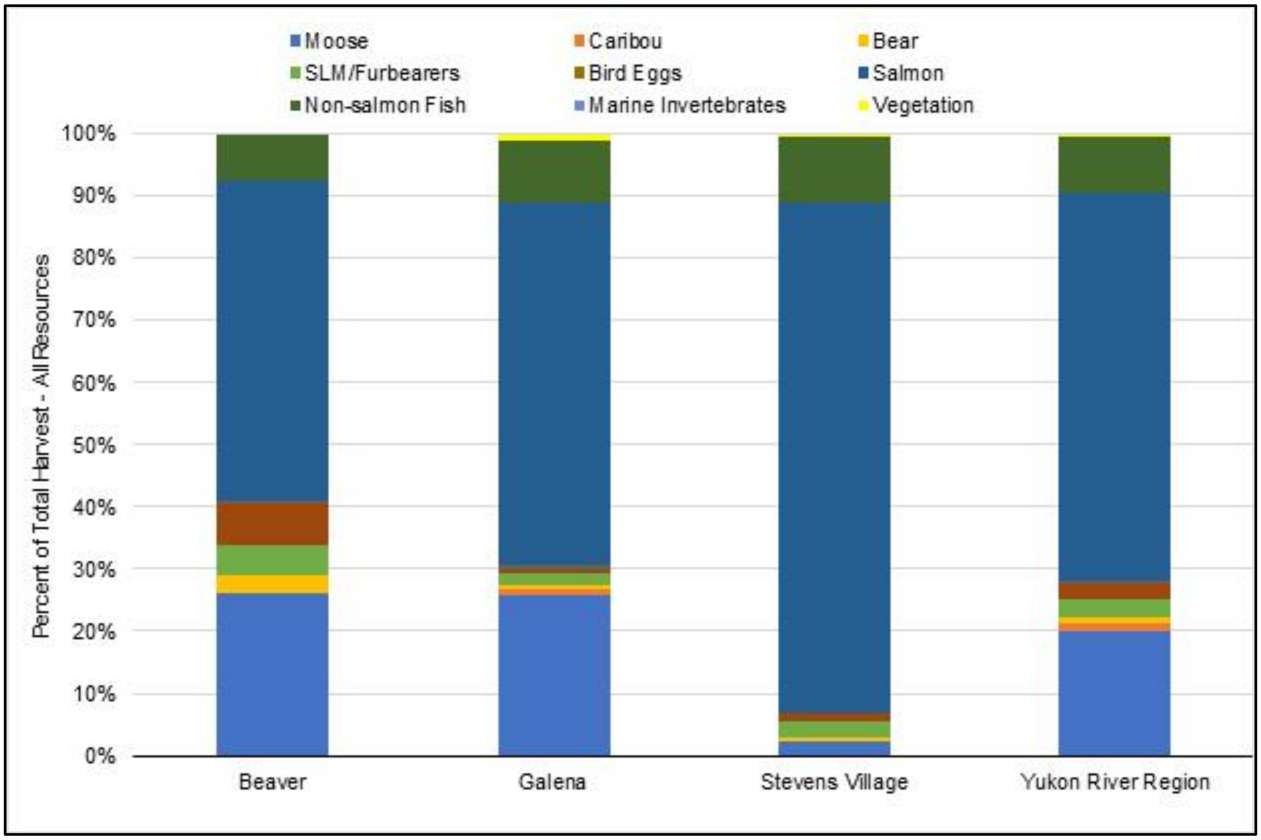

Figure 13. All resources percent of total harvest by Yukon River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of harvest across all available study years for comprehensive (i.e., all resources) household harvest surveys. In some cases, averages represent only a single study year. Available study years for each community are as follows: Beaver (1984-85, 2011); Galena (1985-1986, 2010); Stevens Village (1983-84, 2014).

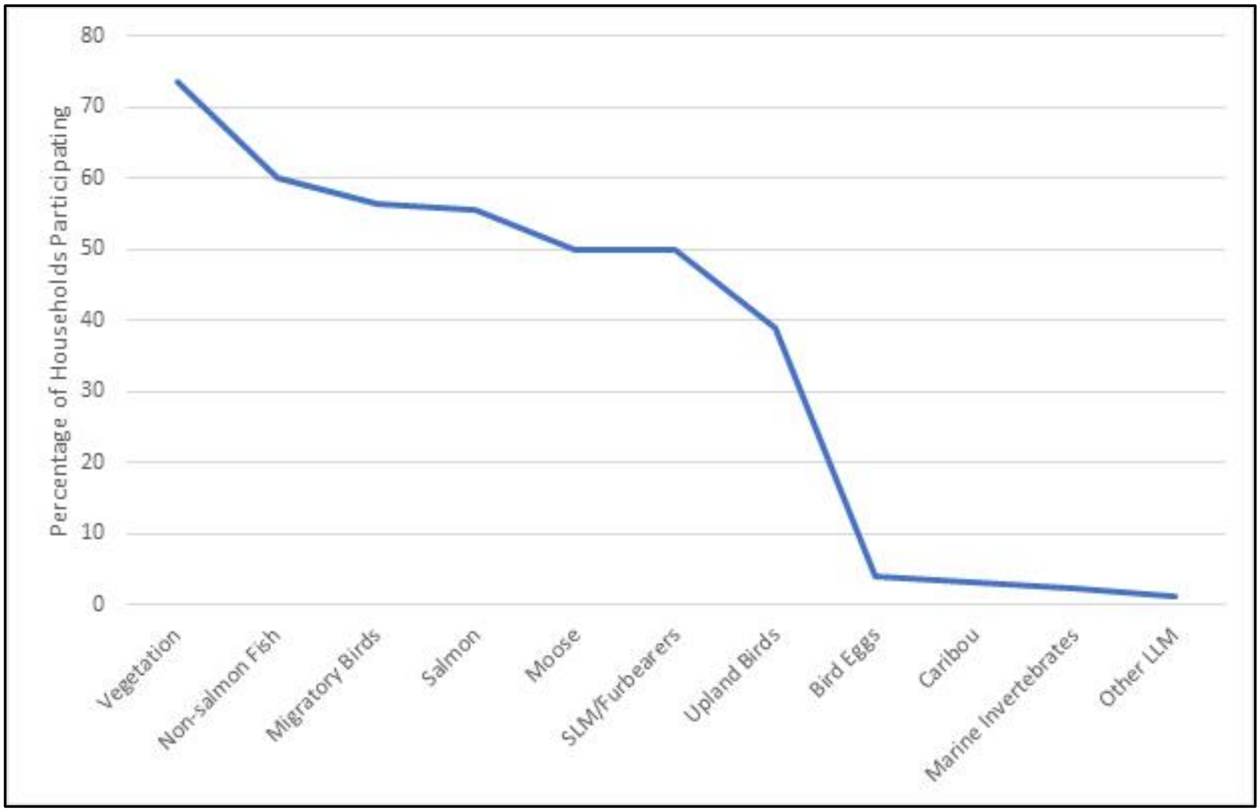

Figure 14. Percent of households attempting harvests of resources, Yukon River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Beaver (1984-85, 2000, 2005, 2008-09, 2009-10, 2010-11, 2011); Galena (1985-1986, 1996-97, 1997-98, 1998-99, 1999-00, 2001-02, 2002-03, 2006, 2010); Stevens Village (1983-84, 1996, 2008, 2008-09, 2009-10, 2010-11, 2014).

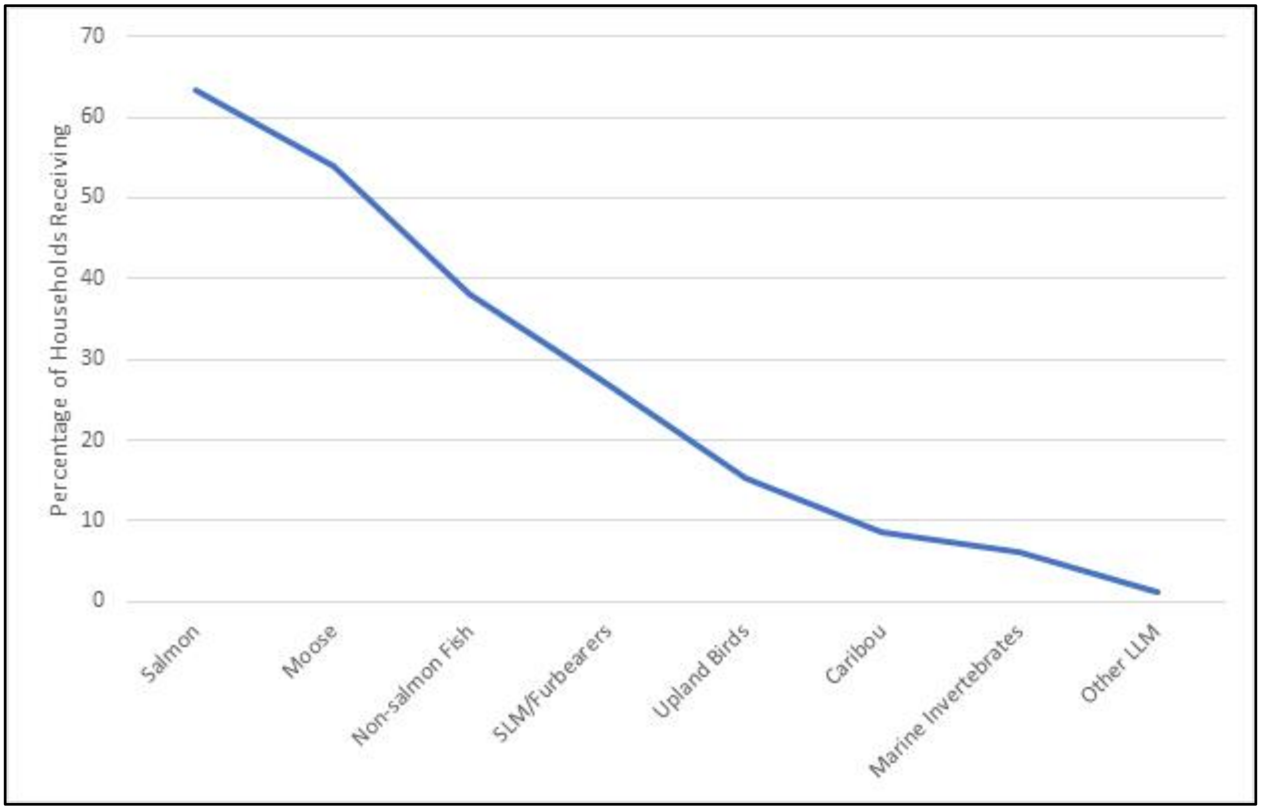

Figure 15. Percent of households receiving resources, Yukon River region communities

Source: See Table 2 for citations, time period, and resources addressed
Notes: Data represent the average percent of households across all available study years. Available study years for each community are as follows: Beaver (1984-85, 2000, 2005, 2008-09, 2009-10, 2010-11, 2011); Galena (1985-1986, 1996-97, 1997-98, 1998-99, 1999-00, 2001-02, 2002-03, 2006, 2010); Stevens Village (1983-84, 1996, 2008, 2008-09, 2009-10, 2010-11, 2014).

Table 35. Average harvest and use data, top 5 species, Yukon River region communities

Community	Species	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% Total harvest
Beaver	Chum salmon	44	30	28	11	25	2,578	12,689	377	157	25.7
Beaver	Moose	33	27	12	12	28	10	5,927	277	90	25.1
Beaver	Chinook salmon	96	36	34	29	66	775	9,369	277	118	21.8
Beaver	Black bear	13	15	8	7	9	7	684	37	10	4.7
Beaver	White-fronted geese	56	52	52	25	8	390	1,213	33	15	4.4
Galena	Chum salmon	59	26	26	15	35	37,770	180,319	876	274	43.4
Galena	Moose	90	64	48	34	55	106	60,907	316	108	25.6
Galena	Chinook salmon	71	41	31	20	46	2,373	29,060	150	49	11.3
Galena	Coho salmon	13	11	11	8	1	1,092	5,775	37	14	5.4
Galena	Humpback whitefish	16	14	14	8	7	5,322	15,965	83	30	3.9
Rampart	Chum salmon	57	57	57	29	29	500	4,673	359	120	31.7
Rampart	Coho salmon	100	71	71	57	100	450	4,319	332	111	29.3
Rampart	Moose	86	57	57	43	86	4	4,011	309	103	27.2
Rampart	Humpback whitefish	43	43	43	29	14	90	501	39	13	3.4
Rampart	Burbot	71	71	71	29	43	53	236	18	6	1.6
Stevens Village	Chum salmon	50	50	47	25	0	6,927	27,583	1,241	438	65.1
Stevens Village	Chinook salmon	63	48	55	21	21	738	12,036	428	148	16.1
Stevens Village	Whitefish	39	39	51	22	2	940	2,186	100	36	6.4
Stevens Village	Moose	56	52	13	16	47	2	2,140	132	31	2.4
Stevens Village	Sheefish	32	32	37	23	1	87	575	29	11	2.4

Source: See Table 2 for citations, time period, and resources addressed

Notes: HH = households; N/A = Not available

Notes: Data represent the average across all available study years for comprehensive (i.e., all resources) household harvest surveys. Available study years for each community are as follows: Beaver (1984-85, 2000, 2005, 2008-09, 2009-10, 2010-11, 2011); Galena (1985-1986, 1996-97, 1997-98, 1998-99, 1999-00, 2001-02, 2002-03, 2006, 2010); Stevens Village (1983-84, 1996, 2008, 2008-09, 2009-10, 2010-11, 2014).

5.5.3 Timing of Subsistence Activities

Data on the timing of subsistence activities for Yukon River study communities are provided in Table 36 This table shows the number of communities reporting subsistence activity or harvests within each month, based on the most recent data sources for each community. Overall, Yukon River communities target the greatest number of resources during September. In general, subsistence activities are at their highest between the spring months of April and May and late summer/fall months of August and September, with less activity in winter.

Spring (April–May) in the Yukon River Region is characterized by warming temperatures, breakup on the rivers, and lengthening days. Spring marks a decrease in seasonal harvests of furbearers and upland birds; however, it also marks the beginning of the waterfowl hunting season, as ducks and geese arrive in the area. Yukon River Region residents occasionally harvest small land mammals, including marten, hare, and beaver, in the springtime, but harvest by month data show harvests more commonly occurring over the winter months (Holen et al. 2012, Van Lanen et al. 2012). Fishing for non-salmon fish occurs in the region during the springtime, either through the ice or after breakup in the open water. The first salmon harvests may also occur in May. Harvests of caribou and bear may also occur in the springtime in a number of communities.

During summer (June–August) residents of the Yukon River Region focus on fishing and collecting plants and berries. Salmon harvesting is a strong focus of certain communities, including Beaver, Rampart, and Stevens Village. Non-salmon fish harvesting also occurs throughout most of the year. Berries are a particularly important resource in the region; they are among the highest- used resources (in terms of the percentage of households using) in many of the communities (Holen et al. 2012). Most large land mammal subsistence activity, more commonly a fall activity, occurs at the end of the summer in August, though communities may take moose or bear year-round. Following spring caribou hunting, residents resume caribou harvesting in August and continue into November. Harvests of waterfowl occur during the summer months, although harvesting decreases during the July nesting and rearing period.

Many subsistence activities which occur over the summer, including fishing, waterfowl hunting, and large land mammal hunting, continue or amplify during the fall (September–October). Moose harvests occur throughout the year but most commonly in the month of September. Bear harvests continue in early fall and berry picking may also continue from the summer into the early fall. Fall in the Yukon River Region marks the end of waterfowl subsistence activity and increased focus on upland birds, such as grouse and ptarmigan. Wood is collected beginning in the fall and is a particularly important resource to prepare for heating through the upcoming winter.

During the winter season (November–March), focus shifts to harvests of small land mammals and furbearers as watersheds freeze over creating conditions for travel to trapping grounds. Pelts of the small mammals and furbearers are prime over the winter season and residents of the region hunt or trap for the pelts and/or meat of small mammals for subsistence purposes. Large land mammal harvests, including caribou, moose, and bears in early winter, occur over the winter months although moose and bear harvests occur with more frequency during other seasons. Ice fishing for non-salmon fish occurs during the early winter months. Residents of the Yukon River Region harvest upland birds throughout the winter and into the spring as the annual cycle of subsistence activities begins again.

Table 36. Yukon River region timing of subsistence activities, number of communities reporting subsistence activity

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon fish	N/A	N/A	3	3	4	4	4	4	4	4	4	1
Salmon	N/A	N/A	N/A	N/A	2	3	3	3	3	2	N/A	N/A
Caribou	N/A	N/A	N/A	1	1	N/A	N/A	1	1	1	1	N/A
Moose	3	3	3	3	3	3	3	3	3	3	3	3
Bear	1	1	1	3	4	3	3	3	3	3	2	1
Furbearers	1	2	1	1		N/A	N/A	N/A	N/A	N/A	1	1
Small land mammals	2	2	2	2	2	2	2	2	2	2	2	2
Upland birds	3	3	3	3	2	2	2	2	3	3	3	3
Waterfowl	N/A	N/A	N/A	2	3	3	2	3	3		N/A	N/A
Eggs	N/A	N/A	N/A	N/A	N/A	2	3	3	3	N/A	N/A	N/A
Plants and berries	2	2	2	2	1	N/A	N/A	N/A	1	2	2	2
Wood	N/A	N/A	3	3	4	4	4	4	4	4	4	1
Total number of resources per month	**6**	**6**	**7**	**9**	**9**	**8**	**8**	**9**	**10**	**8**	**8**	**7**

Source: Andersen et al. 2001; Betts 1997; Brown et al. 2010; Brown et al. 2016; Sumida 1988; Holen et al. 2012; SRB&A 2007; Stevens; Maracle n.d.

Notes: Apr = April; Aug = August; Dec = December; Feb = February; Mar = March; Jan = January; Jul = July; Jun = June; N/A = Not applicable (no or limited subsistence activity); Nov = November; Oct = October; Sep = September

Yukon River Region Communities = 5 (Beaver, Galena, Livengood, Rampart, and Stevens Village)

Each cell contains the number of communities reporting subsistence activity or harvests during each month, based on the most recent data source for each community. Months with only one community report harvests or activity are not included in the table. Resources with no subsistence activity data available are not included in the table. No timing data exist for Livengood.

5.5.4 Travel Method

A recent subsistence mapping study (SRB&A 2016a) collected data on travel methods one of the Yukon River study communities (Stevens Village). In addition, previous research has documented travel methods and routes for Beaver (SRB&A 2007). For Stevens Village, the data show that a majority of use areas are accessed by boat with a much smaller percentage accessed by snowmachine, truck/car, or foot. Many use areas are accessible directly from the community. Primary travel methods used to search for resources within use areas are boat, snowmachine, with lesser use of foot and ATV (SRB&A 2016a). Based on SRB&A (2007), the community of Beaver accesses the highest percentage of their use areas by boat (51 percent), followed by snowmachine (33 percent), four-wheeler (15 percent), and foot (10 percent). Travel routes for Beaver occur along the Yukon River and overland alongside the Yukon River between the community and Stevens Village (SRB&A 2007).

5.5.5 Resource Importance

The relative importance of subsistence resources to the individual Yukon River Region study communities, based on selected variables, is provided in Table 37 through Table 40 (see Section 4.3, Resource Importance Data, for discussion of methods). Based on this analysis, moose, salmon, and vegetation are of high importance in all Yukon River Region study communities. Other resources of high importance in Yukon River Region study communities include migratory birds (two study communities), non-salmon fish (two study communities), and small land mammals (one study community). Marine mammals are of moderate importance in several study communities due to sharing and distribution networks from coastal communities; upland birds are also of moderate importance.

Table 37. Relative importance of subsistence resources based on selected variables, Beaver

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	27	28	25	H
2	Caribou	2	N/A	N/A	L
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	3	M
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	64	31	5	H
7	Marine mammals	N/A	4	N/A	L
8	Migratory birds	78	41	6	H
9	Upland birds	53	19	0.4	M
10	Bird eggs	4	N/A	N/A	L
11	Salmon	41	68	50	H
12	Non-salmon fish	56	38	7	M
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	84	56	N/A	H

Source: See Table 2

Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 38. Relative importance of subsistence resources based on selected variables, Galena

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	64	55	26	H
2	Caribou	5	10	1	L
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	1	L
5	Other large land mammals	1	1	0.3	L
6	Small land mammals/furbearers	29	23	2	M
7	Marine mammals	N/A	10	N/A	L
8	Migratory birds	30	19	1	M
9	Upland birds	49	9	1	M
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	49	56	58	H
12	Non-salmon fish	48	38	10	H
13	Marine invertebrates	3	6	0.1	L
14	Vegetation	79	19	1	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 39. Relative importance of subsistence resources based on selected variables, Rampart

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	57	86	27	H
2	Caribou	N/A	14	N/A	L
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	N/A	I
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	57	29	1	M
7	Marine mammals	N/A	57	N/A	M
8	Migratory birds	43	57	2	M
9	Upland birds	29	29	0.2	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	71	100	61	H
12	Non-salmon fish	86	71	8	H
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	57	86	0.2	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

Table 40. Relative importance of subsistence resources based on selected variables, Stevens Village

Number	Resource	% of HH trying	% of HHs receiving	% of total harvest	Final resource importance evaluation
1	Moose	52	47	2	H
2	Caribou	N/A	2	N/A	L
3	Dall sheep	N/A	N/A	N/A	I
4	Bear	N/A	N/A	0.4	L
5	Other large land mammals	N/A	N/A	N/A	I
6	Small land mammals/furbearers	50	25	3	M
7	Marine mammals	N/A	25	N/A	M
8	Migratory birds	75	23	1	H
9	Upland birds	25	5	0.2	L
10	Bird eggs	N/A	N/A	N/A	I
11	Salmon	61	29	81	H
12	Non-salmon fish	50	5	11	M
13	Marine invertebrates	N/A	N/A	N/A	I
14	Vegetation	75	25	1	H

Source: See Table 2
Notes: H = High; HH = Households; I = Indeterminate; L = Low; M = Moderate; N/A = Not Available

5.6. Subsistence Uses of the Western Arctic Herd

Table 41 provides caribou use and harvest averages across all available study years for the 42 caribou study communities listed in Table 1 and shown on Map 1. The 42 caribou study communities are members of the WAHWG and are subsistence users of the WAH. Caribou is a key subsistence resource for many of the WAHWG study communities. Although caribou herd populations tend to fluctuate, the WAH population has declined substantially in recent years. Recent censuses estimated the herd’s population at 188,000 caribou in 2021 and 164,000 caribou in 2022, its lowest point in decades and below the WAH WG’s minimum objective of 200,000 caribou. Of particular concern to wildlife managers is a decrease in calving and cow survival rates. As a result, the WAH WG changed the herd management level from “conservative” to “preservative,” recommending limits on cow harvests and no harvests of calves (WAH WG 2022). In 2022, the Federal Subsistence Board approved a special action to close some Federal public lands in Units 23 and 26A (the Project is in Unit 23) to moose and caribou hunting by non-federally qualified users for the 2022-2024 hunting seasons. This was in response to a request by the Northwest Arctic Subsistence Regional Advisory Council as well as concerns raised by the WAH working group about the recent WAH population decline (Federal Subsistence Management Program 2022). During recent Regional Advisory Council meetings in both the Northwest Arctic and Western Interior regions, board members have expressed concerns about the availability of caribou, indicating that their migrations are less predictable and the herds are more scattered (Northwest Arctic Subsistence Regional Advisory Council 2023; Western Interior Federal Subsistence Regional Advisory Council 2022a). These concerns are particularly prevalent in the Northwest Arctic region. As one board member observed, the changes in caribou availability have had substantial social and economic effects:

> I have a lot of concerns regarding caribou. We know that they don't come through here anymore. I haven't gotten any fresh caribou meat within well over a year. It is a big

> concern. You know, our grocery stores here in Kotzebue, the shelves are bare, man, I mean they get hit hard…. You know this Pandemic has really hit us hard, this winter has really hit us hard with all these storms. And I could just see how it would be in the villages. It's probably three times worse. You know I see pallets daily going to the villages. I'm pretty sure they're going through a very hard time…. And I know a lot of people, you know, like going out there and pooling their money together and, you know, putting all their fuel and their gas and grub into one boat, you know, with four hunters to go up and try to get caribou for themselves and, man, there's times when they come back with nothing. You know it's beginning to get, in a way, if someone told me this is beginning to get depressing because people aren't filling their freezers.

With few exceptions, use of caribou among the 42 study communities is high, with over 50 percent of households in 30 of the 42 study communities using caribou. The contribution of caribou toward the total subsistence harvest is highest in the communities of Anaktuvuk Pass, Ambler, Shungnak, Deering, Koyuk, Noatak, and Buckland. Caribou contributes an average of at least one-third of the total harvest in those communities. Caribou sharing ranges widely, with between 2 and 71 percent of WAHWG households giving caribou, and between 3 and 84 percent receiving caribou. On average, caribou contribute approximately 25 percent toward the total harvest for the study communities. Nearly half of households (48 percent) participate in caribou hunting, and residents harvest an average of 101 pounds of caribou annually.

Some of the caribou study communities with the highest average per capita harvests are those with use areas overlapping or close to the project area. These include Ambler, Buckland, Shungnak, Anaktuvuk Pass, Noorvik, Selawik, Noatak, and Kiana. Other caribou study communities with high average per capita harvests (over 100 pounds) include Kobuk, Kivalina, Deering, Wainwright, Atqasuk, Nuiqsut, Point Lay, and Koyuk. Several of these communities, including Anaktuvuk Pass and Nuiqsut, rely more heavily on other caribou herds such as the Teshekpuk Herd (TH) and Central Arctic Herd (CAH). While harvest data are only available for a limited number of study years for each community and therefore may not capture wide variations in annual harvests, review of individual study years suggest declining caribou harvests in several study communities. These include Elim, Kivalina, Kobuk, Kotzebue, Noatak, Selawik, and Shungnak. Thus, a number of study communities in the western portion of the project area may have experienced declines in caribou harvests in recent years. In contrast, several communities have seen a recent increase in caribou harvests in recent years, including Allakaket, Ambler, Deering, Hughes (based on two data points), Shishmaref, and Wainwright (based on two data points). A decline in resource harvests does not necessarily equate to a decline in resource dependence. Harvest declines could be a result of changes which are out of a community’s control, such as the availability of caribou within communities’ traditional harvesting areas; ability to access caribou herds due to increasing gas prices; and changes in the timing of the fall caribou migration (Watson 2018). Many communities that are located within the current “peripheral” range of the WAH were established in their present-day locations because of their proximity to key subsistence resources, including caribou. Many subsistence users report that caribou migration changed with the introduction of roads (e.g., DMTS Road) and pipelines (TAPS pipeline), resulting in reduced availability of the resource within their traditional hunting areas (Alatna Tribal Council 2022; Western Interior Federal Subsistence Regional Advisory Council 2022a). Other changes in caribou distribution have occurred over time. In recent years, the winter range of the WAH has shifted, with the primary range shifting from the Nulato Hills toward the Seward Peninsula; even more recently, a large portion of the WAH has wintered in the Brooks Range. Subsistence-based communities are vulnerable to even small changes in resource distribution, as these changes may have large impacts on residents’ ability to access hunting grounds. During population lows, caribou tend to inhabit their core range, thus limiting their availability to communities whose use areas overlap with the peripheral range of a herd.

The centralization of previously semi-nomadic peoples reduced their ability to adapt to the changing distribution and migration patterns of the WAH and other caribou herds. Strong sharing networks between communities and regions ensure that residents of the study communities continue to receive and consume caribou, and the resource remains culturally important to all study communities regardless of current harvest levels. These networks extend from the study communities to other communities and regions throughout the state of Alaska.

5.7. Downstream Subsistence Uses of the Fish

Table 42 provides Chinook salmon, chum salmon, and sheefish use and harvest averages across all available study years for the 32 fish study communities listed in Appendix F, Table 15, and depicted on Volume 4, Map 3-32. The 32 fish study communities are located downstream from tributaries crossed by the project and include 6 communities in the Kobuk-Selawik River basin, 7 communities in the Koyukuk River basin, and 19 communities in the Yukon River basin. As discussed in Section 3.3.2 of the Supplemental EIS (Fish and Aquatics), several species (Chinook salmon, chum salmon, and sheefish) have key spawning grounds in the project area and are therefore vulnerable to downstream impacts from the project. Sheefish in particular require specialized spawning habitat, and the Upper Kobuk River supports the largest spawning population in the northwest region of Alaska. All three of these species are key subsistence species throughout the region. Key spawning drainages for salmon include Henshaw Creek, the Tozitna River, the Indian River, the South Fork Koyukuk River, and the Hogatza River (including Clear, Caribou, and Klikhtentotzna creeks) (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). Key spawning drainages for sheefish are the upper Kobuk and Alatna rivers (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). Other species which may occur in the project area include other species of whitefish (broad whitefish, humpback whitefish), Arctic grayling, burbot, northern pike, and Alaskan blackfish. Both anadramous and resident fish migrate seasonally between main river/stream channels and their tributaries; maintaining seasonal connectivity between these waterways is of critical importance to fish species (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). This section focuses on three species (Chinook salmon, chum salmon, and sheefish) of particular concern.

With few exceptions, use of fish among the 32 study communities is high, with more than 50 percent of households in nearly all fish study communities using Chinook salmon, chum salmon, or sheefish. The contribution of Chinook salmon toward the total subsistence harvest is highest in the Yukon River communities of Kaltag, Anvik, Nulato, Ruby, Marshall, Russian Mission, and Grayling (more than 20 percent of the total harvest). In these and several other communities, at least 50 percent of households participate in harvesting of Chinook salmon. The reliance on Chinook salmon is somewhat more limited in communities on the Koyukuk and Kobuk-Selawik river drainages; however, in many of these communities a substantial percentage of households receive Chinook salmon from other households (see Appendix F, Table 18).

Compared to Chinook salmon, chum salmon is more widely harvested across the study region. In nearly half of the fish study communities (for which data are available), chum salmon account for an average 20 percent or more of the annual subsistence harvest. In two communities (Tanana and Hughes), chum salmon harvests contribute over half of the communities' subsistence harvest, on average. In 9 of the 32 fish study communities, at least half of the households participate in chum salmon harvesting. Again, sharing of chum salmon is high across the region, with an average of 39 percent of households receiving chum salmon (see Appendix F, Table 18).

While typically not harvested in the same numbers as salmon, sheefish are still a key resource in the study region, contributing an average of over 10 percent of the harvest in 6 of the 32 study communities

(Kobuk, Noorvik, Kotzebue, Kotlik, Allakaket, and Shungnak). While sheefish are important to communities in the Kobuk-Selawik river system, communities on the Koyukuk (Alatna, Allakaket) and Yukon (Kotlik, Nunam Iqua, Emmonak, Alakanuk) river drainages also harvest substantial quantities of this resource. Participation in whitefish harvesting is high, with over 50 percent of households in nearly half of the fish study communities attempting harvests of the resource. On average across all fish study communities, 33 percent of households receive sheefish annually (see Appendix F, Table 18).

Chinook and chum salmon returns in northwest Alaska, including along the Kobuk, Koyukuk, and Yukon rivers, have declined since the 1990s, and the ADF&G considers Chinook salmon a “stock of yield concern” (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). These populations have continued to decline since publication of the Final EIS. Since publication of the Final EIS, there have also been drastic declines in coho salmon. The declines in salmon have led to subsistence closures in the Yukon River drainages watershed (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). Finally, the average body size of all salmon species in Alaska has declined since 2010; if these trends continue, subsistence users may require greater numbers of harvested salmon to meet their subsistence and nutritional needs. As salmon harvests have declined, some communities’ harvests have shifted to more non-salmon fish harvests, particular harvests of sheefish and other whitefish (Braem et al. 2015; Watson 2018). The decline in salmon has affected the subsistence economies of many communities in the study region, including a decline in use of fish camps, increased expenses and effort associated with salmon fishing, and a greater reliance on other fish species as well as sharing and bartering networks (Brown and Godduhn 2015). In the lower Yukon River basin, there has been an increase in harvests of chum salmon due to restrictions on Chinook salmon harvests (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS), although in recent years there have been restrictions on chum salmon harvests as well. An Allakaket resident and member of the Western Interior Regional Advisory Council described the lack of salmon in recent years and expressed concerns about the impacts to other key fish species:

> Yeah, we never had salmon running for few years and it's getting worse. First it was king salmon crash and we were restricted to fish and then a couple years ago there was chum salmon decline and now last year there was no fishing except for small fish nets and the people around here are getting concerned about no fish. People hardly even go to fish camp around here anymore. Like when king salmon season was closed they -- king salmon is the main fish diet for people up and down the river and you can't fish for king salmon so they don't fish at all. So it's kind of hard time with no fish. We're depending kind of heavily on the whitefish and sheefish and I'm getting kind of worried that we don't want to deplete those sheefish and whitefish also -- whitefish is pretty good fish too but not as good as king salmon. (Western Interior Federal Subsistence Regional Advisory Council 2022a)

Table 41. Caribou subsistence harvest and use data, caribou study communities

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Allakaket	1981–82	N/A	N/A	6	N/A	6	6	724	19	5	0.5
Allakaket	1982–83	N/A	N/A	0	N/A	N/A	0	0	0	0	0.0
Allakaket	1983–84	N/A	N/A	4	N/A	N/A	4	471	8	3	0.4
Allakaket	1997	42	15	6	10	39	11	1,375	25	8	N/A
Allakaket	1998	100	55	26	20	86	43	5,623	92	29	N/A
Allakaket	1999	93	34	12	15	86	13	1,719	29	10	N/A
Allakaket	2001	21	7	7	3	15	9	1,170	19	7	N/A
Allakaket	2002–03	96	68	44	32	68	106	13,728	312	53	N/A
Allakaket	2011	76	48	33	48	62	95	12,350	217	84	16.0
Allakaket	Average	72	38	15	21	52	32	4,129	80	22	4.2
Ambler	2003	95	74	69	53	50	325	44,237	660	176	N/A
Ambler	2009	78	78	76	52	44	456	61,962	925	260	N/A
Ambler	2012	91	70	62	62	60	685	93,220	1,227	330	54.6
Ambler	Average	88	74	69	56	51	489	66,473	937	255	54.6
Anaktuvuk Pass	1990–91	N/A	N/A	55	N/A	N/A	592	69,964	985	223	N/A
Anaktuvuk Pass	1991–92	N/A	N/A	51	N/A	N/A	545	66,712	940	245	N/A
Anaktuvuk Pass	1992	N/A	74	N/A	N/A	N/A	600	70,222	889	260	82.6
Anaktuvuk Pass	1993–94	N/A	N/A	43	N/A	N/A	574	67,713	846	219	N/A
Anaktuvuk Pass	1994–95	N/A	N/A	N/A	N/A	N/A	322	43,846	516	153	83.5
Anaktuvuk Pass	1996–97	N/A	N/A	N/A	N/A	N/A	210	28,587	362	93	90.5
Anaktuvuk Pass	1998–99	N/A	N/A	N/A	N/A	N/A	500	68,000	756	220	91.3
Anaktuvuk Pass	1999–00	N/A	N/A	N/A	N/A	N/A	329	44,785	560	143	89.6
Anaktuvuk Pass	2000–01	N/A	N/A	N/A	N/A	N/A	732	99,579	1,071	353	90.8
Anaktuvuk Pass	2001–02	N/A	N/A	N/A	N/A	N/A	271	36,910	415	122	78.2
Anaktuvuk Pass	2002–03	N/A	N/A	N/A	N/A	N/A	436	59,310	666	193	92.2

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Anaktuvuk Pass	2006–07	92	61	53	47	63	696	81,490	1,000	299	N/A
Anaktuvuk Pass	2011	95	63	53	52	73	616	77,706	914	251	79.2
Anaktuvuk Pass	2014	89	45	40	47	68	770	104,664	1,057	330	84.2
Anaktuvuk Pass	Average	92	61	49	49	68	514	65,678	784	222	86.2
Atqasuk	1994	N/A	N/A	N/A	N/A	N/A	282	38,352	685	167	61.7
Atqasuk	1996	N/A	N/A	N/A	N/A	N/A	398	54,182	860	241	65.0
Atqasuk	1997	N/A	N/A	N/A	N/A	N/A	266	36,176	613	152	65.3
Atqasuk	2003	93	66	61	66	66	189	N/A	N/A	N/A	N/A
Atqasuk	2004	100	79	79	69	74	314	N/A	N/A	N/A	N/A
Atqasuk	2005	96	70	59	74	63	203	N/A	N/A	N/A	N/A
Atqasuk	2006	95	67	60	76	57	170	N/A	N/A	N/A	N/A
Atqasuk	Average	96	70	65	71	65	260	42,903	719	187	64.0
Bettles	1982	N/A	N/A	0	N/A	0	14	1,788	72	28	10.6
Bettles	1983	N/A	N/A	10	N/A	N/A	5	644	25	8	4.4
Bettles	1984	N/A	N/A	6	N/A	N/A	3	451	12	5	4.4
Bettles	1998	60	40	40	60	20	25	3,276	364	107	N/A
Bettles	1999	67	44	44	33	33	21	2,773	173	52	N/A
Bettles	2002	58	8	0	12	58	0	0	0	0	N/A
Bettles	2011	63	25	25	25	50	6	780	98	65	37.1
Bettles	Average	62	29	18	32	32	11	1,387	106	38	14.1
Brevig Mission	1984	18	N/A	0	7	18	N/A	N/A	N/A	N/A	N/A
Brevig Mission	1989	27	0	0	0	27	0	0	0	0	0.0
Brevig Mission	2000	85	24	20	29	71	76	10,369	153	35	N/A
Brevig Mission	2005	16	15	15	13	8	43	5,835	83	18	N/A
Brevig Mission	2015–16	92	29	19	31	78	65	8,840	136	45	N/A
Brevig Mission	Average	44	20	13	16	37	37	6,189	88	22	4.7
Buckland	2003	86	61	58	54	48	637	86,660	985	212	38.3

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Buckland	2009	67	67	64	46	44	535	72,797	818	168	N/A
Buckland	2016-17	99	86	83	72	81	693	94,217	942	179	N/A
Buckland	2018	97	65	59	54	65	949	129,092	1,278	220	39.7
Buckland	Average	87	70	66	56	59	704	95692	1,006	195	39.0
Deering	1994	78	57	54	43	57	142	19,246	437	131	19.4
Deering	2007	87	55	45	55	74	182	24,743	526	162	N/A
Deering	2013	100	44	38	56	72	404	54,978	1,250	430	64.8
Deering	2017	93	63	57	59	72	342	46539	878	254	-
Deering	Average	90	55	48	53	69	268	36376	773	244	42.1
Elim	1999	96	70	66	60	81	227	30,817	380	99	N/A
Elim	2005	96	79	58	65	85	150	20,421	319	77	N/A
Elim	2010	85	39	28	42	66	83	11,294	128	35	N/A
Elim	Average	92	63	51	56	77	153	20,844	276	70	N/A
Galena	1985	34	10	7	7	28	40	8,383	40	12	1.5
Galena	1996	12	10	10	8	4	40	5,224	29	10	N/A
Galena	1997	16	7	6	8	12	39	5,008	27	9	N/A
Galena	1998	15	4	3	4	12	7	936	5	2	N/A
Galena	1999	9	2	2	2	8	8	999	5	2	N/A
Galena	2001	5	0	0	0	5	0	0	0	0	N/A
Galena	2002	6	2	2	2	4	8	1,091	5	2	N/A
Galena	2010	8	3	1	1	6	6	770	5	2	0.7
Galena	Average	13	5	4	4	10	18	2,801	15	5	1.1
Hughes	1982	N/A	N/A	0	N/A	21	0	0	0	0	0.0
Hughes	2014	31	27	12	4	15	21	2,720	80	30	8.4
Hughes	Average	31	27	6	4	18	10	1,360	40	15	4.2
Huslia	1983	N/A	N/A	25	23	18	53	6,880	121	36	3.3
Huslia	1997	47	21	16	14	31	56	7,343	94	34	N/A

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Huslia	1998	97	65	58	42	40	264	34,320	429	140	N/A
Huslia	1999	81	33	30	18	51	78	10,152	124	40	N/A
Huslia	2002	75	42	35	19	50	82	10,703	141	49	N/A
Huslia	Average	75	40	33	23	38	107	13,880	182	60	3.3
Kaltag	1996	30	17	11	13	23	16	2,095	34	9	N/A
Kaltag	1997	20	4	4	7	18	8	1,075	17	4	N/A
Kaltag	1998	19	10	9	7	10	6	807	13	4	N/A
Kaltag	2001	2	0	0	0	2	0	0	0	0	N/A
Kaltag	2002	0	0	0	0	0	0	0	0	0	N/A
Kaltag	2017	0	0	0	0	0	0	0	0	0	N/A
Kaltag	Average	12	5	4	4	9	5	663	11	3	N/A
Kiana	1999	97	68	65	52	75	488	66,316	691	174	N/A
Kiana	2006	94	62	57	N/A	N/A	306	41,612	438	109	31.2
Kiana	2009	77	80	75	54	55	414	56,337	547	149	N/A
Kiana	Average	89	70	66	53	65	403	54,755	559	144	31.2
Kivalina	1964	N/A	N/A	N/A	N/A	N/A	256	36,338	1,398	209	15.6
Kivalina	1965	N/A	N/A	N/A	N/A	N/A	1010	144,434	5,555	830	53.6
Kivalina	1982	N/A	N/A	N/A	N/A	N/A	346	48,202	1,026	179	22.9
Kivalina	1983	N/A	N/A	N/A	N/A	N/A	564	76,652	1,631	284	30.2
Kivalina	1992	97	77	74	53	68	351	47,539	660	138	18.2
Kivalina	2007	93	64	64	67	69	268	36,458	450	85	13.9
Kivalina	2010	79	67	29	51	73	86	11,657	130	32	N/A
Kivalina	Average	90	69	56	57	70	412	57,326	1,550	251	25.7
Kobuk	2004	89	82	61	46	64	134	18,224	651	148	N/A
Kobuk	2009	86	86	82	68	50	210	28,531	865	194	N/A
Kobuk	2012	93	67	57	57	73	119	16,173	449	98	31.8
Kobuk	Average	89	78	66	57	63	154	20,976	655	147	31.8

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Kotlik	1980	N/A	N/A	7	N/A	N/A	8	1,600	29	4	N/A
Kotlik	Average	N/A	N/A	7	N/A	N/A	8	1,600	29	4	N/A
Kotzebue	1986	88	50	45	40	58	1917	260,645	341	97	24.4
Kotzebue	1991	93	70	63	59	62	3782	514,362	636	141	23.8
Kotzebue	2012	82	44	39	49	59	1804	245,287	301	80	N/A
Kotzebue	2013	84	43	34	42	71	1680	228,438	274	75	N/A
Kotzebue	2014	84	39	29	47	72	1286	174,823	212	59	28.8
Kotzebue	Average	86	49	42	47	64	2094	284,711	353	90	25.7
Koyuk	1998	97	66	59	53	64	263	35,799	484	129	N/A
Koyuk	2004	97	77	72	72	72	425	57,737	671	153	N/A
Koyuk	2005	89	51	46	36	67	143	19,424	221	58	N/A
Koyuk	2006	N/A	N/A	N/A	N/A	N/A	447	60,759	683	168	40.0
Koyuk	2010	95	72	47	48	53	184	24,990	312	84	N/A
Koyuk	2016-17	89	51	46	36	67	143	19,424	221	58	N/A
Koyuk	Average	93	63	54	49	65	267	36,355	432	108	40.0
Noatak	1994	84	84	91	71	50	615	996	83,664	221	47.8
Noatak	1999	95.6	74.4	72	61.1	62.2	683	92,902	938	224	N/A
Noatak	2002	91	76	71	61	64	410	55,733	552	120	N/A
Noatak	2007	97	73	66	78	88	442	60,061	505	114	31.4
Noatak	2010	56	21	21	4	45	66	8,937	78	16	N/A
Noatak	2010–1	95	62	50	51	78	360	48,918	391	90	N/A
Noatak	2016–17	96	70	51	56	84	337	45,783	358	80	N/A
Noatak	Average	88	66	60	54	67	416	44,761	12,355	124	39.6
Noorvik	2002	95	72	71	60	59	988	134,373	873	182	N/A
Noorvik	2008	94	70	70	37	56	767	104,289	724	174	N/A
Noorvik	2012	95	60	59	47	65	851	115,758	857	198	32.8
Noorvik	Average	95	67	67	48	60	869	118,140	818	184	32.8

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Nuiqsut	1985	98	90	90	80	60	513	60,021	790	150	37.5
Nuiqsut	1992	N/A	81	N/A	N/A	N/A	278	32,551	N/A	N/A	21.7
Nuiqsut	1993	98	74	74	79	79	672	82,169	903	228	30.7
Nuiqsut	1994–95	N/A	N/A	N/A	N/A	N/A	258	30,186	N/A	N/A	36.3
Nuiqsut	1995–96	N/A	N/A	N/A	N/A	N/A	362	42,354	N/A	N/A	23.1
Nuiqsut	2000–01	N/A	N/A	N/A	N/A	N/A	496	57,985	N/A	N/A	31.6
Nuiqsut	2002–03	95	47	45	49	80	397	N/A	N/A	118	N/A
Nuiqsut	2003–04	97	74	70	81	81	564	N/A	N/A	157	N/A
Nuiqsut	2004–05	99	62	61	81	96	546	N/A	N/A	147	N/A
Nuiqsut	2005–06	100	60	59	97	96	363	N/A	N/A	102	N/A
Nuiqsut	2006–07	97	77	74	66	69	475	N/A	N/A	143	N/A
Nuiqsut	2010	94	86	76	N/A	N/A	471	55,107	593	N/A	N/A
Nuiqsut	2011	92	70	56	49	58	498	58,226	619	134	N/A
Nuiqsut	2012	99	68	62	65	79	501	58,617	598	147	N/A
Nuiqsut	2013	95	79	63	62	75	586	68,534	692	166	N/A
Nuiqsut	2014	90	66	64	67	59	774	105,193	974	253	N/A
Nuiqsut	2015	96	84	78	74	72	628	73,527	728	180	N/A
Nuiqsut	2016	96	76	67	79	81	481	56,277	592	132	N/A
Nuiqsut	2014	90	66	64	59	67	774	105,193	974	253	28.3
Nuiqsut	Average	96	72	67	71	75	507	63,281	746	165	29.9
Nulato	1996	7	5	5	5	4	13	1,642	18	5	N/A
Nulato	1997	6	4	2	2	4	3	407	5	1	N/A
Nulato	1998	9	8	6	5	6	5	711	10	3	N/A
Nulato	2001	1	0	0	0	1	0	0	0	0	N/A
Nulato	2010	2	0	0	0	2	0	0	0	0	0.0
Nulato	Average	5	3	3	2	3	4	552	7	2	0.0

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Point Hope	1994	-	-	-	-	-	355	48239	309	67	23.2
Point Hope	2014	91	53	30	51	80	185	25,156	143	34	7.6
Point Hope	2015	N/A	56	N/A	N/A	N/A	422	49,374	N/A	N/A	N/A
Point Hope	Average	91	55	30	51	80	394	48118	201	51	15.4
Point Lay	1987	94	72	72	63	73	157	18,418	428	153	17.2
Point Lay	1994	N/A	N/A	N/A	N/A	N/A	223	30,260	522	171	31.3
Point Lay	2002	N/A	N/A	N/A	N/A	N/A	154	20,944	322	85	22.1
Point Lay	2012	93	64	60	71	76	356	48,380	705	186	31.3
Point Lay	2015	N/A	63	N/A	N/A	N/A	224	N/A	N/A	N/A	N/A
Point Lay	Average	94	66	66	67	75	223	29,501	494	149	25.5
Selawik	1999	97	61	61	75	84	1289	175,335	1,124	249	N/A
Selawik	2006	N/A	65	63	N/A	N/A	934	127,120	757	165	N/A
Selawik	2011	97	70	54	59	80	683	92,947	550	109	20.4
Selawik	Average	97	65	59	67	82	969	131,801	810	174	20.4
Shaktoolik	1998	94	59	53	51	88	167	22,699	405	97	N/A
Shaktoolik	1999	94	47	45	29	78	125	16,992	288	73	N/A
Shaktoolik	2003	98	58	58	56	77	198	26,991	450	122	N/A
Shaktoolik	2009	51	51	47	35	25	133	18,100	302	81	N/A
Shaktoolik	Average	84	54	51	43	67	156	21,196	361	93	N/A
Shishmaref	1982	N/A	12	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shishmaref	1989	48	19	19	19	38	197	26,747	227	57	N/A
Shishmaref	1995	78	33	31	56	67	342	46,542	332	83	10.5
Shishmaref	2000	85	39	34	36	69	299	40,651	271	73	N/A
Shishmaref	2009	72	72	65	55	52	339	46,049	374	81	N/A
Shishmaref	2014	92	51	47	57	69	487	66,197	473	107	17.0
Shishmaref	2017	97	67	54	63	77	376	51078	362	96	-
Shishmaref	Average	79	42	37	48	62	340	46211	340	83	13.7

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
St. Michael	2003	68	29	18	16	57	48	6,460	68	16	N/A
St. Michael	2006	N/A	N/A	N/A	N/A	N/A	17	2,366	25	5	N/A
St. Michael	Average	68	29	18	16	57	33	4,413	47	10	N/A
Stebbins	2013	9	3	3	3	6	26	3,482	26	6	1.8
Stebbins	2006	N/A	N/A	N/A	N/A	N/A	0	0	0	0	N/A
Stebbins	2002	5	6	0	0	5	0	0	0	0	N/A
Stebbins	1980	N/A	N/A	0	N/A	N/A	0	0	0	0	0.0
Stebbins	Average	7	5	1	2	5	9	1,161	9	2	0.9
Teller	2000	59	8	6	6	54	21	2,823	40	12	N/A
Teller	2005	9	0	0	0	9	0	N/A	0	0	N/A
Teller	2006	N/A	N/A	N/A	N/A	N/A	0	0	0	0	N/A
Teller	2015–16	47	18	17	13	39	29	3,944	51	16	N/A
Teller	Average	34	4	3	3	32	11	2,823	20	6	N/A
Unalakleet	2002	78	20	15	15	66	167	22,741	96	30	N/A
Unalakleet	2004	88	63	59	50	62	723	98,348	477	140	N/A
Unalakleet	2006	N/A	N/A	N/A	N/A	N/A	554	75,314	378	108	N/A
Unalakleet	Average	83	42	37	32	64	481	65,468	317	93	N/A
Utqiagvik	1987	N/A	N/A	26	N/A	N/A	1595	186,669	199	62	30.1
Utqiagvik	1988	N/A	N/A	27	N/A	N/A	1533	179,314	191	59	29.2
Utqiagvik	1989	N/A	N/A	39	N/A	N/A	1656	193,744	207	64	22.2
Utqiagvik	1992	N/A	46	N/A	N/A	N/A	1993	233,206	N/A	N/A	17.1
Utqiagvik	1995–96	N/A	N/A	N/A	N/A	N/A	2155	293,094	N/A	N/A	24.5
Utqiagvik	1996–97	N/A	N/A	N/A	N/A	N/A	1158	157,420	N/A	N/A	13.3
Utqiagvik	2000	N/A	N/A	N/A	N/A	N/A	3359	456,851	N/A	N/A	29.3
Utqiagvik	2001	N/A	N/A	N/A	N/A	N/A	1820	247,520	N/A	N/A	22.9
Utqiagvik	2003	N/A	N/A	N/A	N/A	N/A	2092	284,444	N/A	N/A	22.8

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Utqiagvik	2014	70	38	33	38	52	4323	587,897	371	111	30.6
Utqiagvik	2015		44				3000	351,000	293		
Utqiagvik	2019						3273	382,941			
Utqiagvik	Average	70	43	31	38	52	2330	296,175	245	69	24.8
Wainwright	1988	N/A	N/A	57	N/A	N/A	505	59,085	476	117	23.0
Wainwright	1989	N/A	N/A	66	N/A	N/A	711	83,187	699	178	23.7
Wainwright	1992	N/A	68	N/A	N/A	N/A	947	110,851	N/A	N/A	34.3
Wainwright	2002	N/A	N/A	N/A	N/A	N/A	866	117,149	806	221	19.1
Wainwright	2009	97	64	61	62	84	1231	167,356	1,073	284	41.7
Wainwright	2014	N/A	N/A	N/A	N/A	N/A	951	111,267	725	N/A	N/A
Wainwright	2015	N/A	N/A	N/A	N/A	N/A	756	88,452	573	N/A	N/A
Wainwright	2016	N/A	N/A	N/A	N/A	N/A	914	106,938	690	N/A	N/A
Wainwright	2017	N/A	N/A	N/A	N/A	N/A	806	94,302	608	N/A	N/A
Wainwright	2018	N/A	N/A	N/A	N/A	N/A	1,012	118,404	772	N/A	N/A
Wainwright	2019	N/A	N/A	N/A	N/A	N/A	804	94,068	N/A	N/A	N/A
Wainwright	Average	97	67	61	62	84	864	104,696	714	200	28.3
Wales	1993	24	7	2	5	21	4	486	10	3	0.4
Wales	2000	21	2	0	7	23	0	0	0	0	N/A
Wales	2010	13	0	0	3	13	0	0	0	0	N/A
Wales	2017	31	0	0	4	31	0	0	0	0	N/A
Wales	Average	22	2	1	5	22	1	122	2	1	0.4
White Mountain	1999	65	36	33	29	42	93	12,654	183	60	N/A
White Mountain	2006	80	29	20	20	69	50	6825	114	35	8.8
White Mountain	2008	85	46	33	34	70	99	13,477	207	69	N/A
White Mountain	2015-16	92	29	19	31	78	65	8,840	136	45	N/A
White Mountain	Average	80	35	26	28	65	77	10449	160	52	8.8
Wiseman	1991	N/A	N/A	N/A	N/A	N/A	10	1,260	N/A	N/A	28.2

Study community	Study year	% of HH using	% of HH trying	% of HH harvesting	% of HH giving	% of HH receiving	Estimated number harvested	Estimated total pounds	Estimated mean HH pounds	Estimated per capita pounds	% of total harvest
Wiseman	2011	80	80	60	60	20	4	520	104	40	13.6
Wiseman	Average	80	80	60	60	20	7	890	104	40	20.9
All Communities	Average	72	47	38	39	53	362	48,029	705	98	25.1

Source: See Table 2
Notes: HH = Households; N/A = Not available
Harvest data not available for Livengood, Fairbanks, and Koyukuk.

Table 42. Fish subsistence harvest data, average across all available study years, fish study communities

Study community	Species	% HHs use	% HHs try to harvest	% HHs harvest	% HHs give	% HHs receive	Total # harvest	Estimated lbs harvested	Average HH lbs	Per capita lbs	% of total harvest
Alakanuk	Chinook Salmon	N/A	N/A	86	N/A	N/A	2,717	43,203	480	73	10.0%
	Chum Salmon	N/A	N/A	100	N/A	N/A	13,693	66,821	742	112	15.5%
	Sheefish	81	59	60	41	34	3,312	21,524	200	35	7.4%
Alatna	Chinook Salmon	33	33	50	33	28	367	6,644	139	39	3.9%
	Chum Salmon	50	33	42	33	33	8,865	54,036	1,157	321	44.3%
	Sheefish	67	67	47	29	33	1,335	9,340	203	56	9.6%
Allakaket	Chinook Salmon	48	29	39	24	33	317	5,374	111	32	4.4%
	Chum Salmon	50	38	42	31	19	9,723	58,398	1,216	346	48.2%
	Sheefish	72	53	55	34	27	1,968	13,111	266	80	12.5%
Ambler	Chinook Salmon	7	4	4	0	4	3	46	1	0	0.0%
	Chum Salmon	76	53	52	34	57	2,902	20,262	281	80	5.4%
	Sheefish	87	72	69	47	56	1,481	20,966	291	84	7.5%
Anvik	Chinook Salmon	100	88	88	39	48	1,246	15,805	497	181	31.7%
	Chum Salmon	58	42	42	13	21	1,072	5,434	172	60	10.8%
	Sheefish	60	51	54	19	31	285	1,982	61	22	3.1%

Study community	Species	% HHs use	% HHs try to harvest	% HHs harvest	% HHs give	% HHs receive	Total # harvest	Estimated lbs harvested	Average HH lbs	Per capita lbs	% of total harvest
Bettles	Chinook Salmon	25	N/A	2	13	13	9	159	5	2	1.0%
	Chum Salmon	13	13	13	N/A	0	338	2,057	79	29	14.3%
	Sheefish	29	8	8	17	17	80	558	22	8	3.4%
Emmonak	Chinook Salmon	89	55	62	35	65	2,649	33,404	266	59	10.6%
	Chum Salmon	91	70	70	41	58	15,638	78,897	572	128	23.7%
	Sheefish	70	51	55	28	40	3,390	27,115	222	50	8.7%
Evansville	Chinook Salmon	46	8	6	15	28	8	133	5	2	2.3%
	Chum Salmon	N/A	N/A	21	N/A	5	447	2,725	103	38	13.7%
	Sheefish	38	8	12	12	24	65	454	18	7	4.2%
Galena	Chinook Salmon	71	41	31	20	46	2,373	29,060	150	49	11.3%
	Chum Salmon	59	26	26	15	35	37,770	180,319	876	274	43.4%
	Sheefish	36	26	25	13	13	1,008	6,308	33	12	1.8%
Grayling	Chinook Salmon	97	84	81	46	48	1,894	24,940	539	143	20.3%
	Chum Salmon	59	39	37	29	27	5,416	27,094	574	139	17.4%
	Sheefish	76	67	72	34	44	786	5,515	116	29	3.9%
Holy Cross	Chinook Salmon	N/A	N/A	N/A	N/A	N/A	1,649	22,756	274	83	13.1%
	Chum Salmon	N/A	N/A	N/A	N/A	N/A	1,218	5,793	70	21	3.3%
	Sheefish	4	2	21	2	2	376	2,816	34	10	3.2%
Hughes	Chinook Salmon	N/A	N/A	68	N/A	16	586	10,603	482	112	7.5%
	Chum Salmon	46	19	19	15	39	15,195	56,895	2,474	603	56.8%
	Sheefish	54	37	48	9	18	232	1,514	62	18	2.3%
Huslia	Chinook Salmon	N/A	N/A	34	13	39	297	4,072	71	21	2.0%
	Chum Salmon	N/A	N/A	43	14	41	22,583	102,603	1,800	533	49.3%
	Sheefish	60	31	34	20	37	896	5,815	85	27	3.0%
Kaltag	Chinook Salmon	85	58	44	42	33	1,323	13,097	214	74	33.8%
	Chum Salmon	67	44	42	27	29	20,905	85,002	1,352	335	13.2%
	Sheefish	61	44	42	23	30	280	1,592	25	9	4.1%

Study community	Species	% HHs use	% HHs try to harvest	% HHs harvest	% HHs give	% HHs receive	Total # harvest	Estimated lbs harvested	Average HH lbs	Per capita lbs	% of total harvest
Kiana	Chinook Salmon	12	4	4	2	8	14	160	2	0	0.4%
	Chum Salmon	86	62	58	37	79	3,298	19,199	199	48	20.7%
	Sheefish	76	59	57	32	58	1,485	15,018	154	37	5.4%
Kobuk	Chinook Salmon	4	4	4	0	0	2	24	1	0	0.0%
	Chum Salmon	83	63	60	38	54	2,174	12,841	384	84	29.5%
	Sheefish	94	81	79	42	43	903	10,199	306	67	23.3%
Kotlik	Chinook Salmon	N/A	N/A	50	N/A	N/A	1,060	16,854	301	45	8.9%
	Chum Salmon	N/A	N/A	86	N/A	N/A	6,884	33,594	600	89	17.8%
	Sheefish	89	62	67	37	58	2,867	18,457	237	42	13.6%
Kotzebue	Chinook Salmon	13	6	5	3	9	266	3,050	4	1	0.2%
	Chum Salmon	84	47	45	41	60	32,714	199,009	244	59	17.0%
	Sheefish	82	54	52	42	52	39,545	217,497	271	66	15.9%
Koyukuk	Chinook Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Chum Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sheefish	66	48	48	16	41	384	2,304	52	22	N/A
Marshall	Chinook Salmon	89	72	67	50	39	3,304	31,186	367	91	23.2%
	Chum Salmon	89	72	70	41	37	5,981	30,408	358	89	22.6%
	Sheefish	19	13	12	8	10	838	4,750	47	12	3.8%
Mountain Village	Chinook Salmon	85	53	70	38	57	2,260	28,838	249	49	9.4%
	Chum Salmon	83	52	73	38	56	14,415	71,511	600	119	24.0%
	Sheefish	60	40	46	34	45	2,906	16,147	133	28	6.4%
Noorvik	Chinook Salmon	8	5	4	2	4	25	236	2	0	0.0%
	Chum Salmon	89	47	45	42	66	15,408	93,115	719	165	16.3%
	Sheefish	82	56	54	36	54	4,054	45,697	348	80	19.0%
Nulato	Chinook Salmon	87	61	60	36	45	2,000	18,878	208	73	30.4%
	Chum Salmon	37	30	27	13	14	991	5,039	56	19	8.1%
	Sheefish	59	37	36	20	32	466	2,797	32	10	3.6%

Study community	Species	% HHs use	% HHs try to harvest	% HHs harvest	% HHs give	% HHs receive	Total # harvest	Estimated lbs harvested	Average HH lbs	Per capita lbs	% of total harvest
Nunam Iqua	Chinook Salmon	N/A	N/A	100	N/A	N/A	1,912	30,405	1,322	220	15.8%
	Chum Salmon	N/A	N/A	100	N/A	N/A	11,487	56,056	2,437	406	29.2%
	Sheefish	83	63	68	27	63	1,928	13,506	504	91	9.7%
Pilot Station	Chinook Salmon	55	20	19	6	43	211	2,022	16	3	2.0%
	Chum Salmon	92	35	35	26	78	24,273	24,273	190	39	24.5%
	Sheefish	53	32	31	18	31	623	3,523	27	6	3.4%
Pitka's Point	Chinook Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Chum Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sheefish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rampart	Chinook Salmon	0	0	0	0	0	0	0	0	0	0.0%
	Chum Salmon	57	57	57	29	29	500	4,673	359	120	31.7%
	Sheefish	29	29	29	0	0	13	145	11	4	1.0%
Ruby	Chinook Salmon	77	45	40	32	47	1,531	14,448	219	80	26.7%
	Chum Salmon	55	40	38	17	23	2,735	13,907	211	77	25.7%
	Sheefish	41	27	25	13	23	158	950	15	5	1.3%
Russian Mission	Chinook Salmon	85	74	63	28	37	2,557	30,666	511	104	22.3%
	Chum Salmon	N/A	N/A	37	N/A	N/A	2,731	14,596	252	51	9.0%
	Sheefish	41	33	33	13	11	541	3,515	44	9	2.7%
Saint Mary's	Chinook Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Chum Salmon	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Sheefish	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shungnak	Chinook Salmon	4	1	0	1	4	0	0	0	0	0.0%
	Chum Salmon	78	52	50	30	58	4,691	28,070	452	105	14.8%
	Sheefish	85	64	64	35	56	2,565	26,155	414	98	12.2%
Tanana	Chinook Salmon	92	53	52	46	47	4,769	81,079	633	270	10.9%
	Chum Salmon	70	66	62	28	27	67,411	400,317	3,127	1,158	53.7%
	Sheefish	36	32	32	15	11	3,042	19,566	155	56	4.6%

Study community	Species	% HHs use	% HHs try to harvest	% HHs harvest	% HHs give	% HHs receive	Total # harvest	Estimated lbs harvested	Average HH lbs	Per capita lbs	% of total harvest
All Communities	Chinook Salmon	53	36	40	22	30	1,219	16,108	244	62	10.4%
Average	Chum Salmon	67	45	50	29	39	12,119	60,446	747	195	24.3%
	Sheefish	60	43	44	24	33	2,594	17,295	146	36	6.9%

Notes: N/A = not applicable

6. Potential Impacts of Proposed Project to Subsistence Uses

6.1. Impact Methods

The potential impacts of the AMDIAR to subsistence uses are discussed under two primary headings: 1) Road Impacts and 2) Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth. The first section, Road Impacts, discusses the direct and indirect impacts of construction and operation of the Ambler Road. This section does not address potential impacts from development and activities that will result from operation of the road. The second section, Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth, addresses potential impacts associated with future mining development scenarios (facilitating access to the Ambler Mining District is a primary purpose of the road), in combination with other past, present, and reasonably foreseeable actions (RFAs) in the region.

The proposed subsistence impact analysis approach is organized as follows:

- Identify Potential Impact Categories
- Identify Impact Indicators
- Analyze Potential Impacts of the Road on Subsistence Uses
- Summarize Impact Indicators
- Discuss Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth

6.2. Impact Categories

Under both Construction and Operation headings, impacts are discussed under the following three subsistence impact categories:

1. Resource Abundance – Successful subsistence harvests depend on an adequate number of animals being available for harvest within a reasonable distance from one’s community. While overall population levels within a region may appear stable, if a resource experiences a decline within a community’s harvesting area (e.g., within a specific stream used commonly by the community) due to direct mortality or decreased egg or calf survival rates in the area, this would indicate a decrease in resource abundance for that community for that resource. While this section references the conclusions of the wildlife chapters in regards to potential population-level effects, more localized effects from a biological perspective may still affect resource abundance for an individual subsistence community.
2. Resource Availability - Successful subsistence harvests depend on continued availability of resources, of adequate quality and health, in traditional use areas. Subsistence availability can be affected by changes in resource health, resource displacement from traditional harvest locations due to altered distribution or migration, or resource contamination (including actual and/or perceived contamination of resources and habitat or habituation of resources to development activities). Similar to resource abundance, while this section references the conclusions of the wildlife chapters in regards to disturbance or displacement of subsistence resources, impacts which may be minimal from a biological perspective may have larger effects on individual subsistence users, and these impacts are also discussed under Resource Availability.

3. User Access - Successful subsistence harvests depend on continued access to subsistence resources and use areas without physical, regulatory, or social barriers. Avoidance of an area due to development activities, infrastructure, concerns over contamination and other project related reasons is also an impact to user access. Access could be negatively affected or enhanced by a project.

Competition, Costs and Time, and Culture are also categories of impacts and often occur as a result of changes in the above three categories of abundance, availability, or access. For example, changes in access can result in changes in harvester competition for resources. Increased access to an area may result in more competition for resources from outsiders and/or from community or nearby community residents who did not previously use the area. Other aspects of a project may result in increased or decreased competition between communities, within a community, or between local hunters and outsiders. Displacement of resources, resource population decline, competition, and economic changes (e.g., income changes, changes in employment levels) can also affect costs and effort associated with subsistence harvest activities. Harvest activity costs are often directly related to distance traveled, in addition to other factors (e.g., gas prices, time spent away from home). Indirect effects of increased travel distances or time required to locate and harvest subsistence resources include increased safety risks. Finally, disruption of harvest activities can also disrupt learning and transmission of subsistence skills, which are key components of Alaska Native cultural identity. Harvesting activities, including distribution and processing of harvest products, foster and maintain social ties that are also important to overall wellbeing. Disruption of harvest activities can weaken those social ties by reducing social interactions. In addition, satisfaction that comes from eating traditional foods is also important to overall wellbeing, and disruptions to harvests of resources can affect the ability to consume subsistence foods. Other potential impacts to culture include avoidance of traditional use areas, loss of the integrity of a culturally significant place, and decreased autonomy (i.e., control over traditional lands, tribal government, development activities). Impacts to competition, costs and time, and culture are identified under the abundance, availability, and user access headings where applicable, and summarized in a separate section following the discussions of impacts to resource abundance, resource availability, and user access.

6.3. Impact Indicators

Two primary impact indicators that could be quantitatively measured for the subsistence study communities are 1) Resource Importance (discussed above under Section 4.3) and 2) Subsistence Use Areas. These impact indicators are based on NEPA guidance, which requires consideration of both context and intensity when assessing significant impacts (40 CFR 1508.27). Understanding the relative importance of each subsistence resource (i.e., Resource Importance) and the location of where these uses occur (i.e., Subsistence Use Areas), helps to better analyze the context and intensity of impacts and which subsistence resources and activities are more vulnerable to impacts from the proposed Project.

This analysis assumes that if a project impact were to affect a resource of higher importance, then that effect would be of a greater intensity to a community compared to a similar effect to a resource of lesser importance. The rationale is based on the fact that resources of higher importance have a greater number of subsistence users who participate in the harvests of that resource, share the resource, or for which the resource contributes a higher amount to the overall subsistence diet.

Furthermore, communities whose use areas are located along the project alternative or whose use areas are bisected (e.g., intersecting in or near the middle of the use area) by the proposed Project would likely experience greater impacts versus those communities that are located farther away or only have a small portion of their use areas intersected by the proposed Project. The rationale that the intensity of an impact would be greater when the proposed Project bisects a community's use area (versus on the periphery of a community's use area) is based on an analysis of subsistence use area mapping studies that record the number of harvesters by use area (SRB&A 2013a, 2009b, a, 2007). These studies have shown that areas closest to the communities are generally used by more people than areas located farther from the community. Other studies have termed this use of an intensively used core area as a "central-based use area" pattern in which a core area surrounding the community supports most of the food production with larger, less frequently used subsistence use areas extending beyond the intensively-used core (Wolfe and Fischer 2003). The analysis for this report acknowledges exceptions can occur if the outer edge of a community's use area is close to the community and limited by a regulatory boundary (e.g., community's use along a National Park) or prominent natural feature (e.g., coastline or mountain range).

For the caribou and fish study communities, the focus is less on project overlap and more on the importance of the resource to the study communities, as these study communities have been included to address more indirect or downstream impacts of the community. Therefore, the impact indicators for the caribou and fish study communities are limited to resource mportance.

The goal of this approach to use key impact indicators (i.e., resource importance, subsistence use areas) is to rely on systematically collected quantitative data to reduce subjective impact assessments, to avoid broad generalities in those analyses in the final assessment, and to allow for replication of the findings in both the baseline and impact assessment analyses. This impact analysis is the product of years of SRB&A research and development of systematic, quantitative, and replicable impact assessment methods. Other examples of quantitative data that have been collected in other subsistence studies around the state, and which could be used as impact indicators in order to provide a more specific and focused impact assessment, include travel methods by use area (to inform user access impacts), overlapping subsistence use areas (to inform the number of subsistence users potentially affected and where), and timing of subsistence activities by use areas (to inform likelihood for potential direct impacts at same time and place). However, these data are not available or were not systematically documented in a quantitative method during past studies in the subsistence study communities in order to incorporate them into the impact analysis as impact indicators. Where applicable, they are discussed in qualitative terms.

As discussed in Section 4.1, harvest data and subsistence use areas may not always accurately reflect a community's use areas and harvest amounts. Relying solely on these indicators may overestimate or underestimate potential impacts if, for example, a community uses a portion of the project area not reflected in previously collected subsistence use area data for the community. Indigenous knowledge (IK) can fill in some of these gaps; for this reason, IK is incorporated into the impact discussion where appropriate.

6.4. Road Impacts

6.4.1 Impacts Common to All Alternatives

The following sections describe the potential impacts of the proposed Ambler Road which are common to all alternatives. Table 43 through Table 46 provides impact indicators for the primary study communities and shows the number of communities whose subsistence use areas are crossed by one or more of the project alternatives, by subsistence resource. The table also shows the relative importance of each subsistence resource to each community, in terms of selected measures of material and cultural importance (see Resource Importance sections above). The project alternatives cross subsistence use areas for 16 of the 27 subsistence study communities. Subsistence use areas are most commonly crossed for small land mammals (15 communities), caribou/moose (12 communities each), and non-salmon fish/vegetation (10 communities each) (see Table 46). Most of these resources (moose, caribou, vegetation, and non-salmon fish) are of high importance to a majority of potentially affected communities. In the case of small land mammals, these resources are generally of low to moderate resource importance to the study communities (see Table 43 through Table 45); while trapping and hunting of furbearers and small land mammals remains culturally important, these activities occur among a smaller subset of community harvesters and provide a minimal amount in terms of subsistence foods. The study communities with the highest numbers of resource uses crossed by the proposed project alternatives are Hughes, Kobuk, Shungnak, Allakaket, Ambler, Bettles, and Evansville (eight or more resources each out of 14 resource categories) (see Table 43 through Table 45).

Data on resource importance for the caribou and fish study communities are provided in Table 48 and Table 49. In 27 of the 42 caribou study communities, caribou is a resource of high importance (see Table 48); data were not available for 4 study communities. Communities where caribou is of moderate resource importance based on selected material and cultural indicators include Bettles, Brevig Mission, Hughes, Huslia, and Teller. Communities where caribou is of low resource importance based on selected material and cultural indicators are Galena, Kaltag, Kotlik, Nulato, Stebbins, and Wales. The communities that would be most likely to experience the effects of a decline in caribou abundance or a change in caribou distribution or health are those for whom the resource is of high importance. However, the other communities may still experience impacts if they have traditional uses of the herd or participate in sharing networks with the affected communities.

For fish, most (24 out of 32) fish study communities have a high material and cultural reliance on one or more of the three key species of Chinook salmon, chum salmon, and sheefish (see Table 49). Data are not available for 3 communities, and for the remaining communities (Alkanuk, Bettles, Evansville, Holy Cross, and Kotlik), these resources are of moderate importance. Communities most reliant on sheefish (high resource importance) include those in the Kobuk (Ambler, Kiana, Kobuk, Noorvik) and Yukon (Grayling and Nunam Iqua) river basins. Communities most reliant on Chinook salmon include those in the Yukon River basin (Anvik, Emmonak, Grayling, Kaltag, Marshall, Nulato, Ruby, Russian Mission), and Shungnak in the Kobuk-Selawik River basin. Finally, a large number of communities have a high reliance on chum salmon, including communities in the Kobuk-Selawik, Koyukuk, and Yukon river basins (see Table 49). These communities would be most likely to experience the effects of a decline in fish abundance or a change in fish distribution or health, if impacts extend outside the project area. However, the other communities harvest these resources (albeit at lower levels) and would likely also experience impacts.

Table 43. Use areas crossing project corridor and resource importance, by community, Alternative A

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Alatna	H[a]	M[a]	L[a]	L[a]	I[c]	M[b]	H[c]	H[b]	H[b]	I[c]	H[b]	M[b]	I[c]	H[b]	4
Allakaket	H[a]	H[a]	L[a]	L[a]	L[c]	M[b]	H[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	4
Ambler	M[a]	H[a]	L[b]	L[a]	L[c]	M[a]	H[b]	M[a]	M[b]	L[c]	H[a]	H[a]	L[c]	H[b]	7
Anaktuvuk Pass	M[b]	H[a]	M[b]	L[b]	L[c]	L[a]	H[c]	L[b]	L[b]	I[c]	M[b]	H[b]	I[c]	H[b]	2
Beaver	H[b]	L[b]	I[c]	M[b]	I[c]	H[b]	L[c]	H[b]	M[b]	L[b]	H[b]	M[b]	I[c]	H[b]	0
Bettles	H[a]	M[a]	L[a]	L[b]	I[c]	M[a]	I[c]	L[b]	L[a]	I[c]	M[a]	H[a]	I[c]	H[a]	8
Buckland	M[b]	H[b]	I[c]	L[b]	M[c]	L[b]	H[b]	M[b]	I[c]	M[b]	H[b]	H[b]	L[b]	H[b]	0
Coldfoot	L[a]	H[b]	I[b]	I[b]	I[c]	I[a]	I[c]	I[a]	L[a]	I[a]	L[b]	I[b]	I[c]	H[a]	6
Evansville	H[a]	H[a]	M[a]	L[b]	I[c]	L[a]	L[c]	L[a]	M[a]	I[c]	H[b]	H[a]	L[b]	H[a]	8
Galena	H[b]	L[c]	I[c]	L[c]	L[c]	M[b]	L[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	0
Hughes	H[b]	M[b]	I[a]	L[b]	I[c]	M[b]	M[c]	M[b]	M[b]	I[c]	H[b]	H[b]	I[c]	H[b]	1
Huslia	H[b]	M[b]	I[b]	L[b]	I[c]	M[b]	I[c]	M[b]	L[b]	I[c]	H[b]	H[b]	I[c]	L[b]	0
Kiana	M[b]	H[c]	L[b]	I[b]	I[c]	L[b]	M[b]	M[b]	L[c]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Kobuk	M[a]	H[a]	I[b]	L[a]	I[c]	L[a]	H[b]	M[a]	M[b]	I[c]	H[b]	H[b]	I[c]	H[a]	6
Kotzebue	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[b]	H[b]	0
Livengood	I[c]	I[c]	I[c]	I[b]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	0
Manley Hot Springs	M[b]	L[c]	I[c]	L[b]	I[c]	L[b]	I[c]	L[b]	M[b]	L[c]	H[b]	M[b]	L[c]	H[c]	0
Minto	H[b]	L[b]	L[c]	L[b]	I[c]	M[b]	I[c]	H[b]	M[b]	L[b]	H[b]	M[b]	L[c]	H[b]	0
Nenana	H[b]	L[b]	L[b]	I[b]	I[c]	L[b]	I[c]	I[b]	H[b]	I[b]	H[b]	H[b]	I[b]	I[c]	0
Noatak	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	L[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Noorvik	M[b]	H[b]	L[b]	L[b]	L[c]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Rampart	H[b]	L[b]	I[c]	I[b]	I[c]	M[b]	M[c]	M[b]	L[b]	I[c]	H[b]	H[b]	I[c]	H[b]	0
Selawik	M[b]	H[a]	I[c]	L[b]	I[c]	L[b]	H[b]	M[b]	M[b]	L[b]	M[b]	H[b]	L[c]	H[b]	1
Shungnak	M[a]	H[a]	L[a]	L[a]	I[c]	M[a]	H[b]	H[a]	L[b]	L[c]	H[a]	H[b]	L[c]	H[a]	8

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Stevens Village	H[b]	L[c]	I[c]	L[b]	I[c]	M[b]	M[c]	H[b]	L[b]	I[c]	H[b]	M[b]	I[c]	H[b]	0
Tanana	H[b]	L[b]	I[c]	L[b]	I[c]	H[b]	I[c]	M[b]	H[b]	I[b]	H[b]	M[b]	I[b]	H[b]	0
Wiseman	H[a]	H[c]	H[b]	I[b]	L[c]	M[a]	I[c]	M[a]	H[a]	I[a]	H[b]	H[b]	I[c]	H[a]	6

Source: see Map 2 through Map 27; Table 2

Notes: DS = Dall sheep; H = Resource of high importance; I = Resource of indeterminate importance (no community harvest data); L = Resource of low importance; LLM = Large land mammal; M = Resource of moderate importance; MB = Migratory bird; MM = Marine mammal; MI = Marine invertebrates; NSF = Non-salmon fish; SML = Small land mammal; UGB = Upland game bird; V = vegetation

[a]Project Crosses Community Subsistence Use Area Data.

[b]Project Does Not Cross Community Subsistence Use Area Data

[c]No community subsistence use area defined, so project impact or lack of impact cannot be determined.

Table 44. Use areas crossing project corridor and resource importance, by community, Alternative B

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Alatna	H[a]	M[a]	L[a]	L[a]	I[c]	M[a]	H[c]	H[b]	H[b]	I[c]	H[b]	M[b]	I[c]	H[b]	5
Allakaket	H[a]	H[a]	L[a]	L[a]	L[c]	M[b]	H[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	4
Ambler	M[a]	H[a]	L[b]	L[a]	L[c]	M[a]	H[b]	M[b]	M[b]	L[c]	H[a]	H[a]	L[c]	H[a]	7
Anaktuvuk Pass	M[b]	H[a]	M[b]	L[b]	L[c]	L[a]	H[c]	L[b]	L[b]	I[c]	M[b]	H[b]	I[c]	H[b]	2
Beaver	H[b]	L[b]	I[c]	M[b]	I[c]	H[b]	L[c]	H[b]	M[b]	L[b]	H[b]	M[b]	I[c]	H[b]	0
Bettles	H[a]	M[a]	L[a]	L[b]	I[c]	M[a]	I[c]	L[b]	L[a]	I[c]	M[a]	H[a]	I[c]	H[a]	8
Buckland	M[b]	H[b]	I[c]	L[b]	M[c]	L[b]	H[b]	M[b]	I[c]	M[b]	H[b]	H[b]	L[b]	H[b]	0
Coldfoot	L[a]	H[b]	I[b]	I[b]	I[c]	I[a]	I[c]	I[a]	L[a]	I[a]	L[b]	I[b]	I[c]	H[a]	6
Evansville	H[a]	H[a]	M[a]	L[b]	I[c]	L[a]	L[c]	L[a]	M[a]	I[c]	H[b]	H[a]	L[b]	H[a]	8
Galena	H[b]	L[c]	I[c]	L[c]	L[c]	M[b]	L[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	0
Hughes	H[b]	M[b]	I[a]	L[b]	I[c]	M[b]	M[c]	M[b]	M[b]	I[c]	H[b]	H[b]	I[c]	H[b]	1
Huslia	H[b]	M[b]	I[b]	L[b]	I[c]	M[b]	I[c]	M[b]	L[b]	I[c]	H[b]	H[b]	I[c]	L[b]	0
Kiana	M[b]	H[b]	L[b]	I[b]	I[c]	L[b]	M[b]	M[b]	L[c]	L[b]	H[b]	H[b]	L[c]	H[b]	0

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Kobuk	M[a]	H[a]	I[b]	L[a]	I[c]	L[a]	H[b]	M[a]	M[b]	I[c]	H[b]	H[b]	I[c]	H[a]	6
Kotzebue	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[b]	H[b]	0
Livengood	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	0
Manley Hot Springs	M[b]	L[c]	I[c]	L[b]	I[c]	L[b]	I[c]	L[b]	M[b]	L[c]	H[b]	M[b]	L[c]	H[b]	0
Minto	H[b]	L[b]	L[c]	L[b]	I[c]	M[b]	I[c]	H[b]	M[b]	L[b]	H[b]	M[b]	L[c]	H[b]	0
Nenana	H[b]	L[b]	L[b]	I[b]	I[c]	L[b]	I[c]	I[b]	H[b]	I[b]	H[b]	H[b]	I[b]	I[b]	0
Noatak	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	L[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Noorvik	M[b]	H[b]	L[b]	L[b]	L[c]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Rampart	H[b]	L[b]	I[c]	I[b]	I[c]	M[b]	M[c]	M[b]	L[b]	I[c]	H[b]	H[b]	I[c]	H[b]	0
Selawik	M[b]	H[a]	I[c]	L[b]	I[c]	L[b]	H[b]	M[b]	M[b]	L[b]	M[b]	H[b]	L[c]	H[b]	1
Shungnak	M[a]	H[a]	L[a]	L[a]	I[c]	M[a]	H[b]	H[a]	L[b]	L[c]	H[a]	H[b]	L[c]	H[a]	8
Stevens Village	H[b]	L[c]	I[c]	L[b]	I[c]	M[b]	M[c]	H[b]	L[b]	I[c]	H[b]	M[b]	I[c]	H[b]	0
Tanana	H[b]	L[b]	I[c]	L[b]	I[c]	H[b]	I[c]	M[b]	H[b]	I[b]	H[b]	M[b]	I[b]	H[b]	0
Wiseman	H[a]	H[b]	H[b]	I[b]	L[c]	M[a]	I[c]	M[a]	H[a]	I[a]	H[b]	H[b]	I[c]	H[a]	6

Source: see Map 2 through Map 27; Table 2

Notes: DS = Dall sheep; H = Resource of high importance; I = Resource of indeterminate importance (no community harvest data); L = Resource of low importance; LLM = Large land mammal; M = Resource of moderate importance; MB = Migratory bird; MM = Marine mammal; MI = Marine invertebrates; NSF = Non-salmon fish; SML = Small land mammal; UGB = Upland game bird; V = vegetation

[a]Project Crosses Community Subsistence Use Area Data.

[b]Project Does Not Cross Community Subsistence Use Area Data

[c]No community subsistence use area defined, so project impact or lack of impact cannot be determined.

Table 45. Use areas crossing project corridor and resource importance, by community, Alternative C

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Alatna	H[a]	M[a]	L[b]	L[a]	I[c]	M[a]	H[c]	H[b]	H[b]	I[c]	H[b]	M[a]	I[c]	H[b]	5

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Allakaket	H[a]	H[a]	L[a]	L[a]	L[c]	M[a]	H[c]	M[a]	M[a]	I[c]	H[b]	H[a]	L[c]	H[a]	9
Ambler	M[a]	H[a]	L[b]	L[a]	L[c]	M[a]	H[b]	M[a]	M	L[c]	H[a]	H[a]	L[c]	H[a]	8
Anaktuvuk Pass	M[b]	H[a]	M[b]	L[b]	L[c]	L[a]	H[c]	L[b]	L[b]	I[c]	M[b]	H[b]	I[c]	H[b]	2
Beaver	H[b]	L[b]	I[c]	M[b]	I[c]	H[b]	L[b]	H[b]	M[b]	L[b]	H[b]	M[b]	I[c]	H[b]	0
Bettles	H[b]	M[b]	L[b]	L[b]	I[c]	M[b]	I[c]	L[b]	L[b]	I[c]	M[b]	H[b]	I[c]	H[b]	0
Buckland	M[b]	H[b]	I[c]	L[b]	M[c]	L[b]	H[b]	M[b]	I[c]	M[b]	H[b]	H[b]	L[b]	H[b]	0
Coldfoot	L[b]	H[b]	I[b]	I[b]	I[c]	I[b]	I[c]	I[b]	L[b]	I[b]	L[b]	I[b]	I[c]	H[b]	0
Evansville	H[b]	H[b]	M[b]	L[b]	I[c]	L[b]	L[c]	L[b]	M[b]	I[c]	H[b]	H[b]	L[b]	H[b]	0
Galena	H[b]	L[c]	I[c]	L[c]	L[c]	M[b]	L[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	0
Hughes	H[a]	M[a]	I[a]	L[a]	I[c]	M[a]	M[b]	M[a]	M[b]	I[c]	H[a]	H[a]	I[c]	H[a]	9
Huslia	H[b]	M[a]	I[b]	L[b]	I[c]	M[a]	I[c]	M[b]	L[b]	I[c]	H[a]	H[b]	I[c]	L[b]	3
Kiana	M[b]	H[b]	L[b]	I[b]	I[c]	L[b]	M[b]	M[b]	L[c]	L[b]	H[b]	H[a]	L[c]	H[b]	1
Kobuk	M[a]	H[a]	I[b]	L[a]	I[c]	L[a]	H[b]	M[a]	M[a]	I[c]	H[a]	H[a]	I[c]	H[a]	9
Kotzebue	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[b]	H[b]	0
Livengood	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	0
Manley Hot Springs	M[b]	L[c]	I[c]	L[b]	I[c]	L[b]	I[c]	L[b]	M[b]	L[c]	H[b]	M[b]	L[c]	H[b]	0
Minto	H[b]	L[b]	L[c]	L[b]	I[c]	M[b]	I[c]	H[b]	M[b]	L[b]	H[b]	M[b]	L[c]	H[b]	0
Nenana	H[b]	L[b]	L[b]	I[b]	I[c]	L[b]	I[c]	I[b]	H[b]	I[b]	H[b]	H[b]	I[b]	I[b]	0
Noatak	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	L[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Noorvik	M[b]	H[b]	L[b]	L[b]	L[c]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Rampart	H[b]	L[b]	I[c]	I[b]	I[c]	M[b]	M[c]	M[b]	L[b]	I[c]	H[b]	H[b]	I[c]	H[b]	0
Selawik	M[b]	H[a]	I[c]	L[b]	I[c]	L[a]	H[b]	M[b]	M[b]	L[b]	M[b]	H[b]	L[c]	H[b]	2
Shungnak	M[a]	H[a]	L[a]	L[a]	I[c]	M[a]	H[b]	H[a]	L[b]	L[c]	H[a]	H[a]	L[c]	H[a]	9
Stevens Village	H[a]	L[c]	I[c]	L[a]	I[c]	M[a]	M[c]	H[a]	L[a]	I[c]	H[b]	M[a]	I[c]	H[a]	7
Tanana	H[a]	L[a]	I[c]	L[a]	I[c]	H[a]	I[c]	M[b]	H[b]	I[b]	H[b]	M[b]	I[b]	H[b]	4

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Wiseman	H[b]	H[b]	H[b]	I[b]	L[c]	M[b]	I[c]	M[b]	H[b]	I[b]	H[b]	H[b]	I[c]	H[b]	0

Source: see Map 2 through Map 27; Table 2

Notes: DS = Dall sheep; H = Resource of high importance; I = Resource of indeterminate importance (no community harvest data); L = Resource of low importance; LLM = Large land mammal; M = Resource of moderate importance; MB = Migratory bird; MM = Marine mammal; MI = Marine invertebrates; NSF = Non-salmon fish; SML = Small land mammal; UGB = Upland game bird; V = vegetation

[a]Project Crosses Community Subsistence Use Area Data.

[b]Project Does Not Cross Community Subsistence Use Area Data

[c]No community subsistence use area defined, so project impact or lack of impact cannot be determined.

Table 46. Use areas crossing project corridor and resource importance, by community, any alternative

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Alatna	H[a]	M[a]	L[a]	L[a]	I[c]	M[a]	H[c]	H[b]	H[c]	I[c]	H[b]	M[a]	I[c]	H[b]	6
Allakaket	H[a]	H[a]	L[b]	L[a]	L[c]	M[a]	H[c]	M[a]	M[a]	I[c]	H[b]	H[a]	L[c]	H[a]	9
Ambler	M[a]	H[a]	L[b]	L[a]	L[c]	M[a]	H[b]	M[a]	M[b]	L[c]	H[a]	H[a]	L[c]	H[a]	8
Anaktuvuk Pass	M[b]	H[a]	M[b]	L[b]	L[c]	L[a]	H[b]	L[b]	L[b]	I[c]	M[b]	H[b]	I[c]	H[b]	2
Beaver	H[b]	L[b]	I[c]	M[b]	I[c]	H[b]	L[c]	H[b]	M[b]	L[b]	H[b]	M[b]	I[c]	H[b]	0
Bettles	H[a]	M[a]	L[a]	L[b]	I[c]	M[a]	I[c]	L[b]	L[a]	I[c]	M[a]	H[a]	I[c]	H[a]	8
Buckland	M[b]	H[b]	I[c]	L[b]	M[a]	L[b]	H[b]	M[b]	I[c]	M[b]	H[b]	H[b]	L[b]	H[b]	0
Coldfoot	L[a]	H[b]	I[b]	I[b]	I[c]	I[a]	I[c]	I[a]	L[a]	I[a]	L[b]	I[b]	I[c]	H[a]	6
Evansville	H[a]	H[a]	M[a]	L[b]	I[c]	L[a]	L[b]	L[a]	M[a]	I[c]	H[b]	H[a]	L[b]	H[a]	8
Galena	H[b]	L[c]	I[c]	L[c]	L[c]	M[b]	L[c]	M[b]	M[b]	I[c]	H[b]	H[b]	L[c]	H[b]	0
Hughes	H[a]	M[a]	I[a]	L[a]	I[c]	M[a]	M	M[a]	M[b]	I[c]	H[a]	H[a]	I[c]	H[a]	9
Huslia	H[b]	M[a]	I[b]	L[b]	I[c]	M[a]	I[c]	M[b]	L[b]	I[c]	H[a]	H[b]	I[c]	L[b]	3
Kiana	M[b]	H[b]	L[b]	I[b]	I[c]	L[b]	M[b]	M[b]	L[c]	L[b]	H[b]	H[a]	L[c]	H[b]	1
Kobuk	M[a]	H[a]	I[b]	L[a]	I[c]	L[a]	H[b]	M[a]	M[a]	I[c]	H[a]	H[a]	I[c]	H[a]	9
Kotzebue	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[b]	H[b]	0

Study community	Moose	Caribou	DS	Bear	Other LLM	SLM	MM	MB	UGB	Eggs	Salmon	NSF	MI	V	Number of known resource use areas crossed
Livengood	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	I[c]	0
Manley Hot Springs	M[b]	L[c]	I[c]	L[b]	I[c]	L[b]	I[c]	L[b]	M[b]	L[c]	H[b]	M[b]	L[c]	H[b]	0
Minto	H[b]	L[b]	L	L[b]	I[c]	M[b]	I[c]	H[b]	M[b]	L[b]	H[b]	M[b]	L[c]	H[b]	0
Nenana	H[b]	L[b]	L[b]	I[b]	I[c]	L[b]	I[c]	I[b]	H[b]	I[b]	H[b]	H[b]	I[b]	I[b]	0
Noatak	M[b]	H[b]	L[b]	L[b]	L[b]	L[b]	H[b]	M[b]	L[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Noorvik	M[b]	H[b]	L[b]	L[b]	L[c]	L[b]	H[b]	M[b]	M[b]	L[b]	H[b]	H[b]	L[c]	H[b]	0
Rampart	H[b]	L[b]	I[c]	I[b]	I[c]	M[b]	M	M[b]	L[c]	I[c]	H[b]	H[b]	I[c]	H[b]	0
Selawik	M[b]	H[a]	I[c]	L[b]	I[c]	L[a]	H[b]	M[b]	M[c]	L[c]	M[b]	H[b]	L[c]	H[b]	2
Shungnak	M[a]	H[a]	L[a]	L[a]	I[c]	M[a]	H[b]	H[a]	L[b]	L[c]	H[a]	H[a]	L[c]	H[a]	9
Stevens Village	H[a]	L	I[c]	L[a]	I[c]	M[a]	M	H[a]	L[a]	I[c]	H[b]	M[a]	I[c]	H[a]	7
Tanana	H[a]	L[a]	I[c]	L[b]	I[c]	H[a]	I[c]	M[b]	H[b]	I[b]	H[b]	M[b]	I[b]	H[b]	3
Wiseman	H[a]	H[b]	H[b]	I[b]	L[c]	M[a]	I[c]	M[a]	H[a]	I[a]	H[b]	H[b]	I[c]	H[a]	6

Source: see Map 2 through Map 27; Table 2

Notes: DS = Dall sheep; H = Resource of high importance; I = Resource of indeterminate importance (no community harvest data); L = Resource of low importance; LLM = Large land mammal; M = Resource of moderate importance; MB = Migratory bird; MM = Marine mammal; MI = Marine invertebrates; NSF = Non-salmon fish; SML = Small land mammal; UGB = Upland game bird; V = vegetation

[a]Project Crosses Community Subsistence Use Area Data.

[b]Project Does Not Cross Community Subsistence Use Area Data

[c]No community subsistence use area defined, so project impact or lack of impact cannot be determined.

Table 47. Number of communities with use areas crossing the project, by alternative and resource

Resource	Number of communities crossing Alternative A	Number of communities crossing Alternative B	Number of communities crossing Alternative C	Number of communities crossing any Alternative	Affecting greatest number of communities
Moose	9	9	8	12	A/B
Caribou	9	9	10	12	C
Dall sheep	6	6	3	6	A/B
Bear	5	5	7	7	C
Other large land mammals	0	0	0	0	N/A

Resource	Number of communities crossing Alternative A	Number of communities crossing Alternative B	Number of communities crossing Alternative C	Number of communities crossing any Alternative	Affecting greatest number of communities
Small land mammals	8	9	11	15	C
Marine mammals	0	0	0	0	N/A
Migratory birds	6	5	6	9	A/C
Upland game birds	4	4	3	7	A/B
Eggs	2	2	0	2	A/B
Salmon	3	3	5	6	C
Non-salmon fish	3	3	8	10	C
Marine invertebrates	0	0	0	0	N/A
Vegetation	6	7	6	10	B
Total Number of Communities Crossed	**12**	**12**	**12**	**16**	**N/A**

Source: see Map 2 through Map 27; Table 2

Notes: A = Alternative A; B = Alternative B; C = Alternative C; N/A = Not applicable; No. = Number

Table 48. Resource Importance of caribou, caribou study communities

Study community	Resource importance
Allakaket	H
Ambler	H
Anaktuvuk Pass	H
Atqasuk	H
Buckland	H
Deering	H
Elim	H
Golovin	H
Kiana	H
Kivalina	H
Kobuk	H
Kotzebue	H
Koyuk	H
Noatak	H
Noorvik	H
Nuiqsut	H
Point Hope	H
Point Lay	H
Selawik	H
Shishmaref	H
Shungnak	H
St. Michael	H
Unalakleet	H
Utqiagvik	H
Wainwright	H
White Mountain	H
Wiseman	H
Bettles	M
Brevig Mission	M
Hughes	M
Huslia	M
Teller	M
Galena	L
Kaltag	L
Kotlik	L
Nulato	L
Stebbins	L
Wales	L

Study community	Resource importance
Fairbanks	No Data
Koyukuk	No Data
Nome	No Data
Shaktoolik	No Data

Notes: H = Resource of High Importance; M = Resource of Moderate Importance; L = Resource of Low Importance

Table 49. Resource importance of chum salmon, Chinook salmon, and sheefish, fish study communities

Study community	Chinook salmon	Chum salmon	Sheefish	All
Alatna	M	H	M	H
Allakaket	M	H	M	H
Ambler	L	H	H	H
Anvik	H	M	M	H
Emmonak	H	H	M	H
Galena	M	H	M	H
Grayling	H	M	H	H
Hughes	M	H	M	H
Huslia	M	H	M	H
Kaltag	H	M	M	H
Kiana	L	H	H	H
Kobuk	L	H	H	H
Kotzebue	L	H	M	H
Marshall	H	H	M	H
Mountain Village	M	H	M	H
Noorvik	L	H	H	H
Nulato	H	M	M	H
Nunam Iqua	M	H	H	H
Pilot Station	M	H	M	H
Rampart	L	H	L	H
Ruby	H	H	L	H
Russian Mission	H	M	M	H
Shungnak	H	H	L	H
Tanana	M	H	M	H
Alakanuk	M	M	M	M
Bettles	L	M	M	M
Evansville	M	M	M	M
Holy Cross	M	M	M	M
Kotlik	M	M	M	M
Koyukuk	No Data			

Study community	Chinook salmon	Chum salmon	Sheefish	All
Pitka's Point	No Data			
St. Mary's	No Data			

Notes: H = Resource of High Importance; M = Resource of Moderate Importance; L = Resource of Low Importance

During scoping, tribal, village, and corporation entities as well as Alaska Native resource co-management entities expressed concerns regarding potential road impacts. Based on the traditional knowledge of the individuals living in the Project area, the scoping meeting participants described potential impacts to resource abundance, resource availability, and user access as well as compounded impacts resulting from changes to resource abundance and availability and user access. The traditional knowledge observations and concerns are discussed below under the various impact headings.

Resource Abundance

Construction

Whereas many large-scale projects in Alaska have distinct construction and operation phases, the AMDIAR will undergo several periods of construction (lasting approximately two years each) interspersed with longer periods of operation/exploration. Construction impacts will be greatest during Phase 1 when the majority of construction (e.g., culvert and bridge installation, primary placement of gravel) will occur. Construction activities which could affect resource abundance through removal or disturbance of habitat include blasting/mining, operation of construction equipment, excavation, placement of gravel, placement of ice roads and ice pads during initial road construction, construction noise, human presence, water withdrawal, installation of bridges and culverts, and air and ground traffic. Construction activities may also cause direct mortality to individual animals, including caribou, moose, fish, and waterfowl through vehicle and aircraft collisions, pile driving, and blasting.

The AMDIAR could cause direct mortality to caribou resulting from construction vehicle strikes, particularly if the caribou use the road as a movement corridor or insect relief area. Individual caribou may become ill through ingestion of chemicals used during construction or mining. Fish may experience direct mortality through driving of bridge pile, and certain activities such as pile driving, construction sedimentation, and stream diversions, may alter or degrade fish habitat thereby reducing egg survival downstream. Road construction and operation can contribute to thawing of permafrost which could cause thaw slumps along river and stream banks. Slumping could increase sedimentation, degrade water quality, and affect fish spawning habitat (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). Overall, increased sedimentation from construction activities, particularly in spawning grounds, can smother eggs, alter feeding habitat, and decrease fish production. Water withdrawal may kill individual fish but would likely not have population-level effects.

During the scoping period, the traditional knowledge provided by the Native Village of Kotzebue indicated that silt and contaminants as well as changes to water flows in the Kobuk River region watersheds may lead to decreased health and abundance of sheefish, salmon, whitefish, and Dolly Varden char populations. The Native Village commented that these resources are essential to the livelihood of the community of Kotzebue, particularly due to the fact that they are inexpensive to harvest and are available throughout the year:

> Healthy and abundant sheefish and salmon require pristine watersheds free from silt and contaminants, in addition to sufficient water flows and unfettered access to the most remote parts of the Kobuk River for their annual spawning runs. Salmon are critical to our members, representing a major source of income and subsistence resources necessary for their continued quality of life and livelihood. Sheefish are a major part of the annual

> cycle of subsistence for our members as they are commonly harvested near Kotzebue for the majority of the year. They somewhat uniquely represent an egalitarian resource, in that they are easily harvested for much of the year by the entire community because of their proximity and without requiring scarce, or expensive, methods and means. Whitefish that feed in the summer in coastal lagoons of Kotzebue Sound and continue to be harvested as a treasured food by our members, also use the Kobuk River and its tributaries for spawning and overwintering purposes, as do Dolly Varden char. (Native Village of Kotzebue 2018)

Waterfowl nesting and feeding near the road corridor or gravel sites may also experience direct habitat loss or may ingest chemicals associated with construction activities and dust deposition. Some individual mortalities of waterfowl would likely occur as a result of increased air traffic in the region. Direct loss of vegetation resulting from gravel mining, gravel placement, and fugitive dust would cause decreased abundance of vegetation (e.g., berries, wild greens) along the road corridor. In addition, clearing and grading along the road ROW could cause an increase in wildlife mortality (e.g., destruction of dens, clearing of habitat), particularly for resources such as small land mammals.

Operation

Operation activities which could affect resource abundance include the presence of roads and bridges (e.g., habitat fragmentation), the presence of other infrastructure such as communications towers and culverts, fuel or other contaminant spills, dust deposition, road and air traffic, and human activity. The presence of the road in addition to related culverts, bridges, and gravel infrastructure would alter and degrade fish habitat both upstream and downstream from the road, which could affect fish abundance for subsistence users in certain waterways crossed by the road corridor. Increased thawing of permafrost along the road could result in slumping along riverbanks which could also degrade water quality and affect fish abundance. It is not possible to predict the location and magnitude of such changes, although key sheefish spawning areas in the Kobuk River drainage and whitefish spawning in the Alatna River may be particularly vulnerable to population-level impacts.

Habitat fragmentation resulting from sustained disturbances could result in decreased abundance of certain resources over time. In the case of caribou, other Alaskan herds such as the Central Arctic Herd have maintained habitat connectivity and general migration patterns despite being intersected by highways and roads. Fragmentation of the WAH and RMH range resulting from a road may be more pronounced because the WAH and RMH ranges have less development and therefore have had less opportunity to habituate to human activity. The likelihood of longer term impacts on resource abundance vary by resource and are discussed below under the individual alternatives, under Indirect and Cumulative Impacts, and in individual biological resources discussions.

As with construction, some direct mortalities may occur as a result of collisions with vehicles, aircraft, or infrastructure during operations, particularly if animals such as moose are attracted to the road ROW as a movement corridor. Ingestion of contaminated water or vegetation as a result of spills could also cause illness in individual animals; larger spills into waterways would have larger effects on fish abundance, particularly in spawning streams.

Concerns about potential contamination of sheefish and chum salmon spawning grounds have already been voiced in the study communities (Watson 2014). The Kobuk River supports the largest population of spawning sheefish in Alaska, and the Alatna River is the only spawning habitat for sheefish in the upper Koyukuk River drainage. In addition, sheefish spawning grounds are particularly sensitive to changes in water velocity, temperature, pH, and other factors. Salmon spawning habitat is also vulnerable in changes to water chemistry. A member of the Western Interior Regional Advisory Council provided the following observations about water quality, salmon spawning, and the importance of smaller clearwater tributaries:

> All my life I never did catch a fish in the silt water at all. So it's something to think about. I hope they think about it because you come in here and older Natives that are alive right now they always say they don't know what they're talking about. For them to be 70, 80 years, they know what they're talking about. They never did catch a salmon in those silt water places. It's all flats, so there's no drainages that run up into the mountains. Once you start going into elevation, that's where you're going to find your salmon. *(Western Interior Federal Subsistence Regional Advisory Council 2022b)*

Changes to natural water chemistry resulting from exposure of geologic materials could affect egg survival and fish populations, having far-reaching effects on downstream subsistence users of whitefish and salmon. As discussed in Section 5.7, Downstream Subsistence Uses of Fish, Chinook and salmon returns have declined in recent years, increasing the reliance of some communities on harvests of non-salmon fish (e.g., sheefish). Thus, the study communities would be particularly vulnerable to additional changes in salmon and non-salmon fish abundance. Impacts related to changes in Chinook salmon abundance would be most likely among Yukon River study communities, while impacts related to changes in sheefish abundance would be most likely among Kobuk River communities. Chum salmon impacts would affect communities in all three river basins (Kobuk-Seward, Koyukuk, and Yukon) (see Table 22). Over time, fugitive dust along road corridors may increase the affected area of vegetation which could in turn affect caribou, waterfowl, and other animals feeding in the vicinity of the road but would likely not result in population-level effects. Of particular concern to caribou are declines in lichen cover along gravel roads as a result of dust deposition. Illegal use of the road by hunters may result in increased mortality of moose and caribou along the road corridor, although likely not to the level of reducing overall population numbers.

Ingestion of contaminated water or vegetation as a result of spills could also cause illness in individual animals. Mines would use the road to transport fuel and other chemicals and toxic materials. Key sheefish, whitefish, and salmon spawning streams crossed by the proposed road corridors and therefore vulnerable to spills and other contamination include the Kobuk River, Alatna River Henshaw Creek, South Fork Koyukuk River, and Hogatza River. Larger spills into waterways would have larger effects on fish habitat and abundance, particularly if spills occur in sheefish, whitefish, or salmon spawning streams, and could have population-level effects. A large-scale spill could result in reduced harvests of aquatic resources in addition to marine resources, including marine mammals, farther downstream from the proposed road and mines, as a result of local harvester concerns about contamination. In addition to spills, leaching of acid rock into waterways would affect aquatic habitat quality for sheefish, whitefish, Chinook and chum salmon, and other aquatic resources. Small changes in water quality could have substantial impacts on fish populations.

Resource Availability

Many of the subsistence study communities have high unemployment rates, incomes below the poverty line, and high food insecurity (Guettabi, Greenberg, Little, and Joly 2016). Despite these factors, community populations are stable. Subsistence activities and harvests are a key component in maintaining residents' ability to remain in their communities (Guettabi et al. 2016). Because of the importance of subsistence to maintaining the stability of the mixed economy and resilience of the study communities, these communities are also particularly vulnerable to impacts on subsistence harvests and subsistence resource availability. Furthermore, many of the subsistence study communities do not currently have road access and have majority Alaska Native populations which have specific cultural, social, and spiritual identities and needs that are inextricably linked to subsistence, which adds to their vulnerability associated with change introduced through an industrial road. These communities would be most vulnerable to potential impacts subsistence resource availability resulting from the project.

The Ambler Access Project Subsistence Advisory Committee (SAC) has identified several resources of particular concern to subsistence, including caribou, moose, salmon, and sheefish. SAC members have noted declines in the availability some of these resources in recent years, including caribou, moose, and salmon (AIDEA 2022, 2023).

Harvest amounts are dependent on the availability and abundance of subsistence resources within a community's subsistence land use area and are not necessarily reflective of a community's dependence on or preference for a given resource. In prehistoric times, when the Athabascans and Iñupiat of the area lived semi-nomadic lifestyles, the response to a decline in resource availability may be to move to a more suitable location. With today's communities established in permanent locations, relocating to a more productive area, at least on a permanent or semi-permanent basis, is not an option for most individuals. Thus, today, communities adapt to the availability of resources within their subsistence use areas, and when one resource declines or is not available when harvesters can access them, residents may increase their harvest of a different resource in response. One example of this is the declining harvests of caribou within the Upper Koyukuk Region and corresponding increase in moose harvests starting in the late twentieth century. This shift in harvests was in response to changes in the distribution of caribou away from traditional land use areas, and the gradual appearance of moose within those areas. Another recent example is the decline in salmon runs in recent years, and the corresponding increase in harvests of other fish species. As the Alatna First Chief observed, "With the current salmon situation we have to start relying more and more on the local fishes" (Alatna Tribal Council 2022). Other recent trends within the region observed by local residents and wildlife biologists include declining chum salmon and Chinook salmon runs; changes in the distribution of the WAH and reduced availability for certain communities; and recent declines in the availability of moose in the Upper Koyukuk region, with increased availability in the Kobuk River region (Watson 2019). A decline in multiple resources at once would reduce a community's ability to adapt to these changes and to find suitable substitutions for the declining harvests.

Construction

Construction activities that may affect resource availability for subsistence users include excavation, blasting, mining, ROW clearing, gravel placement, construction of ice roads, and pads, operation of construction equipment, general construction noise, human activity, vehicle and air traffic, sedimentation from construction activity, and fuel or other contaminant spills. Infrastructure such as the pioneer road, ice roads, material sites, culverts, and bridge piles may also pose as physical obstructions for terrestrial mammals and fish. The 16 communities who have use areas overlapped by the project alternatives would experience direct impacts to resource availability; larger impacts to resource behavior, migration, or distribution could result in indirect impacts to resource availability for all 27 subsistence study communities, the 42 caribou study communities, and the 32 fish study communities.

In the short term, blasting may displace or divert resources such as large land mammals, small land mammals, and waterfowl, due to the noise associated with such activities (Section 3.2.6). Blasting also destroys vegetation and surrounding habitat for resources such as caribou, moose, and waterfowl. Clearing of trees and brush for the ROW and stripping of topsoil and organic material may alter or degrade resource habitat, particularly for herbivores that depend on surface vegetation or for fish in streams or rivers affected by erosion and sedimentation. In addition, these activities would remove berry, wild plant, and wood harvesting areas for study communities along the road corridor. Habitat alteration can affect resource distribution, thereby reducing the availability of those resources to subsistence users in traditional hunting or harvesting areas.

Construction of the action alternatives would result in direct habitat loss for WAH caribou. A reduction in lichen-dominated vegetation would have greater impacts to the WAH, as lichen is a particularly important food source to the WAH. One member of the Northwest Arctic Regional Advisory Council (2023) noted how forage availability has long-term effects on caribou migration:

> They can't migrate in the same area years and years because they eat up all that food and it takes so long for the lichen to grow that the caribou won't come to there.

The action alternatives would result in removal of habitat in the winter, migratory, and perlipheral ranges of the WAH. Loss of winter habitat would be particularly detrimental to the WAH, as winter foraging can be limited (see Section 3.3.4, Mammals, of the Supplemental EIS). A member of the Northwest Arctic Regional Advisory Council noted that in recent years climate change has made winter foraging even more difficult for the caribou herds:

> This climate change in the past maybe five, six years and knowing the caribou and stuff, after it snows in November we usually get rain and when it snows, that rain it'll freeze on top of the tundra and the caribou are having hard time feeding so – and we lose a lot of caribou due to starvation due to this climate change, so people out there need to be aware of that because a lot of people will wonder why are we losing so much caribou. So this climate change did lots of damage on our subsistence take on caribou… And the people should know that it affects the herd. *(Northwest Arctic Regional Advisory Council 2022)*

If loss of foraging lands results in the WAH changing their distribution in search of more suitable habitat, then local communities could experience reduced hunting success or have to travel farther to locate caribou.

Resource movement, particularly for migratory animals such as caribou, may be diverted due to increased human and material presence, air and ground traffic, noise, and/or contamination and dust from construction activities (see detailed discussion below, under "Caribou"). This general disturbance of wildlife could result in subsistence resources being unavailable at the time and place that subsistence users are accustomed to finding them.

Noise from construction equipment, gravel placement, blasting, mining, vehicle traffic, aircraft and helicopters, and human activity, would likely displace or divert certain resources (Section 3.2.6). Traffic itself causes a physical barrier for migratory animals, particularly caribou, and can also displace or divert resources when herds are separated (Vistnes and Nellemann 2007). Some animals, such as certain species of small land mammals and caribou, can become habituated to certain development activities over time; however, this habituation can result in changes to resource distribution and may also cause increased mortalities due to vehicle strikes. During the construction years, estimated air traffic volumes are 5 to 9 fixed wing aircraft trips each week, and one helicopter trip per week. Ground traffic would increase over the three phases of the AMDIAR but would be less during the construction phases.

Potential effects of construction activities on resource availability also include contamination resulting from fuel and other chemical spills, dust deposition, sedimentation due to erosion along river and stream banks, and increased emissions. Construction activity may lead to concerns by local residents about contamination of subsistence resources, particularly plants and berries, which are of high importance to nearly all potentially affected communities (see Resource Importance sections) and which could be directly affected by fugitive dust along the road corridors. This concern would be especially elevated in areas where naturally occurring asbestos is exposed during construction or contained in the gravel fills used for the project. Fuel spills and erosion may also result in contamination of waterways, affecting fish and other animals who ingest contaminated water. Contamination or perceived contamination can have indirect effects on subsistence, as subsistence users may reduce their consumption of a resource if there is a fear of contamination; thus, resources perceived as unhealthy or contaminated are considered unavailable to local residents.

The influx of workers during the multi-year construction period would also cause a substantial increase in human disturbance and activity within the region, which would likely result in decreased availability of certain resources in the vicinity of construction areas The potential for impacts to resource availability resulting from hunting or fishing by temporary construction workers is a key concern which has been raised by the study communities. This analysis assumes that no road users authorized by AIDEA (including construction workers) will be allowed to also hunt or fish from the road. In other words, construction workers or truck drivers will not be allowed to stop and hunt or fish using the road for access. However, it is possible that workers may choose to return to the area after construction is complete to engage in harvesting activities within the area, which could increase the number of hunters in the area over time and reduce resource availability for local residents.

The following sections provide a more in-depth discussion of potential impacts to the resources which are most commonly harvested by the study communities along the proposed road corridors and which are of high importance to a majority of those study communities. These resources include caribou, moose, fish, and vegetation.

Caribou

As noted above, the proposed road routes cross through community caribou hunting areas for 12 communities: Hughes, Kobuk, Shungnak, Allakaket, Ambler, Bettles, Evansville, Alatna, Huslia, Anaktuvuk Pass, Selawik, and Tanana. For seven of these communities, caribou are a resource a high importance (see Table 46), while for the remaining five communities, caribou are of moderate or low importance based on selected measures. While caribou are harvested in lesser quantities than in the past for a number of the study communities, changes to subsistence uses of caribou are often a result of changes in caribou migration or distribution which are out of a community's control. In many cases, communities were originally situated in areas known to be productive for caribou harvests, only to witness shifts in the distribution of the caribou herds which made them difficult to access. In more recent years, construction of TAPS and the Dalton Highway was reported by local residents to shift the distribution of caribou, and residents within the eastern portion of the proposed road corridors, such as Bettles, Alatna, and Allakaket, experienced a decline in harvests. Today, some residents from the northern and eastern portions of the project area travel to the southwest of the community toward Buckland into the WAH wintering grounds to harvest caribou (see Sections 5.1 and 5.3). Without the means (e.g., transportation, funds) to access caribou herds, communities rely on sharing networks for their dependence on caribou and may shift their resource focus to other resources which are more available, such as moose. This does not mean that caribou is no longer culturally important to these communities, and if migration or distribution of the herds change in the future such that they are available, communities would likely resume previous levels of harvesting. In addition to the communities who have documented use of the proposed corridors, additional subsistence study communities and caribou study communities may experience impacts to caribou availability if the road causes larger impacts on caribou movement However, such large-scale changes in caribou movement and distribution are not expected to occur (see Section 3.3.4, Mammals, of the Supplemental EIS).

Impacts on the resource availability of caribou may result from changes in caribou migration, distribution, behavior, and health. In addition, changes in harvester access can affect resource availability by reducing or delaying access to productive hunting areas; these impacts are discussed in the section below, "User Access." Impacts to the abundance of caribou, in terms of overall population, are discussed above, under "Resource Abundance." This section addresses the potential for impacts to the availability of caribou within traditional harvesting areas. While certain local changes to caribou movement or distribution may seem minimal from a biological perspective (i.e., not affecting overall population levels, body condition, herd ranges, etc.), local changes can have much larger impacts on resource availability to local hunters. It is important to a harvester's success that caribou are available within traditional hunting areas at the expected time during the seasonal round, and that the resources are accessible via available forms of transportation. Small changes can result in decreased hunting success due to a variety of factors. For example, a later arrival of caribou into one's hunting area could reduce harvest success if the caribou arrive during freeze-up, when neither river nor overland travel is possible, or at a time when other resource harvesting activities are at their peak. In addition, behavioral responses to stimuli, such as caribou acting skittish or running away from riversides, can result in hunters not being able to harvest caribou within a reasonable hauling distance, thus forcing them to abandon a hunt (SRB&A 2018). Thus, while conclusions related to impacts on caribou availability draw on the conclusions of the terrestrial mammals sections of the EIS, there are many additional impacts which are not addressed in the biological analysis.

Future changes in the distribution or migration of the caribou resulting from the road and other factors may result in changes to boundaries for the winter, migratory, and peripheral ranges of the herd, thus affecting the availability of the herd to communities in different ways. Currently, the project area crosses through the winter, migratory (fall and spring), and peripheral range for the WAH; the total range, including calving grounds, for the Ray Mountain Herd (RMH); and the peripheral range of the Hodzana Hills caribou herd (HHH). All of the action alternatives overlap with fall migration routes near Kobuk; fall migration routes have become more concentrated to the southwest as winter distribution has shifted toward this area. The Native Village of Kotzebue commented on the supreme importance of caribou to their community and the profound cultural impacts that a decrease in the presence of the WAH would have on the community of Kotzebue. They commented that it is essential that the WAH be able to migrate freely:

> It is impossible to overstate the importance of caribou to our members. Their absence in the annual subsistence cycle would irreversibly change the character of the culture and impose major hardship on the people as it would be impossible to replace the quantity and quality of food that caribou currently provide. (Native Village of Kotzebue 2018)

The primary construction activities which may affect caribou availability to local communities include air and ground traffic, construction noise (e.g., blasting, machinery), the presence of linear infrastructure (e.g., pioneer road), and human activity. Air traffic has been a commonly reported and observed impact on caribou on the North Slope and in Northwest Alaska (SRB&A 2009b, 2018, Georgette and Loon 1988, Sullender 2017). Air traffic is observed to cause behavioral changes, skittish behavior, and delayed or diverted crossing behavior, which in turn has impacts on caribou hunting success for local hunters. These types of behaviors are most commonly observed in response to helicopter traffic, although fixed-wing aircraft have also been observed to elicit similar responses (Sullender 2017). In addition to changes in behavior, increased exposure to aircraft disturbance may also affected body condition through increased energy expenditures (e.g., more time fleeing versus feeding or resting) (Sullender 2017). Furthermore, increased energy expenditures may result in reduced foraging rates and, ultimately, decreased mating success/pregnancy rates.

Avoidance of development areas are most common in caribou during the calving season, but can occur at other times as well. On the North Slope, caribou have been found to reduce their use of habitat within 3.1 miles of development during the calving season, and 1.2 miles during the post-calving season. "Active infrastructure" (e.g., roads with traffic rather than just the roads themselves) may cause more avoidance behavior (see Section 3.3.4, Mammals, of the Supplemental EIS). Roads and road traffic are also believed to cause behavioral and migratory changes in caribou which can affect hunting success. Deflections or delays of caribou movement from roads and associated ground traffic and human activity have been documented in the traditional knowledge of harvesters (SRB&A 2009b, SRB&A 2014, SRB&A 2018) and during behavioral studies on caribou, particularly for maternal caribou (displacement of between 1.24 and 2.5 miles [2 and 4 km] from roads) (ABR and SRB&A 2014). In recent years, reports of ground traffic–related impacts on the North Slope caribou hunting, particularly in the vicinity of Nuiqsut, have increased with the construction of gravel roads in the area (SRB&A 2016b, 2017, 2018). Impacts and road have also been observed by Noatak and Kivalina caribou hunters in regards to the Red Dog DMTS (SRB&A 2014). Residents have observed that some caribou will stop once they reach the DMTS, sometimes traveling alongside the road before crossing, and other times bypassing the road altogether. As the chairman of the Western Interior Federal Subsistence Regional Advisory Council stated at a February 2022 meeting,

> My comment would be that caribou are pretty afraid of the roads. It's graphic with GPS collars on caribou at the Red Dog Road. It's graphic on the Dalton Highway when the Porcupine Herd was unfamiliar with this road and came straight perpendicular to it. They kept moving back for four years. Finally they started to cross the road. Those roads really impeded caribou migrations. *(*Western Interior Federal Subsistence Regional Advisory Council 2022)

As indicated in the above quote, such behavior has also been documented through radio collar observation. A study conducted by (Wilson, Parrett, Joly, and Dau 2016), found that the DMTS influenced the movements of approximately 30 percent of radio-collared WAH caribou, and of those individuals, the average delay in crossing was 33 days. Caribou from the Teshekpuk Herd (TH) were not similarly affected, which could be due to greater exposure of the TH to industrial development in the eastern portion of its range. In general, observed caribou behavior in response to the DMTS is variable: in some cases caribou cross seemingly without delay, while in other cases herds scatter and migration is delayed for multiple days (Wilson et al. 2016, ABR and SRB&A 2014). Responses to roads also seem to vary from year to year based on the context in which roads are encountered including the motivation of the caribou to cross (e.g., during mosquito and oestrid fly harassment seasons) (see Section 3.3.4, Mammals, of the Supplemental EIS). Recent studies specific to the WAH show that current herd movements avoid existing roads.

In addition to impacts to resource abundance, the Alaska Native entities present at the scoping meetings also described potential impacts to resource availability in traditional use areas. A majority of the traditional knowledge comments noted the potential for altered migration, particularly in regards to caribou as well as aquatic resources. The Western Interior Alaska Subsistence Regional Advisory Council noted that noise disturbances resulting from increased traffic will decrease availability of key terrestrial and aquatic resources within at least a 50 mile radius of the Project:

> The Council emphasizes that the impacts of developing the Ambler Road Project will have adverse and far reaching effects within at least 50 miles of each side of the road. These impacts include noise disturbance to terrestrial and aquatic wildlife resulting from increased motorized off-road vehicle traffic and boat use extending up the coast and into the Kobuk River Drainage. The increased motorized off-road vehicle traffic and boat use resulting from development of the Amber Road will also have significant adverse impacts up and down the Koyukuk River, John River, and Alatna River drainages. (Western Interior Alaska Subsistence Regional Advisory Council 2018)

The tendency for caribou to divert around areas of disturbance is evidenced by traditional hunting methods which are still observed today. According to the (WAHWG 2017), caribou hunting traditions ensure that caribou migratory paths are well established before hunting begins:

> Hunters in Kiana were instructed to wait two days after the first caribou passed through for the migration to be established. By waiting to harvest caribou, the community protected the migration for years to come.

Other traditions indicate that residents should camp and hunt on the south sides of rivers in the fall so that caribou cross these linear features before encountering hunters. This reduces the likelihood of further deflection away from the river and overall changes in migratory paths.

Both large and small changes and delays in caribou movement could have substantial impacts to hunters waiting for the caribou migration. In the case of the proposed Ambler Road, WAH caribou typically migrate through the Kobuk River Valley area twice a year (fall and spring migration) and some WAH caribou winter in the area as well. The fall migration is the most intensive caribou hunting season for most communities, although residents may also hunt small groups of overwintering caribou or during their spring migration (Braem et al. 2015) Table 6). In general, the westernmost subsistence study communities have more access to the WAH, while communities on the periphery of the herd's range (e.g., Alatna, Allakaket) may be more vulnerable to smaller changes in the herd's annual movements (Guettabi et al. 2016). In 2017, residents from Allakaket noted that a poor snow year in combination with few caribou migrating near their village had resulted in low caribou hunting success rates that year (WAHWG 2017). Despite their greater proximity to the WAH migratory range, communities along the western end of the proposed road corridors (e.g., Ambler, Kobuk, and Shungnak) have indicated that the WAH has altered its migratory path farther west toward Buckland, which has caused community residents to shift their hunting focus to the west and south of their communities (Watson 2018). Thus, further changes to this migration could cause other shifts in the availability of caribou to these communities. Larger changes to the migration of the WAH or reduced availability or large diversions in individual study years could affect resource availability to any of the 42 caribou study communities. However, because the overall migratory patterns of the WAH are expected to remain intact (see Section 3.3.4, Mammals, of the Supplemental EIS), it is unlikely that resource availability will be affected within the use areas for communities farther removed from the AMDIAR.

The Native Village of Kotzebue traditional knowledge comments during scoping emphasized the point that changes in resource availability will affect subsistence communities that are not located within the path of, or directly adjacent to, the Project. They noted that this is particularly true when considering the migratory nature of certain key species, particularly caribou which are essential to the health and wellbeing of the community of Kotzebue:

> While the area in question is only infrequently visited by our tribal members, sheefish, salmon and caribou – three of the most critical resources to the Tribe, are dependent on the continued health and wellbeing of this area…. Caribou which are the mainstay for Kotzebue cultural, nutritional and spiritual connection to the country use the entire Region at various times of the year. The migratory nature of these species should be taken into account so that communities not located directly adjacent to the proposed road (like Kotzebue), but who rely on the migratory resources using this area, are overtly acknowledged as directly impacted with a vested interest in this project and are included alongside the affected communities with closer proximity to the actual road for the purpose of impacts. (Native Village of Kotzebue 2018)

The Native Village of Kotzebue also provided their traditional knowledge on the ways in which a road corridor can affect caribou migration, noting that caribou are sensitive to noise and development and are able to see, hear, and feel development long before they reach a road or construction area. The Native Village used Red Dog Road (i.e., DMTS) as an example to illustrate the effects that development of roads has had on the WAH. They noted that while the Red Dog Road is shorter and therefore not directly comparable to the proposed Ambler Road, it can still be used as an example to demonstrate impacts to caribou including habitat fragmentation and disruption of migration paths.

> The major consideration with the road and the route selection would be to minimize the impact to their ability to freely migrate from the northern Brooks Range in the fall to their southern wintering habitat and back again in the spring and a road running east to west in the middle of this migratory route is a serious cause for concern. This type of migration impact has already been documented in regards to the much shorter Red Dog road. The related issue of habitat fragmentation is also detrimental to caribou and development and this road and the expected related spur roads, along with the increasing ability to develop future roads connected to this road in the future, is of serious concern for the long-term health of the western Arctic caribou herd. It has also to be kept in mind that even with the proactive approach taken along the relatively short Red Dog road in regards to stopping traffic while caribou are near the road there are still demonstrable impacts. It is unknown if such a strategy will, or even could, be put in place on the Ambler road, given the differing ownership and political affiliations of the mine developers in the Ambler District, in addition to the totally different logistical challenges in regards to the hauling season and distances that would be covered by the trucks. It also needs to be kept in mind that while it is practical to stop trucking on the Red Dog road due to its short length and nearby facilities on both ends, which would be totally different on the Ambler road, it also is exclusively tundra/willow habitat and herds of caribou can be relatively easily spotted at a distance. This will not be the case on the Ambler road, where both the topography and the spruce dominated areas will make it impossible in many places along the road to even observe caribou until they are right next to the road, but of course the caribou will still be able to smell, feel and hear the road and its associated traffic well before they reach it. (Native Village of Kotzebue 2018)

Effects on caribou movement are most likely to occur when linear structures are placed parallel to the herd's primary movement (Wilson et al. 2016). Perpendicular roads may also intercept caribou and cause delayed crossing (CPAI 2018, BLM 2018a). In the case of the proposed Ambler Road, Alternatives A and B are located perpendicular to the WAH's primary north-south movement and will thus likely cause deflections or delays in caribou movement at least during peak migratory periods. Alternative C would be less likely to intercept caribou because it is outside the main migratory range. While temporary disruptions to caribou movement in the WAH range have not been shown to alter overall migration patterns or reduce connectivity between seasonally-important ranges, the frequency and magnitude of caribou responses to roads would likely increase as the density of roads increases. In addition, even small changes in caribou distribution and movement from a biological perspective can have large impacts on hunter success.

Louden Tribal Council in Galena provided their traditional knowledge comments and summarized many of the above described impacts regarding the potential impacts of the Project on the migratory behavior and overall health of the WAH, noting that the ambient stress created by roads may cause migration route changes, avoidance, decreased populations, and habitat fragmentation. The Tribal Council also commented on the potential impacts that the road and road corridor may present including increased hunting pressure, increased predation, and increased mortality by traffic collisions:

> BLM needs to consider the full range of potentially serious impacts a project of this scale could have on the migratory behavior, habitat, and health of the Western Arctic Caribou Herd. The proposed road would cut east to west through a significant portion of the migratory range of the Western Arctic Caribou Herd, one of North America's largest existing wild caribou herds. Risks to caribou from roads include impeding migration routes, habitat fragmentation, and possibly local extinctions. Increased noise levels from road and air traffic in the region may lead to caribou avoidance of the road and displacement from their historical range. Roads create ambient stress in caribou, which results in less energy available for feeding, mating, and calving. Further, caribou may suffer direct mortality by traffic collisions, increased pressure from recreational hunting, and increased predation risk by wolves due to clear cutting in the road corridor and more efficient travel routes into caribou range. (Louden Tribal Council 2018)

Moose

The proposed road corridors cross moose hunting areas for 12 communities and are of high importance to eight of these communities. In some subsistence study communities located within the WAH's peripheral range (e.g., Alatna and Allakaket), moose has supplanted caribou as the primary large land mammal harvested, as caribou have become less available and moose have become more available in the region (Watson 2018).

Impacts to moose availability would generally be on a smaller geographic scale than for caribou, as moose have smaller ranges and residents do not rely on seasonal migratory movements when hunting them. Thus, impacts to moose hunting would occur primarily in the vicinity of the road where moose could exhibit avoidance or other behavioral changes. Because a majority of moose hunting in the region occurs along rivers during the fall months, impacts would be most likely to occur in areas where the road corridor crosses key moose hunting rivers such as the Koyukuk and Kobuk rivers and smaller drainages such as the Alatna, John, and Wild Rivers. Residents may experience decreased success in these areas due to moose remaining farther from the riversides or in deeper brush. However, impacts to moose availability would be localized.

While moose may initially exhibit avoidance of the road corridor, they also tend to habituate relatively quickly to human activity (see Section 3.3.4, Mammals, of the Supplemental EIS). Moose may also be attracted to the ROW as a movement corridor or because of the availability of new vegetation in maintained areas of the ROW (see Section 3.3.4, Mammals, of the Supplemental EIS). This could increase their availability to hunters in those areas but could also result in higher rates of injury or mortality due to traffic collisions.

Fish

As noted above, the proposed road routes cross through community non-salmon fishing areas for 10 communities: Hughes, Kobuk, Shungnak, Allakaket, Ambler, Bettles, Evansville, Alatna, and Kiana. For eight of these 10 communities, non-salmon fish are a resource a high importance (see Table 46), while for the remaining two communities, non-salmon fish are of moderate importance based on selected measures. Key fish species for these study communities include chum salmon, sheefish, and humpback and broad whitefish and, to a lesser extent, cisco, northern pike, grayling, burbot, and trout. The AMDIAR crosses streams and rivers which support spawning habitat for both sheefish and chum salmon. In particular, the Kobuk and Alatna rivers are key spawning grounds for sheefish and are also important fishing areas for the subsistence study communities. Both of these drainages are crossed by proposed project corridors. In addition to the communities who have documented use of the rivers crossed by the project corridors, communities upstream and downstream from the project corridors could experience impacts on fish availability if larger impacts to fish movement or health occur.

Construction activities which may affect fish availability to subsistence communities include installation of bridges and culverts, related pile installation, stream diversions, and stream excavation, water withdrawal, blasting at material sites, and contamination. Fish could be temporarily diverted, displaced, or obstructed due to culvert placement, excavation, or stream diversion. Ice roads and pads may also temporarily block fish passage if the compacted ice takes longer to melt. While impacts to fish resulting from construction activities are expected to be localized, subsistence users often harvest fish in specific locations along rivers; thus, localized changes in fish distribution could have impacts on resource availability for individual harvesters. Construction activities in waterways could also increase stream turbidity that could affect downstream harvesting areas or make these areas less desirable for fishing in the short-term. Construction of ice roads and pads would require water withdrawals from lakes and rivers near construction activity. Water withdrawal would be limited to 15 percent in waterbodies with sensitive fish species such as salmon and whitefish. Water withdrawal may kill individual fish but would likely not have population-level effects, as ADF&G's fish habitat permits include requirements for water intakes to avoid fish injury (see Section 3.3.2, Fish and Aquatics, of the Supplemental EIS). Water withdrawals for ice roads would alter water quality and water flows, and could potentially affect fish habitat, although these impacts are expected to be temporary and short term. Runoff from melting ice roads and pads could also have temporary effects on water quality.

Changes in the availability of fish species could affect subsistence users throughout the project area and downstream from the project area, particularly if the project results in changes in fish distribution or the timing of fish migrations. Subsistence users often harvest specific resources at specific times and places, and if these patterns are disrupted they may experience declines in harvest success or have difficulty accessing traditional use areas when resources become available in those areas (e.g., if the fish arrive late and subsistence users cannot use boats to access them).

Concerns about potential contamination of sheefish and chum salmon spawning grounds have already been voiced in the study communities (Watson 2014). The Kobuk River supports the largest population of spawning sheefish in Alaska, and the Alatna River is the only spawning habitat for sheefish in the upper Koyukuk River drainage. In addition, sheefish spawning grounds are particularly sensitive to changes in water velocity, temperature, pH, and other factors. Salmon spawning habitat is also vulnerable in changes to water chemistry. Changes to natural water chemistry resulting from exposure of geologic materials could affect egg survival and fish populations, having far-reaching effects on downstream subsistence users of whitefish and salmon. As discussed in Section 5.7, Downstream Subsistence Uses of Fish, Chinook and salmon returns have declined in recent years, increasing the reliance of some communities on harvests of non-salmon fish (e.g., sheefish). Thus, the study communities would be particularly vulnerable to additional changes in salmon and non-salmon fish abundance. Impacts related to changes in Chinook salmon abundance would be most likely among Yukon River study communities, while impacts related to changes in sheefish abundance would be most likely among Kobuk River communities. Chum salmon impacts would affect communities in all three river basins (Kobuk-Seward, Koyukuk, and Yukon) (see Table 49).

The introduction of invasive species (both fish and/or aquatic plants) could also impact fish habitat and/or productivity and impact fish availability to subsistence users. Unlike other construction impacts that are expected to be more short-term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled, reducing fish availability for subsistence users along the AMDIAR. If fuel or other contaminant spills occur near fish bearing streams, subsistence harvesters along may avoid harvesting fish if they are perceived (or confirmed) to be contaminated or unhealthy. In the case of larger spills, contamination concerns and avoidance may extend to communities located downstream from the AMDIAR (e.g., Huslia, Noorvik, and Kiana). A study in six communities on the North Slope found that between 22 and 54 percent of household heads had avoided eating certain subsistence foods in the previous year because of concerns about contamination (SRB&A 2017).

Vegetation

The proposed road corridors cross vegetation harvesting areas for 10 communities (see Table 46) and are of high importance to all of these communities. Construction activities which may affect the availability of vegetation, including berries, wild plants, and wood, include clearing of the ROW, fugitive dust resulting from the road and ore concentrate trucks, and contamination from fuel spills.

AMDIAR construction will result in the removal of vegetation harvesting areas for local residents and the introduction of invasive plants along roadways which may reduce the availability of native plant and berry species. In addition, a larger area surrounding the road will likely be removed from use for some individuals due to concerns about contamination. Impacts to vegetation harvest areas resulting from roads has been documented in relation to the Red Dog DMTS (SRB&A 2009b). Residents form Kivalina have reported observing dust on vegetation and changes in the taste or appearance of berries. In addition, some individuals have reported that they no longer use traditional vegetation harvesting areas along the DMTS due to concerns about contamination. Communities along the proposed road corridors may also experience reduced availability of vegetation in traditional harvesting areas during and after construction of the road. Because core harvesting areas for vegetation often occur in close proximity to communities, those communities in closest proximity to the road corridor would be most likely to experience impacts on their vegetation harvesting areas. Dust deposition could eliminate vegetation within 16 feet of roads and may cause avoidance of vegetation harvesting at greater distances (see Section 3.3.1, Vegetation and Wetlands, of the Supplemental EIS).

Operation

Disturbance, displacement, or contamination of subsistence resources during operations could result in these resources being unavailable at the time and place that local harvesters are accustomed to finding them. In general, impacts would be similar to the construction impacts (discussed above) pertaining to traffic, dust deposition, human activity, contamination, and infrastructure. However, the impacts would occur over a longer time frame and would occur with either greater or lesser frequency or intensity depending on the impact source. Under Phase 3, the final road would be larger and access roads and maintenance stations would be in place.

During operation, the availability of subsistence resources could be affected through human activity, air and ground traffic, and maintenance activities, resulting in skittish behavior, changes in local distribution of resources, and/or diversion from usual migration routes. In addition, road and other infrastructure may physically divert certain animals. Spills or other contamination could also affect the local distribution of resources such as fish and vegetation or may result in resources being considered unavailable to local harvesters due to concerns of contamination.

Sources of noise from maintenance and operation of the road would include vehicle traffic, small fixed-wing aircraft, helicopters, maintenance equipment and activities (grading, sanding, plowing, gravel placement), and human activity. Noise above ambient levels may displace or divert resources from traditional areas (see discussion above, under Construction) (Section 3.2.6). The frequency of truck traffic would increase over the three phases of the AMDIAR, and would be substantially higher once mine production began, with up to 200 trips per day at peak mine production. Increased traffic along the Dalton Highway may also displace caribou from the HHH thus affecting resource availability to users of that herd, although documented harvests from the HHH by local residents are relatively limited. While the road under Phase 2 would be a single-lane road and traffic would occur in one-way convoys, the road would be upgraded to a two-lane road under Phase 3 and traffic would not occur in convoys. Air traffic would decline slightly during operations, with an estimated two to six aircraft trips weekly (one to two to each maintenance station) and an additional helicopter trip per week. While overall ground traffic would be higher during mine production, human activity would be lower once construction is complete.

The cleared area within the ROW and road may create a travel corridor for large land mammals which could lead to a two-fold effect on resource availability. First, if the cleared area draws large land mammals to the corridor there could be a corresponding decline in large land mammals in areas they were previously found. Furthermore, a cleared area within the ROW with a high concentration of large land mammals could be a draw for local hunters traveling overland in the winter by snowmachine or by off-road vehicle during other times of the year. This could cause a reduction in the availability of certain resources in other traditional harvest areas. In addition, in the long-term, if the road facilitates access into the area after reclamation, the availability of moose in the area may decrease due to increased hunting.

During operations, the final two-lane road combined with an increase in traffic would likely increase the potential for deflection or delay of caribou movements, particularly during the fall migration south (see above under Construction). Over time, local caribou distribution may be altered to the extent that residents no longer find caribou within their usual hunting areas or experience reduced hunting success in those areas. Some industrial road projects in the state of Alaska provide for access to roads for local residents. In other communities where roads have been built, access to private roads has in some way offset some of the impacts to resource availability; however, lack of access to local hunters for the AMDIAR would introduce subsistence impacts with no offsetting subsistence benefit.

Stream and riverbeds may experience increased sedimentation or alteration over time due to the presence of culverts and bridge piers. The impacts of erosion and beaver dams on salmon spawning grounds was a topic discussed during a recent meeting of the Northwest Arctic Subsistence Regional Advisory Council (2022), highlighting the importance of access to spawning grounds:

> I think some of them creeks are dammed up, pretty much dammed with the beaver and that's one thing that's causing the fish not to come out, and no air and stuff like that happening statewide,’it's not just happening here. But salmon spawning, man, I tell you the erosion t’at's happening and’it's turning the river shallower, seems like, and I ha’en't gone up river for quite awhile it seems like the ri’er's changed abo– -- above Kobuk’it's really changing... But salmon spawning, oh, man, t’ey're going to be lower and lower down this way for salmon spawning because getting pret– -- a lot of dead salmon on the sides after spawning.

If culverts and bridges are not properly maintained or if erosion control measures are not taken, fish migrations could be temporarily disrupted or blocked, which could reduce fish availability for subsistence users. Erosion from improperly maintained culverts could also increase sedimentation in fish spawning habitat. Ice roads and pads may also temporarily block fish passage if the compacted ice takes longer to melt. The risk of contamination from dust deposition and fuel would continue through the life of the project and depending on the magnitude of spills could have far-reaching impacts on upstream and downstream subsistence users. Changes in the availability of fish species could affect subsistence users throughout the project area and downstream from the project area, particularly if the project results in changes in fish distribution or the timing of fish migrations. Subsistence users often harvest specific resources at specific times and places, and if these patterns are disrupted they may experience declines in harvest success or have difficulty accessing traditional use areas when resources become available in those areas (e.g., if the fish arrive late and subsistence users cannot use boats to access them). At a meeting of the Northwest Arctic Subsistence Regional Advisory Council in November 2022, one board member noted the impact of changes in the timing of fish migrations on harvesting success in recent years:

> We are in a time right now that this weather, the climate change and when we're out in the springtime waiting for the whitefish to come out of the lakes and we're trying to put away and dry whitefish and it's cold. We don't have -- maybe some days we'd have two to three warm days that would help dry our fish and stuff but with this climate change and stuff now we're missing the spawning whitefish and stuff going up the river. They're going up early and the water is so high all summer, all fall so most of us really didn't get a chance to get our whitefish and stuff... that's what we really live on is the nice big (in Iñupiaq) they are called, the whitefish. And now everybody's having a hard time and it's continuing every year. We don't know when the fish are going to move. Springtime we usually have a -- we know when they're supposed to be coming out. I missed pike, most of us did because we didn't even know when they came out of the lakes or anything. I didn't really get any pike to dry this spring. (Northwest Arctic Subsistence Regional Advisory Council 2022)

Gravel mining and associated blasting will continue throughout operations for roadway maintenance, and thus some individual loss or displacement of fish will continue during operations. =The introduction of invasive plants along road corridors could impact resource habitat and/or productivity and impact the availability of certain resources, including wild edible plants and berries, to subsistence users (see Section 3.3.1, Vegetation and Wetlands, of the Supplemental EIS). Invasive aquatic plants could also alter aquatic and wetland habitat and reduce the availability of fish and other resources in certain areas. Unlike other construction impacts that are expected to be more short term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled, potentially reducing plant and berry availability for subsistence users along the road corridors. However, Appendix N includes mitigation measures to help control and minimize the spread of NNIS.

Most of the restrictions to availability would cease once the road was fully reclaimed and closed. The noise and activity of the reclamation process itself, including the removal of bridges and culverts that would increase water turbidity, may displace animals and fish that are subsistence resources and make them unavailable. After closure was complete, and as stream channels settled into equilibrium and the corridor gradually revegetated, the corridor likely would become habitat for plants and animals. It is not clear that this would necessarily reestablish previous (year 2020) resource availability patterns, but a source of disturbance would be gone.

User Access

Construction

Sixteen of the 27 subsistence study communities have subsistence use areas crossing one or more of the proposed road corridor alternatives (see Table 46). These communities would be the most likely to experience direct impacts to user access resulting from the proposed road. Of these communities, five have use areas which are bisected by one or more of the road alternatives, meaning that access to a large portion of their hunting, fishing, and gathering areas would require crossing the road corridor (depending on the chosen alternative). These communities are Bettles, Evansville, Hughes, Kobuk, and Shungnak. Alatna, Allakaket, and Ambler are also bisected but to a lesser degree (i.e., the road crosses more on the periphery rather than through the center of their use areas) than the above five communities. As shown in Table 46 above, the subsistence activities which most commonly occur in the vicinity of the proposed corridors include hunting and trapping of small land mammals and furbearers, hunting of moose and caribou, vegetation harvesting, non-salmon fish harvesting, and migratory bird hunting. Other resource harvesting activities that could be affected include hunting of other large land mammals (Dall sheep and bear), hunting of upland game birds, salmon fishing, and to a lesser extent, egg harvesting.

Impacts to harvester access would occur within the vicinity of the road corridor, where harvesters could be faced with physical obstructions to access or by causing harvesters to avoid construction work areas. Construction infrastructure such as the pioneer road, ice roads, construction laydown materials, and heavy equipment could present physical barriers to subsistence users. In addition, individuals traveling overland may have to divert around material sites and other areas which are unsafe for travel. Although the road will include crossing ramps for local residents to use when traveling overland, hunters may not be permitted to cross construction-phase roads until crossing areas are established, thus obstructing travel altogether for a period of time. Potential impacts of the physical road to user access are discussed in further detail under Operation.

Physical obstructions to access would be most common for residents traveling overland by snowmachine or off-road vehicle. Harvesters traveling overland to access use areas for caribou, furbearers, and geese may be diverted around construction areas if there are physical obstructions. Overland trails, routes, or traplines would be bisected by the project. In these cases, residents may abandon or alter traplines to avoid regular crossing of the project corridor, including construction-phase roads and ice roads. In addition, there may be periods of time during construction where access along certain river drainages, which can serve as both winter and summer travel corridors, is obstructed due to bridge construction activities (e.g., installation of bridge pilings).

The degree of impacts from construction would depend on whether the timing of construction activities conflicts with subsistence use areas and activities for a community. Because construction would occur year-round, it is likely that there would be direct conflicts with construction activities for certain subsistence use areas. According to data collected for several communities whose use areas are bisected by the AMDIAR (Hughes, Bettles, and Evansville), in addition to several additional communities whose use areas overlap with portions of the AMDIAR (Alatna, Allakaket, and Wiseman/Coldfoot), residents of the region primarily use boats and snowmachines to access hunting and gathering areas, although road-connected communities (Wiseman/Coldfoot) also commonly use road vehicles to access harvesting areas (see travel method discussions above). Subsistence activities occur year-round, peaking in the fall (August and September) and again in the mid-winter and early spring (February through April) for most study communities with available data. The project corridors cross areas used for both riverine and overland travel, and construction activities would occur year-round; thus, residents may experience impacts to construction during all subsistence seasons and activities which are overlapped by the AMDIAR.

In addition to physical barriers to subsistence users during construction, residents may also experience reduced access due to security restrictions around construction work areas or general avoidance of development areas. Even if regulatory and physical barriers do not exist in certain areas of the project area, subsistence users may choose not to access nearby subsistence use areas any longer because construction-related sites, smells, lights, noises, and activities can disturb resources, reduce the potential for a successful harvest, and negatively affect the harvester’s experience (Section 3.2.6). In addition, residents may avoid hunting in the vicinity of the road due to concerns about shooting near infrastructure and human activity, or because of a lack of knowledge regarding security protocols. Any incidences of spills or other forms of uncontrolled hazardous waste discharge that occur during construction could lead to harvester concerns of contamination (real or perceived) and result in users avoiding subsistence use areas near the contaminated areas, thereby reducing user access. Finally, subsistence users may avoid hunting near construction work areas due to a general discomfort with conducting traditional subsistence activities near non-local workers and industrial activity.

Avoidance of industrial areas by subsistence users has been documented on the North Slope of Alaska, particularly for the community of Nuiqsut. In a recent study monitoring the impacts of oil and gas development on Nuiqsut caribou hunters, between 51 percent and 61 percent of caribou harvesters reported avoidance of any subsistence use area during four years of the Nuiqsut Caribou Subsistence Monitoring Project, and between 33 percent and 46 percent did so for development reasons (CPAI 2018, SRB&A 2018). Residents have noted that avoidance of industrial areas varies from year to year depending on activity levels within a given area and other factors. Thus, it is likely that a proportion of hunters from the subsistence study communities will avoid certain areas of the proposed road corridor at some point during the life of the AMDIAR. Avoidance may be higher during construction due to the higher activity and noise levels.

Operation

As noted above, 16 of the 27 subsistence study communities have subsistence use areas crossing one or more of the proposed road corridor alternatives, and the road and other project related infrastructure will represent a direct loss of traditional subsistence hunting and harvesting areas for these communities. During AMDIAR operation, residents would continue to experience physical barriers to access resulting from infrastructure such as roads, although the presence of crossing ramps would help reduce those impacts. Harvesters traveling overland to access use areas for caribou, furbearers, and geese may be diverted around operational infrastructure if there are physical obstructions. Physical obstructions to harvesters traveling by boat along river channels would be unlikely during operation. In addition to physical obstructions, residents from the subsistence study communities will also experience reduced access resulting from road use policies, user avoidance, and contamination concerns throughout the life of the project.

Scoping comments shared concerns regarding user access to traditional subsistence use areas. They noted that user access may be decreased due to a tendency for subsistence hunters to avoid areas of development:

> Subsistence harvesters often avoid areas of development. As a result, avoidance areas will extend far beyond the immediate footprint of the road, causing the loss of subsistence use areas across a broad area. (Louden Tribal Council 2018)
>
> A proposed Ambler Mining Road that severs Evansville Incorporated's land base would create a physical encumbrance that would adversely impact management and enjoyment of the land. (Evansville Inc. 2017)

As noted above, the AMDIAR will not permit access to local residents for subsistence purposes but will allow for residents to cross the road at established crossing areas. AIDEA has indicated they will establish a committee which will help identify appropriate locations for crossings. The efficacy of crossing ramps to reduce access impacts for local hunters will depend on the location, design, and frequency of the ramps. Because subsistence users do not always use or follow established trails when pursuing resources overland, instead traveling in various directions based on environmental factors (e.g., weather, snow and ice conditions) and traditional knowledge of resource distribution and behavior, the presence of crossing ramps will not eliminate impacts to user access. Subsistence users may have to travel additional distances when pursuing resources in order to locate approved crossing areas, or they may take safety risks by crossing in areas not approved for crossing. In addition, despite the presence of crossing ramps, some individuals may still have difficulty using crossing ramps, especially when hauling sleds. Subsistence users in the community of Nuiqsut have reported difficulty under certain conditions when using crossing ramps on industrial roads near their community (SRB&A 2018).

While road access for local subsistence users will not be permitted, it is possible that residents from nearby study communities will use the cleared area within the ROW alongside the road as a travel corridor for overland (snowmachine or off-road vehicle) travel, particularly if resources such as moose concentrate in these corridors. Use of the ROW may facilitate access to hunting areas farther from the community as well as between communities. AIDEA indicates that ROW travel will be prohibited, and security will patrol the roads to prevent violations. Enforcement measures will reduce but not eliminate use of the ROW. Restrictions on use of the ROW, particularly by local residents when certain areas of the road will be crossable, may be difficult to enforce. Increased non-local access would be less likely but may affect subsistence uses for residents of the subsistence study communities by increasing human activity and competition in the area.

Competition from non-local hunters, facilitated by guiding and air charter services, is an existing source of impacts to subsistence users within the region. Sport hunting of the WAH has increased substantially since 2000, and conflicts between locals and sport hunters related to aircraft disturbances are commonly reported (see Section 3.3.4, Mammals, of the Supplemental EIS). Residents have reported actions from non-local hunters which are inconsistent with traditional Athabascan and Iñupiaq values, such as hunting for sport, wasting meat, hunting in key migration corridors, or targeting the “lead caribou” in a herd, thus deflecting them from their usual routes (Braem et al. 2015). A potential for increased access by outside hunters is a primary concern which has been voiced by a number of subsistence study communities (Watson 2014). Local harvesters are often at a disadvantage when in direct competition with non-local harvesters, as they do not have the financial means to cover large areas using planes and other modes of travel in search of subsistence resources, and their cultural values preclude them from harvesting resources in way that benefits only themselves (e.g., intercepting a migrating herd). The magnitude of impacts related to competition will depend on the ability to control access along roads and ROWs. The likelihood of non-local hunters accessing the ROW would depend on policies regarding ROW use in addition to measures taken to prevent or limit access to the ROW (e.g., boulders, berms, or fencing near entry points). Preventative measures would help lessen the impact of increased use along the ROW but would likely not eliminate the impact, as some individuals would likely use the ROW regardless of use policies. The use of cleared ROWs regardless of use policies has been documented by rural residents throughout the state of Alaska associated with TAPS and other local development and transportation projects (SRB&A 2016). While less likely, it is also possible that individual hunters, including local and non-local hunters, may trespass and use the road itself to access hunting areas during periods of low activity on the road. Security gates at the road entrance will reduce the likelihood of trespassing with road vehicles; however, trespassing with off-road vehicles may still occur. Several Alaska Native entities expressed similar concern regarding the potential for increased access to traditional subsistence use areas by non-local hunters. They indicated that increased competition and hunting pressure will decrease resource abundance and availability and negatively impact subsistence harvesting success by local residents. While the proposed Road will be commercial access only, scoping meeting participants highlighted the lack of specific information on how public access will be restricted and indicated that restricting all public access will be impossible.

> The potential for unauthorized use of the road and right-of-way, as well as possible future authorized public use of the road, presents additional concerns. For instance, unauthorized individuals could use the road to access areas that would not otherwise be accessible, and compete for subsistence resources traditionally used and relied on by residents of the local community. (Doyon Ltd. 2018)

> BLM should assume the public will be able to access the road, because there is no information on how public access will be restricted. Unrestricted access and illegal road use may lead to increased hunting pressure. Further, poaching by construction and mining workers should be considered. Even if road use is limited to industrial access and poaching is limited, the estimated 400 trucks per day on a long industrial road has the potential to greatly impact subsistence hunting and harvesting success. (Louden Tribal Council 2018)

During operations, harvester avoidance of the project area may be reduced from construction levels due to decreased noise and human activity disturbances, although avoidance responses would likely continue throughout the life of the project for certain individuals. In general, the total area of infrastructure would be greater under operations and would include a two-lane road, bridges, road maintenance stations, vehicle turnouts, material sites, water source access roads, road maintenance access roads, air strips, and communications towers. Thus, the area of infrastructure-related avoidance by local residents would be larger during operations. For some individuals, avoidance may extend to a larger area than the footprint if they perceive that resources are less available due to noise, traffic, and human activity associated with road operation. As with construction, any spills or other forms of uncontrolled hazardous waste discharge that occur during operations could lead to harvester concerns of contamination (real or perceived). These concerns could result in users avoiding subsistence use areas near contaminated areas, thereby reducing user access and also impacting resource availability.

Because the road corridor bisects subsistence use areas for a number for communities (Bettles, Evansville, Hughes, Kobuk, and Shungnak), residents from these communities may not have the option to avoid the road altogether to continue accessing traditional subsistence use areas. Thus, total avoidance of the AMDIAR area may be more likely for residents from communities whose use areas are on the periphery of the AMDIAR area.

Socio-Cultural Impacts

Impacts to resource abundance, resource availability, and user access would likely affect the costs and time associated with conducting subsistence activities and could have larger socio-cultural impacts on residents in the AMDIAR area. Decreased abundance or availability of resources may result in residents spending more time and effort in the pursuit of those resources, with greater risks to hunter safety. Some residents may reduce the time spent harvesting subsistence resources if the resources are unavailable in traditional harvesting areas and residents do not have the money to expend on traveling farther. These impacts could be further compounded by increased unauthorized access by non-local harvesters with greater means to access resources and harvesting practices which are in direct conflict with traditional Athabascan and Iñupiaq values. Impacts related to resource availability, such as decreased community subsistence harvests, would likely have greater impacts to vulnerable low income, unconnected, and low-harvest households (Kofinaset al. 2016). Decreased harvests among the study communities could also have more wide-ranging effects due to the potential impacts on sharing networks within the region in addition to networks which extend to other regions (Kofinas et al. 2016). Sharing is a key value across the study region which is central to subsistence and which strengthens social and kinship ties across communities and regions. Such impacts have already been felt across the region in recent decades due to declining salmon returns (Brown and Godduhn 2015), and these impacts could be compounded by the project if there are further reductions in the availability of salmon, sheefish, caribou, and other resources.

Changes in traditional land use areas over time could also have effects on cultural identity, as a community's identity is inextricably tied to the lands of their ancestors. The proposed road corridor bisects an area that is a traditional boundary between the Iñupiat and Athabascans, including an area of shared use; impacts to resource availability and changes in subsistence use patterns could disrupt these traditional boundaries and associated cultural identity of the residents of the area (Watson 2018). In the case of the Iñupiat of the Koyukuk River valley, their identity continues to be strongly associated with traditional use areas north of the Kobuk River and into the Brooks Range, despite recent shifts in contemporary subsistence patterns resulting from changes in resource availability, land management, and access. Further changes to the availability of caribou and other resources and a shifting away from the traditional use areas of their ancestors could erode resident's sense of identity. Finally, if the road reduces the availability of key subsistence resources such as caribou, moose, or sheefish, communities may experience negative social effects (e.g., increased drug and alcohol use, increased depression) resulting from poor harvests of those resources in a given year, increased food insecurity, and perceived degradation of culturally or spiritually important places and resources.

Economic opportunity associated with increased revenue/dividends, job opportunities, and income, can have positive effects on rural communities and on subsistence use patterns by encouraging residents to remain in their home communities and invest their income into to subsistence technologies and pursuits. Increased income and job opportunities can also have negative impacts on subsistence use patterns by changing the socioeconomic status of certain community members, reducing the time available to engage in subsistence activities, facilitating a shift toward store-bought goods, and altering social roles within a community. Local jobs directly associated with road construction and operation will be limited in number, temporary, and requiring skills and qualifications which most local residents do not have (see EIS Section 3.4.5, Socioeconomics and Communities).

Job opportunities would be greatly reduced after construction, with the road employing between 9 and 15 local residents, depending on the alternative. The relatively lucrative mining jobs are more likely to go to NANA shareholders and to residents of the closest communities (Kobuk, Ambler, Shungnak), because 2 of the largest mines are on NANA land or subject to NANA agreements. Such jobs, which allow both for relatively high income and for chunks of time off that may be used for subsistence activities, are less likely to go to Doyon shareholders whose subsistence areas would be equally affected. Those communities in the Doyon region with fewer job benefits coupled with distance from the new road would be further affected because they would not benefit from reduced costs of supplies and fuel; only communities close to the road, such as Bettles/Evansville (Alternatives A and B) and Hughes (Alternative C) have potential to see benefits from reduced costs of fuel, goods, and groceries, including fuel, fishing and hunting tools, snowmobiles and boats that help in the subsistence harvest. Other subsistence communities in the Doyon region would experience the impacts of the road crossing their subsistence use areas but would be too far from the road to benefit from the reduced costs of subsistence activities.

All alternatives would cross ANCSA Native corporation land (see EIS Appendix F, Table 5), some of it Doyon Limited land and some NANA land (regional corporations) and some of it land associated with smaller Native corporations. It is likely the corporations would sell gravel from their lands for road construction and maintenance, and may collectively receive tens of millions of dollars (Cardno 2015). Shareholders likely would receive dividends from the regional corporations bolstered by those payments. NANA shareholders would be expected to benefit substantially more because of payments from the mines in addition to payments for gravel. These funds may help individuals adapt to subsistence impacts by providing funds toward subsistence equipment and supplies, but the funds would not go solely to shareholders in communities experiencing project impacts to subsistence; the funds would go all shareholders.

Those communities close to the road that end up connecting by spur road or trail, or just by snowmobile or boat, could experience a change in the balance between the subsistence economy and cash economy. For instance, a study on the economic benefits and subsistence impacts of public-use roads found that communities' locations along public roads were associated with an approximately one-third decrease in subsistence harvests, with little to no benefit in terms of increased personal incomes (Magdanz et al. 2016). The impacts of a private use road have not been well investigated.

Over time, decreased abundance and availability of resources, in combination with decreased access to or avoidance of traditional harvesting areas, may reduce overall participation rates in subsistence or harvest amounts. When subsistence users' opportunities to engage in subsistence activities are limited, then their opportunities to transmit knowledge about those activities, which are learned through participation, are also limited. If residents stop using portions of the project area for subsistence purposes, either due to avoidance of development activities or reduced availability of subsistence resources, the opportunity to transmit traditional knowledge to younger generations about those traditional use areas would be diminished. While communities would likely maintain a cultural connection to these areas and acknowledge these areas as part of their traditional land use area, the loss of direct use of the land could lead to reduced knowledge among the younger generation of place names, stories, and traditional ecological knowledge associated with those areas. There would also be fewer opportunities for residents to participate in the distribution and consumption of subsistence resources, ultimately affecting the social cohesion of the community. Any changes to residents' ability to participate in subsistence activities, to harvest subsistence resources in traditional places at the appropriate times, and to consume subsistence foods could have long-term or permanent effects on the spiritual, cultural, and physical well-being of the study communities by diminishing social ties that are strengthened through harvesting, processing, and distributing subsistence resources, and by weakening overall community well-being.

6.4.2 Alternative A: AIDEA Proposed Route (GAAR North) to the Dalton Highway

Alternative A crosses use areas for 12 subsistence study communities, including Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Kobuk, Selawik, Shungnak, and Wiseman. Thus, these communities would likely experience direct impacts of the AMDIAR on their subsistence uses in terms of direct loss of subsistence use areas, impacts on user access, and direct impacts to resource availability (e.g., localized disruptions to resource behavior or distribution resulting from project activities and infrastructure). Impacts to resource abundance or larger impacts to resource availability resulting from changes to migration routes or habitat use could extend to other subsistence study communities or, the 42 WAHWG study communities, and the 32 fish study communities.

Communities with the highest number of resource uses crossed (five or more resources) include Bettles, Evansville, Shungnak, Ambler, Coldfoot, Kobuk, and Wiseman. Alternative A bisects community uses for Bettles, Evansville, Kobuk, and Shungnak, (i.e., community residents would need to cross or detour around the road in order to access a large portion of their subsistence use area), and therefore in terms of access these communities would be most heavily impacted by Alternative A. Bettles, Evansville, and Kobuk would be located closest to the road corridor and would therefore be more likely to experience benefits of the road related to lowered costs of subsistence supplies/equipment and other goods in the event that these communities can develop a way to create an access route from their community to the nearby corridor (Kobuk is the only community that will have direct access). Potential negative impacts of increased access to communities are often associated with the increased potential or ease of bringing drugs, alcohol, and other prohibited substances into communities and the negative sociocultural impacts that could ensue. The attending Alaska Native entities during scoping expressed concerns that increased access to subsistence use areas and increased access to and from communities may negatively impact the cultural wellbeing of many in the area. The Native Village of Allakaket discussed the potential effects of outside access to their community, noting that while road access to the community will likely not be of much benefit to residents, it may create opportunities for bootleggers and drug dealers to access the community:

> The road is too far north from our village to make it practical to bring in groceries and goods to reduce the cost of living, but it is not so far as to prevent those who want to make a great deal of money from drugs and alcohol from driving down the road and then by snowmachine or four-wheeler to Allakaket. Regardless of whether mining or trucking companies prohibit substance abuse, there will be individuals willing to bring it into Allakaket. We have seen no plans on the part of the state or federal government to provide a greater police presence to stop this. We in Allakaket do not even have a public safety officer to address this. (Allakaket Tribal Council 2018)

> [The Project] should take into account the potential for reduced subsistence diets and increases in access to alcohol and drugs. (Allakaket Tribal Council 2018)

Key subsistence harvesting areas that Alternative A would cross through include the Ambler River, Kobuk River, Mauneluk River, Beaver Creek, Reed River, Alatna River, Upper Koyukuk River, Iniakuk River and Lake area, John River, Wild River, and South and North Fork Koyukuk river. Each of these locations are traditional harvesting areas for multiple communities, particularly among the Kobuk River Region and Koyukuk River Region communities and for multiple resources (see Sections 5.1 and 5.3).

Resources for which availability could be directly affected under Alternative A include caribou (nine communities), moose (nine communities), small land mammals (eight communities), migratory birds (six communities), Dall sheep (six communities), and vegetation (six communities) (see Table 43). Of these resources, moose, caribou, and vegetation are resources of high importance to majority of the potentially affected study communities (see Table 43). For a smaller number of communities, harvests of salmon, non-salmon fish, bear, and eggs could be directly affected.

Alternative A crosses through key migratory range for the WAH and could therefore affect the availability of WAH caribou to the south (in the fall) and north (in the spring/summer) of the road. The road runs perpendicular to the primary direction of movement during migration, thus introducing an impact source that could lead to caribou being diverted and delayed during migration. Caribou cross the Alternative A corridor during both the fall and winter (see Section 3.3.4, Mammals, of the Supplemental EIS). Alternative A is to the north of a majority of the study communities whose caribou hunting activities peak in the fall. Deflections of caribou to the north of these communities during the fall months could have substantial impacts on resource availability to subsistence harvesters. The likelihood of such deflections would vary annually based on environmental and development-related (e.g., traffic and noise levels) factors. The importance of maintaining the north-south migration is evident in traditional hunting methods which place hunting camps to the south of rivers and allow the first of the caribou herd to pass by before hunting them (WAHWG 2017). Direct impacts to caribou availability along the road corridor resulting from smaller-scale disruptions may occur for the communities of Bettles, Evansville, Shungnak, Ambler, Kobuk, Alatna, Allakaket, Anaktuvuk Pass, and Selawik. For Anaktuvuk Pass, the road corridor is on the periphery of their caribou hunting areas. Larger-scale disruptions may extend to other users of the WAH. Alternative A does not occur within the range of the RMH. Traffic increases on the Dalton Highway may affect the HHH and may affect subsistence activities near the Dalton Highway.

Under Alternative A, fish availability could be directly affected for four study communities: Bettles, Evansville, Shungnak (for salmon), and Ambler. Non-salmon fish are a resource of high importance to these communities. In particular, sheefish spawning grounds which are particularly sensitive to changes in environmental conditions, occur along the Alatna and Kobuk rivers, which are crossed by the Alternative A corridor. Any impacts from construction or operation of the road corridor which change water quality downstream could affect sheefish spawning grounds and could impact communities downstream from the corridor on the Koyukuk and Ambler River drainages, including Alatna, Allakaket, Hughes, Huslia, Ambler, Kobuk, Shungnak, Kiana, and Noorvik. In the Kobuk-Selawik river basin, sheefish are a resource of high importance to the communities of Ambler, Kiana, Kobuk, and Noorvik. If impacts extend outside the Kobuk-Selawik river basin, then other communities with a high reliance on sheefish (Grayling, Nunam Iqua) could also be affected (see Table 49). These communities could experience indirect impacts if larger changes to fish health or availability occur. Alternative A has a greater potential to directly affect sheefish spawning grounds compared to Alternative C. In addition to sheefish spawning grounds, Alternative A also crosses streams in the Upper Koyukuk drainage which support spawning for Chinook, chum salmon, and whitefish, including the Alatna River, Henshaw Creek, North Fork Koyukuk River, Wild River, and John River. Chum salmon are a resource of high importance to most communities in the Koyukuk River basin (see Table 49). Impacts to these spawning grounds could also have larger effects to communities who harvest salmon downstream from the road corridor.

6.4.3 Alternative B: AIDEA Alternative Route (GAAR South) to the Dalton Highway

Alternative B is similar to Alternative A in terms of the communities which could be directly affected and the nature of the potential impacts. Alternative B crosses use areas for 12 subsistence study communities: Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Kobuk, Selawik, Shungnak, and Wiseman (see Table 44). Thus, these communities would likely experience direct impacts of the AMDIAR on their subsistence uses in terms of direct loss of subsistence use areas, impacts on user access, and direct impacts to resource availability (e.g., localized disruptions to resource behavior or distribution resulting from project activities and infrastructure). The primary difference between Alternatives A and B in terms of direct community impacts is that the route would not overlap with migratory bird hunting areas for Ambler but would overlap with vegetation harvest areas for that community. Alternative B would cross through similar key subsistence harvesting areas as Alternative A, with the addition of the Hogatza River area and Norutak Lake which are used by multiple Kobuk and Koyukuk River Region communities (see Sections 5.1 and 5.3). Alternative B would cross within about seven miles of sheefish spawning habitat on the Reed River and would therefore introduce higher potential for degradation and contamination of that habitat from spills (see Section 3.3, Fish and Aquatics, of the Supplemental EIS). Such changes would particularly affect communities for which this resource is of high importance (Ambler, Kiana, Kobuk, and Noorvik). If impacts extend outside the Kobuk-Selawik river basin, then other communities with a high reliance on sheefish (Grayling, Nunam Iqua) could also be affected (see Table 49). In addition, impacts related to water withdrawals would be somewhat higher under Alternative B due to ice roads (and water withdrawals) occurring closer to key sheefish spawning habitat. For caribou, the effects would the same as under Alternative A (see Section 3.3.4, Mammals, of the Supplemental EIS). Impacts to resource abundance or larger impacts to resource availability resulting from changes to migration routes or habitat use could extend to other subsistence study communities or, in the case of caribou, to the 42 WAHWG study communities.

6.4.4 Alternative C: Diagonal Route to the Dalton Highway

Alternative C crosses use areas for 12 subsistence study communities (see Table 47), including Alatna, Allakaket, Ambler, Anaktuvuk Pass, Hughes, Huslia, Kiana, Kobuk, Selawik, Shungnak, Stevens Village, and Tanana. These communities would likely experience direct impacts of the AMDIAR on their subsistence uses in terms of direct loss of subsistence use areas, impacts on user access, and direct impacts to resource availability (e.g., localized disruptions to resource behavior or distribution resulting from project activities and infrastructure). Impacts to resource abundance or larger impacts to resource availability resulting from changes to migration routes or habitat use could extend to other subsistence study communities or, in the case of caribou, to the 42 WAHWG study communities. However, larger migratory changes are less likely under Alternative C than Alternatives A and B (see discussion below).

Communities with the highest number of resource uses crossed (five or more resources) include Allakaket, Hughes, Kobuk, Shungnak, Ambler, Stevens Village, and Alatna. Alternative C bisects community uses for Hughes, Kobuk, and Shungnak (i.e., community residents would need to cross or detour around the road in order to access a large portion of their subsistence use area), and therefore in terms of access these communities would be most heavily impacted by Alternative C. These three communities would also be most likely to experience benefits of the road related to lowered costs of subsistence supplies/equipment and other goods in the event that these communities can develop a way to create an access route from their community to the nearby corridor. The community of Kobuk would be located directly along the Alternative C route.

Key subsistence harvesting areas that Alternative C would cross through include the Lower Kobuk River, Pah River Flats, Hogatza River, Hughes Creek, Indian River, Melotzina River, Ray Mountains, and Ray River. Each of these locations are traditional harvesting areas for multiple communities, particularly among the Koyukuk, Tanana, and Yukon River Region communities (see Sections 5.3, 5.4, and 5.5).

Resources for which availability could be directly affected under Alternative C include small land mammals (11 communities), caribou (10 communities), non-salmon fish (eight communities), moose (eight communities), bear (seven communities), vegetation (six communities), migratory birds (six communities), and salmon (five communities) (see Table 45). For a smaller portion of communities, harvests of Dall sheep and upland game birds could be affected. For a majority of the study communities, caribou, moose, non-salmon fish, salmon, and vegetation are resources of high importance (see Table 45). Alternative C would have greater noise impacts compared to Alternatives A and B as it will affect more previously undisturbed land than Alternatives A and B, and noise would spread wider under Alternative C due to terrain differences. Thus, impacts on resource availability and user avoidance related to noise may occur over a greater area under Alternative C (Section 3.2.6)

Alternative C does not cross through the primary migratory range for the WAH and does not intersect the primary north-south migratory movement of the herd. Therefore, the alternative would be less likely to affect migration routes and behavior for WAH caribou and less likely to have direct and indirect effects on resource availability to the caribou study communities. However, Alternative C does occur within the wintering grounds for the WAH and affects an overall greater amount of WAH habitat, and therefore direct impacts to caribou availability along the road corridor may occur for the communities of Allakaket, Hughes, Kobuk, Shungnak, Ambler, Alatna, Huslia, Anaktuvuk Pass, Selawik, and Tanana, all of whom have caribou hunting areas overlapped by the alternative. Loss of winter habitat would be particularly detrimental to the WAH due to the difficulty in accessing lichen. Reduced survival during winter resulting from a lack of foraging opportunities could have larger effects outside the immediate area and affect more distant WAH communities. As noted above, some past population declines in the WAH have been attributed to extreme winter weather conditions, lack of access to lichen, and high winter mortality rates (see Section 3.3.4, Mammals, of the Supplemental EIS). For Anaktuvuk Pass, the road corridor is on the periphery of their caribou hunting areas. Alternative C bisects the overall and summer ranges of the RMH; due to the small size of population and herd range, impacts to this herd could be more amplified; however, the RMH is difficult to access and hunted by the subsistence study communities only occasionally and therefore direct impacts to local hunters would be possible but unlikely. No impacts to the HHH would occur as a result of Alternative C.

Compared to Alternatives A and B, Alternative C crosses areas of higher value moose habitat and therefore could have greater impacts to moose availability in nearby communities. Impacts would be relatively localized along the road system and therefore would affect communities with moose hunting areas closest to the road corridor (e.g., Hughes, Kobuk, and Shungnak).

Compared to Alternatives A and B, under Alternative C, fish availability could be directly affected for a greater number of communities (eight communities versus four). Alternative C crosses Kobuk River directly downstream from sheefish spawning habitat. Thus, any changes to waterways which obstruct access to spawning grounds or affect water quality could have larger indirect impacts to communities who harvest sheefish upstream and downstream from the road corridor, including Alatna, Allakaket, Bettles, Evansville, Hughes, Kobuk, Shungnak, Ambler, Huslia, and Kiana. However, Alternative C would be less likely to have direct impacts on sheefish spawning grounds. In addition, while Alternative C would cross more fish streams than alternatives A and B, it would construct more bridges and fewer minor culverts which are more likely to obstruct fish passage. Alternative C would also have more impacts related to ice roads and water withdrawals due to more miles of ice roads under this alternative. In addition to sheefish spawning grounds, Alternative C also crosses streams which support spawning for Chinook and chum salmon. For many Yukon River communities, Chinook salmon is a resource of high importance (see Table 49) and is also a resource of yield concern to the ADF&G. Chum salmon is a resource of high importance in most communities in the Kobuk-Selawik, Koyukuk, and Yukon river basins. Impacts to salmon spawning grounds could also have larger effects to communities who harvest salmon downstream from the road corridor along the Yukon and Koyukuk rivers.

6.4.5 Combined Phasing Option

Under the combined phasing option, the road would be constructed over two, rather than three, phases. This alternative would not involve construction of a pioneer road; instead, the construction road would be constructed to Phase 2 standards. Reducing the overall length of construction from 3 to 4 years to 2 to 3 years would reduce the duration of construction-related noise and activity, thus reducing long-term impacts to subsistence users and resources. Initial construction of a wider road would require longer culverts and more water withdrawals for ice roads and ice pads, thus having greater potential short-term impacts to fish related to water quantity and quality. While impacts would continue during operation, human activity and noise from air traffic would likely be less. Both air traffic and human activity can cause disturbances to wildlife, resulting in skittish behavior and changes in resource distribution and movement. Constructing the road to Phase 2 standards may lessen, but not eliminate, subsistence user concerns related to fish and water impacts.

6.5. Community Impact Indicator Summaries

This section presents a summary of impact indicators by community and alternative. Subsistence study communities with the greatest number of resources of high importance and use areas bisected by the project (compared to having partial, peripheral, isolated, or no use areas crossed by the project) would likely experience the greatest intensity of effects related to the project. The following definitions are used in defining the level of project intersection with community use areas:

- Bisect – proposed project crosses through the center or large portions of a community’s use areas
- Partial – proposed project intersects a portion of use areas near the community
- Periphery – proposed project intersects use areas located on the outer edge of the community’s use areas
- Isolated – proposed project intersects community use areas in one specific, contained location
- None – proposed project does not intersect with the community’s use areas

In summary, for Alternatives A and B, Shungnak, Evansville, Bettles, and Kobuk would experience the greatest intensity of impacts due to the greater number of resources of high importance that are overlapped with the Project and that their subsistence use areas are bisected by the Project (Table 50,

Table 51). Ambler, Allakaket, and Alatna could also experience a higher intensity of impacts due to greater numbers of resources of higher importance and larger portions of use areas potentially affected. Alternative C would be similar except Bettles and Evansville would be unlikely to experience effects and Hughes would be added to the list of communities that would experience greater impacts from the Project (Table 52). These tables do not account for the potential for larger indirect effects that could occur, particularly for resource availability impacts, which are more uncertain and for which systematic, quantifiable impact indicators are not readily available.

Table 50. Alternative A impact indicator summary – resource importance and use areas

Community	Number of high resources crossed	Number of moderate resources crossed	Number of low resources crossed	Number of resource of indeterminate importance crossed	Level of project intersection with use areas
Shungnak	4	2	2	0	Bisect
Evansville	4	2	2	0	Bisect
Bettles	3	3	2	0	Bisect
Kobuk	2	2	2	0	Bisect
Ambler	3	3	1	0	Partial
Allakaket	2	0	2	0	Partial
Alatna	1	1	2	0	Partial
Wiseman	3	2	0	1	Periphery
Selawik	1	0	0	0	Periphery
Hughes	0	0	0	1	Periphery
Coldfoot	1	0	2	3	Isolated
Anaktuvuk Pass	1	0	1	0	Isolated
Beaver	0	0	0	0	None
Buckland	0	0	0	0	None
Galena	0	0	0	0	None
Huslia	0	0	0	0	None
Kiana	0	0	0	0	None
Kotzebue	0	0	0	0	None
Livengood	0	0	0	0	None
Manley Hot Springs	0	0	0	0	None
Minto	0	0	0	0	None
Nenana	0	0	0	0	None
Noatak	0	0	0	0	None
Noorvik	0	0	0	0	None
Rampart	0	0	0	0	None
Stevens Village	0	0	0	0	None
Tanana	0	0	0	0	None

Table 51. Alternative B impact indicator summary – resource importance and use areas

Community	Number of high resources crossed	Number of moderate resources crossed	Number of low resources crossed	Number of resource of indeterminate importance crossed	Level of project intersection with use areas
Evansville	4	2	2	0	Bisect
Shungnak	4	2	2	0	Bisect
Bettles	3	3	2	0	Bisect
Kobuk	2	2	2	0	Bisect
Ambler	4	2	1	0	Partial
Alatna	1	2	2	0	Partial
Allakaket	2	0	2	0	Partial
Wiseman	3	2	0	1	Periphery
Selawik	1	0	0	0	Periphery
Hughes	0	0	0	1	Periphery
Coldfoot	1	0	2	1	Isolated
Anaktuvuk Pass	1	0	1	0	Isolated
Beaver	0	0	0	0	None
Buckland	0	0	0	0	None
Galena	0	0	0	0	None
Huslia	0	0	0	0	None
Kiana	0	0	0	0	None
Kotzebue	0	0	0	0	None
Livengood	0	0	0	0	None
Manley Hot Springs	0	0	0	0	None
Minto	0	0	0	0	None
Nenana	0	0	0	0	None
Noatak	0	0	0	0	None
Noorvik	0	0	0	0	None
Rampart	0	0	0	0	None
Stevens Village	0	0	0	0	None
Tanana	0	0	0	0	None

Table 52. Alternative C impact indicator summary – resource importance and use areas

Community	Number of high resources crossed	Number of moderate resources crossed	Number of low resources crossed	Number of resource of indeterminate importance crossed	Level of project intersection with use areas
Shungnak	5	2	1	0	Bisect
Kobuk	4	3	2	0	Bisect
Hughes	4	3	1	1	Bisect

Community	Number of high resources crossed	Number of moderate resources crossed	Number of low resources crossed	Number of resource of indeterminate importance crossed	Level of project intersection with use areas
Allakaket	4	3	2	0	Partial
Ambler	4	3	1	0	Partial
Alatna	1	3	1	0	Partial
Stevens Village	3	2	2	0	Periphery
Tanana	2	0	1	0	Periphery
Huslia	1	2	0	0	Periphery
Selawik	1	0	1	0	Periphery
Anaktuvuk Pass	1	0	1	0	Isolated
Kiana	1	0	0	0	Isolated
Beaver	0	0	0	0	None
Bettles	0	0	0	0	None
Buckland	0	0	0	0	None
Coldfoot	0	0	0	0	None
Evansville	0	0	0	0	None
Galena	0	0	0	0	None
Kotzebue	0	0	0	0	None
Livengood	0	0	0	0	None
Manley Hot Springs	0	0	0	0	None
Minto	0	0	0	0	None
Nenana	0	0	0	0	None
Noatak	0	0	0	0	None
Noorvik	0	0	0	0	None
Rampart	0	0	0	0	None
Wiseman	0	0	0	0	None

Project intersection is less relevant to determining indirect and downstream impacts on subsistence uses of caribou and fish. Instead, the relative importance of these resources to individual communities is most relevant to the likelihood and magnitude of these impacts. The relative importance of caribou, sheefish, Chinook salmon, and chum salmon to the caribou and fish study communities are summarized in Table 48 and Table 49. The methods for cacluation resource importance are provided in Section 6.3, Impact Indicators.

Caribou are of high importance to 27 of the 42 caribou study communities, most of which are located in the Kobuk-Selawik and Koyukuk drainages and on the North Slope. These are the communities that would be most likely to be affected under each of the action alternatives. Caribou study communities with a lower reliance on caribou are located primarily on the Yukon River (see Table 48).

Non-salmon fish species are of high importance to 24 of the 32 fish study communities. Specifically, sheefish are of high importance to 6 of the 32 fish study communities, and these communities are located on the Kobuk and Yukon river drainages. Chinook salmon are of high importance to 9 of 32 fish study communities, and these communities are located primarily on the Yukon River drainage. Finally, chum salmon are of high importance to 19 of the 32 study communities, and these communities are located throughout the Kobuk-Selawik, Koyukuk, and Yukon river drainages (see Table 49).

6.6. Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth

This section discusses other indirect and cumulative impacts of the AMDIAR and associated growth in the region, including mining development and other road access. Various economic, social, and environmental changes throughout history have affected subsistence use patterns of the study communities and required subsistence users to be highly adaptive. Major historic events that have affected subsistence in the region include pre-contact trade and contact between Iñupiat and Athabascans; initial European contact that introduced western trade goods; the fur trade in the early nineteenth century that introduced a market economy and the use of firearms; the late nineteenth and early twentieth century gold rush that resulted in territorial shifts, establishment of new comm unities, intermarriage, and a subsequent starvation period compounded by a caribou decline; introduction of new technologies such as outboard motors; and missionaries and school requirements that resulted in the centralization of communities and abandonment of semi-nomadic subsistence patterns (Watson 2018).

More recent actions which have affected subsistence uses and resources within the study region include mineral exploration (e.g., South32 mining exploration between the Dalton Highway and GAAR), mining development (including the Red Dog Mine), infrastructure projects, scientific research, recreation and tourism, sport hunting and fishing, hunting and harvesting regulations, establishment of wildlife refuges and national parks, and environmental changes resulting from climate change. Construction of the TAPS and Dalton Highway have affected subsistence access and resource availability for communities in the eastern portion of the project area, with many residents believing that the highway and pipeline have resulted in changes to caribou migration across the region. The Red Dog Mine, including the DMTS and port site, has introduced contamination concerns for local residents, particularly Kivalina residents who are situated downstream from the mine, and have affected resource distribution and migration for resources such as caribou and marine mammals possibly resulting in decreased harvests of these resources over time (EPA 2009). Increased sport hunting and fishing in the region and associated air traffic have resulted in increased competition for local subsistence users in addition to disturbance and displacement of subsistence resources such as caribou. The establishment of GAAR in the 1980s also affected access to and use of traditional harvesting areas for residents of nearby communities within the northeastern portion of the project area (Watson 2018). Current subsistence use patterns, as described in Section 5, are the result of the adaptation of communities to all of the above forces of change. Any future actions, regardless of how minor they seem at the time, will also contribute to changes in subsistence patterns.

Impacts of climate change include changes in the predictability of weather conditions such as the timing of freeze-up and breakup, snowfall levels, storm and wind conditions, and ice conditions (e.g., ice thickness on rivers and lakes), all of which affect individuals' abilities to travel to subsistence use areas when resources are present in those areas. In addition, subsistence users may experience greater risks to safety when travel conditions are not ideal. Changes in resource abundance or distribution resulting from climate change can also affect the availability of those resources to subsistence users or may cause subsistence users to travel farther and spend more time and effort on subsistence activities (Brinkman 2016).

Construction and operation of the AMDIAR would likely result in changes to resource abundance, resource availability, and user access for many of the subsistence study communities. The project would introduce a large industrial road corridor into an area that was previously undeveloped and which was used primarily for subsistence and recreational purposes. Under any alternative, 12 communities have direct uses of the project corridor(s), and a majority of these communities are rural, low-income, non-road-connected communities who rely on subsistence to support their mixed economy. The AMDIAR would introduce impacts to resource abundance and resource availability for key resources such as sheefish, whitefish, salmon, and caribou, while also reducing (rather than facilitating) access to traditional harvesting areas. The road itself may increase access to and reduce costs of commercial goods for certain communities; however, few local jobs directly associated with the road (e.g., maintenance and operation) will be available after construction. Impacts to resource availability and user access will be most pronounced for communities who do not experience increased income associated with the road (i.e., road or mining jobs) and/or do not experience benefits of the road related to lowered costs of subsistence supplies/equipment, food, or other goods. These communities would have less opportunity to purchase or invest in fuel and equipment to adjust to changes in access and resource availability.

RFAs within the region that could contribute to subsistence impacts include development of the Ambler Mining District (Arctic, Bornite, Sun, and Smucker projects); use of the AMDIAR for commercial access; use of the AMDIAR for commercial use by local communities and Native Allotment owners. Secondary access roads connecting the AMDIAR to other mining areas and claims, Air Force lands, and local communities are also a potential. Other RFAs that could contribute to the impacts of the AMDIAR include mining projects outside the Ambler Mining District (Manh Cho Mine), infrastructure projects (OTZ Telephone Cooperative project, Dalton Highway improvements, broadband connectivity projects), and changes in land management. See Appendix H for more details.

The AMDIAR will facilitate additional mining and other development throughout the study region, which will contribute to impacts on subsistence resource abundance, resource availability, and user access for subsistence users across the region. The hypothetical development scenario assumes that the road would result in aggressive exploration of the Ambler Mining District and that the four most advanced mining projects would be developed. With production activities at each development expected to occur over 5 to 35 years, the overall life of mining development associated with the road would likely extend well beyond 35 years. While the proposed road would be the primary access to the District, access roads would likely occur to individual developments, contributing to habitat fragmentation in the region. Construction and mining activities associated with development of these projects would result in a long-term increase in impacts associated with human activity, noise, traffic, infrastructure, and contamination, which could affect the abundance and availability of resources such as caribou, moose, fish, waterfowl, and vegetation. Direct impacts would be highest for the communities closest to these four development projects: Kobuk, Shungnak, and Ambler, although indirect impacts would also occur for communities who harvest fish downstream from the projects and communities who harvest WAH caribou.

Mining development will result in the physical removal of traditional subsistence hunting and harvesting areas for the study communities in addition to decreased access to these areas through security/access restrictions and through user avoidance of development areas. The overall area available for subsistence use will likely shrink over time due to the increasing presence of infrastructure and human activity within traditional use areas.

Construction of additional access roads to mines, communities, and other locations will contribute to fragmentation of habitat for resources such as caribou and moose, which would remove usable habitat for these resources and in the case of caribou could cause substantial changes in range distribution. While the construction of roads would result in a net loss of current habitat areas, clearing and maintenance of ROWs may also create new movement corridors and feeding areas, particularly for moose. Direct mortalities may occur as a result of collisions with vehicles, particularly if animals such as moose are attracted to the road ROW as a movement corridor. Impacts to migrating caribou increase with density of roads and infrastructure (see Section 3.3.4, Mammals, of the Supplemental EIS). Impacts to caribou migration and abundance could reverberate throughout the communities who rely on the WAH. These impacts would be particularly likely among communities for whom caribou is a resource of high importance (see Table 21), but could extend beyond those communities if a decline in caribou harvests affects sharing networks or results in higher harvests of other resources (e.g., moose).

Mining activities would cause further disturbance to wildlife through the presence of mine pits and noise and disturbance from heavy machinery, blasting, and human activity. Mine development and additional road construction would also contribute to further contamination and alteration of waterways which may cause substantial degradation to spawning grounds and other habitat for non-salmon fish (sheefish and other whitefish) and salmon that are key subsistence species across the region. Mining and further road development could have population-levels effects on certain fish species, particularly if mine activities result in contamination or degradation of Kobuk River sheefish spawning grounds and Alatna River whitefish spawning grounds. As discussed in Section 3.3.2 of the Supplemental EIS (Fish and Aquatics), mining activities, particularly in the absence of proper mitigation, can alter water flows, reduce water quantity, and cause contamination and changes in water chemistry which could affect essential fish habitat. Such impacts have been seen within the study region with past mining activities, such as placer gold mines. Potential cumulative impacts of potential large scale mining projects on fish health and abundance, including impacts of tailings management and release of toxic materials, changes in water chemistry, transport and movement of soil and rock, construction of additional infrastructure, surface and groundwater disruptions, dewatering, and toxic water treatment are discussed in Section 3.3.2 of the Supplemental EIS (Fish and Aquatics). Mining related removal of groundwater would lower the water table well below natural stream or lake levels and considerably reduce flow into streams and the hyporheic zone. Depending on the location and scale of operation, dewatering has the potential to substantially reduce groundwater flows into important spawning, egg incubating, and wintering habitats relied upon by salmon, sheefish, whitefish, and other important subsistence species which could have potential population level impacts (SEIS Section 3.3.2, Fish and Aquatics). One of the four potential mine projects is located on a stream that is a direct tributary of the Kobuk River's only sheefish spawning grounds, the other three enter downstream of that spawning ground. Contamination of these tributaries could have population level impacts on sheefish, a key subsistence resource in the study region. Many communities across the region, including in the Kobuk-Seward, Koyukuk, and Yukon river basins, have a moderate to high reliance on sheefish (see Table 22). Impacts of a decline in sheefish could have effects on all of these communities, and may have larger impacts if the decline in sheefish results in a higher harvest of other resources.

The potential for increased access into the project area resulting from local and non-local use of the project road and ROW (regardless of legality) may increase competition in the region for certain resources and decrease harvesting success for local hunters. Secondary access roads developed by communities would likely be used, at least by local residents, for subsistence harvesting activities and could create harvesting corridors and increase competition within those areas. Even if the road is reclaimed, the remaining cleared area within ROW would likely become accessible for local and non-local hunters traveling by snowmachine and off-road vehicles. If the road, ROW, or reclaimed ROW increases access into the region, state and federal regulators may respond by introducing stricter hunting and harvesting regulations as well, which would affect availability of resources to local communities. Increased competition and decreased resource availability may result in residents having to travel farther and spend more time, money, and effort to harvest resources such as moose and caribou.

The potential for increased access into the region was a key concern voiced by residents during both scoping and traditional knowledge studies associated with the AMDIAR (Watson 2014, BLM 2018b). Many residents do not believe that the road will remain private and point to previous roads which they believed to have restricted access which were eventually opened to the public (e.g., the Dalton Highway). The WAHWG cited the Dalton Highway as an example of how restricted access roads can easily be opened to the public due to political and public pressure:

> The WACH declined for much of the last two decades. Reduced population levels during that time led to harvest restrictions. Although the most recent caribou count indicates a population that is stabilizing or possibly starting to increase, concerns remain that increased access due to roads could greatly compound user conflict and limited availability of caribou. We recognize that the proposed road is currently specified as being commercial-only. However, history (e.g., with the Dalton Highway) suggests that once roads are established they eventually become used by the public. We are greatly concerned that the Ambler Road will not remain closed to public use given this history and the multiple jurisdictions (State, Federal and Native) that the proposed road would cross. (Western Arctic Caribou Herd Working Group 2018)

In addition, it is unclear whether the road would allow access to small mining claims; while large mines would likely have policies regarding hunting and fishing by workers, smaller mining outfits or individuals may allow these activities. According to Guettabi et al. (2016), increased access resulting from the road and/or ROW would likely reduce harvest success for local hunters, particularly for moose. Specifically, the study analyzed harvest rates by the number of hunters in game management units (GMUs) and found that the quantity of moose harvested was inversely related to the number of moose hunters within a GMU. The study estimated that for every one percent increase in the number of moose hunters in the project area, communities along the project corridor would harvest approximately 1.09 times less moose than if there were no additional access to the region. Unauthorized public use of the road may result in use of the road corridor by non-local hunters, increasing competition for local communities and potentially affecting resource availability. Increased hunting activity along a road corridor into a previously road-free region could result in changes to resource distribution and behavior along the road corridor, particularly if hunting activity deflects migrating resources such as caribou. Increased access of the area resulting solely from illegal trespass of restricted roads and/or ROWS would likely not have the same level of impacts on harvesting success as a public road would. According to the WAHWG (2017), communities within the region have already experienced increased competition in traditional hunting areas, with greater numbers of hunters concentrated within smaller areas. Sport hunting is a key issue within the region for subsistence harvesters, and illegal access to the area via a road or ROW would contribute to these impacts.

The BLM is currently preparing an EIS regarding potential revocation of ANCSA 17(d)(1) withdrawals, including parcels in the Kobuk-Seward planning area. Revocation of withdrawals on certain parcels of land could result in changes in subsistence management, including the loss of federal subsistence priority on those lands for local residents. Such changes, in combination with increased hunting competition in the region, could affect subsistence uses and harvest success for certain study communities.

If the AMDIAR results in reduced availability of subsistence resources such as moose, caribou, sheep, small land mammals, fish, waterfowl, or vegetation, or if it decreases access to traditional use areas, then residents from the study communities may have to spend greater amounts of time, effort, and money in order to locate and procure these resources. Residents may also have to travel farther to less familiar areas to find resources, with greater risks to health and safety. While some hunters respond to changes in resource availability by taking more trips and increasing costs in order to harvest what they need, others may choose to take fewer trips because of lack of funds or reduced success.

Communities in the study region currently have high levels of unemployment and low income with high costs of living; despite these factors, many of the study communities have remained stable and resilient through a mixed economy which revolves around subsistence hunting and harvesting (Guettabi et al.

2016). Construction of the AMDIAR and associated mining development would result in increased employment opportunities and income for residents of some of the subsistence study communities. Residents may invest the income from construction, operation, and mining jobs into supplies and equipment (e.g., snowmachines, outboards, fuel, ammunition) to support subsistence activities. In addition, the ability to use the road to transport commercial goods, including subsistence supplies and equipment, may also reduce certain costs associated with subsistence. However, at this time, there is no guarantee that this benefit is certain for any community. In addition, benefits associated with increased employment and income would be most likely to occur for NANA shareholders and communities due to agreements between mining companies on NANA lands regarding local hire policies. Thus, interior communities such as Alatna, Allakaket, Bettles, and Evansville may experience subsistence impacts (e.g., reduced resource availability and access to traditional harvesting areas) without the counter benefits of increased income and employment associated with mine development.

Those individuals who obtain long-term employment associated with the AMDIAR or associated mining developments may experience reduced time to engage in subsistence activities, although they may continue to invest monetarily in and support subsistence activities for others in the community. Those with mining jobs may move away from their communities, as some have done in association with the Red Dog Mine, to larger urban centers. The benefits of increased employment and income will likely only occur for certain households and certain communities and could cause social tensions associated with increased inequality. As noted in BurnSilver and Magdanz (2019), household responses to social, economic, and environmental change are not homogenous, and benefits of economic growth are generally not distributed equally. Certain households are more vulnerable to changes in community economic status and disruptions in subsistence harvesting, social ties, and sharing. Household sensitivity and adaptive capacity are good indicators of how households will respond to sudden change. Factors determining household sensitivity include low-harvest, low-income households, or households that are “unbalanced” or “spread thin” (e.g., medium-harvest, low income; or low harvest, high income). Certain communities have greater adaptive capacity, overall, than others, but all communities show significant variation among individual households. Thus, increased economic benefits to a region will not be distributed equally to all households and the most vulnerable households will likely experience the greatest consequences of subsistence disruptions through weakened social networks and the inability to adapt to changes in resource availability.

In rural Alaska, certain households or individuals play a particularly important role in harvesting and distributing subsistence foods to households and individuals who are unable to hunt or harvest for themselves. Research from the ADF&G has found that as a general rule, 30 percent of households, referred to as “super-harvester households,” generally harvest 70 percent of the total community harvest (Wolfe 2004). Harvests may be even more concentrated for specific resources such as caribou (SRB&A Forthcoming, Kofinas, BurnSilver, Magdanz, Stotts, and Okada 2016). An increase in employment associated with the road and mine developments may result in some households or individuals shifting away from their roles as super-harvesters as they have less time to engage in subsistence activities as they once did. Subsistence roles within a community regularly change and evolve due to household circumstances (e.g., age and number of household members, employment levels, income, health), and communities generally adapt to these changes, with new harvesters filling or returning to previous subsistence roles as their circumstances allow and as the need presents itself. In addition, the roles of super-harvester households and high-earning households are not mutually exclusive; in fact, Kofinas et al. (2016) found that many super-harvester households are high income households, and the vast majority of high harvesting households have at least one employed household member. Other research has shown an inverse relationship between income and harvesting levels, with high income associated with lower harvests (Guettabi, Greenberg, Little, and Joly 2016). On a community scale, Magdanz, Greenberg, Little, and Koster (2016) found a 2.5 percent decrease in in household mean harvests for each 10 percent increase in household income. In a single study community controlling for household size, the harvest-income association disappeared. Thus, recent research suggests that at a community and household level, increased income is not associated with increased harvest.

It is likely that responses to increased income will vary by households; some households will invest their increased income into subsistence pursuits (including providing gas and supplies to active harvesters from other households), while others may gradually participate less in the subsistence economy. A sudden increase in employment levels in a community may cause at least a temporary disruption in social ties and roles within the subsistence study communities, which could cause a decline in the distribution of subsistence foods for a period of time.

A number of studies have documented the resilience of subsistence communities in the face of sudden or dramatic changes, noting that communities and households often respond to scarcity of one resource (caribou) by increasing their harvests of another, or by increasing income sources when subsistence foods are less available (Martin 2015). Resilience allows communities and households to adjust to changes while maintaining access to key cultural resources and activities. However, the ability of households to be resilient in the face of change does not negate the existence of impacts, nor does it imply that households can simply adapt to all forces of change. In addition, as discussed above, communities and households are not homogenous in their capacity to adapt to sudden change (BurnSilver and Magdanz 2019) Larger disruptions to subsistence ties, particularly in combination with decreased availability of key subsistence resources, could affect social, cultural, and economic well-being, particularly to the more vulnerable low income, unconnected, and low-harvest households who rely on strong sharing networks for their food security (Kofinas et al. 2016). Over time, if communities in the region become road-connected, the availability of goods, increased income and employment opportunities, and decreased harvesting opportunities could result in an overall decrease in subsistence harvests among the study communities.

Ultimately, the cumulative impacts to subsistence resulting from the AMDIAR, other reasonably foreseeable developments, and climate change could result in reduced harvesting opportunities for local residents and alterations in subsistence harvesting patterns. A recent analysis comparing road-connected communities to non-road-connected communities showed that road-connected communities have substantially lower subsistence harvests than non-road-connected communities (Guettabi et al. 2016). Other research (e.g., Magdanz et al. 2016) has shown an estimated decline of one-third of subsistence harvests for communities along a publicly accessible road, with the potential for a relatively modest increase in income; thus, the loss to subsistence would likely not be offset by an increase in income, nor would increase income address the social or cultural losses to communities. These studies analyzed socio-economic impacts of a road into the study region based on the assumption that the road would eventually become publicThe road-connected communities in its analysis were located on publicly-accessible roads in more densely populated areas. It is reasonable to assume that a road into the area, with associated development activities and the potential for increased employment opportunities and transport of commercial goods, could affect income and subsistence harvest levels for the study communities. If the road eventually became open to authorized public access, then communities would experience much more substantial impacts on subsistence harvests and uses.

The potential for increased access to the region resulting from a publicly accessible road is a primary concern that has been voiced by a number of subsistence study communities (Watson 2014). While the BLM is not considering issuance of a ROW for a public road, it is reasonably foreseeable that the road would become open to public access in the future (see Appendix H, Section 2.2.2). Public use of the road may increase to the project area by non-local hunters, increasing competition for local communities and potentially affecting resource availability. Increased hunting activity along a road corridor into a previously road-free region could result in changes to resource distribution and behavior along the road corridor, particularly if hunting activity deflects migrating resources such as caribou. In addition, an increase in outsiders in the region may have cultural and spiritual effects on local residents if they witness hunting behavior that is inconsistent with traditional Athabascan and Iñupiaq values (e.g., not targeting the "lead caribou" in a herd, wasting meat). Overall, increased non-local access into the region would increase subsistence competition and reduce resource availability and harvest success for local residents.

The combination of reduced resource availability, decreased user access, increased income (for some communities), and increased access to commercial goods (for some communities), will likely alter subsistence harvesting patterns across the region and affect overall subsistence harvests for many of the study communities, particularly those located along the road corridor. The likelihood and magnitude of these effects would increase substantially if the road becomes open to authorized public use. Decreased harvests among the study communities could have wide-ranging effects due to the potential impacts on sharing networks within the region in addition to networks which extend to other regions (Kofinas et al. 2016). Sharing is a key value across the study region which is central to subsistence. Decreased harvests could disrupt existing sharing networks to other communities and regions if residents are unable to share as widely or frequently as they are accustomed.

Cumulative impacts of Alternative A and B related to resource abundance and availability would likely be greater than those under Alternative C, as they would be more likely to affect resource availability of migrating caribou to the subsistence study communities, particularly during the fall months, and are most likely to have population-level effects on sheefish and whitefish, all key subsistence species among the study communities. These alternatives would also be more likely to have larger indirect effects on caribou availability to the 42 caribou study communities, and downstream effects on the 32 fish study communities. However, impacts related to user access and direct impacts on resource availability along the road corridors would be similar across all alternatives and would affect a similar number of study communities.

When subsistence users' opportunities to engage in subsistence activities are limited, then their opportunities to transmit knowledge about those activities, which are learned through participation, are also limited. If residents stop using portions of the project area for subsistence purposes, either due to avoidance of development activities or reduced availability of subsistence resources, the opportunity to transmit traditional knowledge to younger generations about those traditional use areas would be diminished. While communities would likely maintain a cultural connection to these areas and acknowledge these areas as part of their traditional land use area, the loss of direct use of the land could lead to reduced knowledge among the younger generation of place names, stories, and traditional ecological knowledge associated with those areas. There would also be fewer opportunities for residents to participate in the distribution and consumption of subsistence resources, ultimately affecting the social cohesion of the community. Any changes to residents' ability to participate in subsistence activities, to harvest subsistence resources in traditional places at the appropriate times, and to consume subsistence foods could have long-term or permanent effects on the spiritual, cultural, and physical well-being of the study communities by diminishing social ties that are strengthened through harvesting, processing, and distributing subsistence resources, and by weakening overall community well-being.

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Appendix M. ANILCA Section 810 Evaluation

Note: This entire Appendix has been revised from the previous version and replaced with new content that is specific to the Supplemental EIS process only. Therefore, none of the text has been highlighted to indicate new or substantially revised text.

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Table of Contents

A. ANILCA Section 810 Final Evaluation

This analysis of subsistence impacts is prepared for the Ambler Road Draft Supplemental Environmental Impact Statement (EIS) that analyzes the environmental consequences of a proposed road to the Ambler Mining District (District). In 2020, the U.S. Bureau of Land Management (BLM) issued an EIS and an associated Section 810 of Alaska National Interest Lands Conservation Act (ANILCA) evaluation in response to a right-of-way (ROW) application from the Alaska Industrial Development and Export Authority (AIDEA). AIDEA is proposing to construct an all-season industrial access transportation corridor extending from the Dalton Highway to the Ambler Mining District in Northwest Alaska. The road would provide access for exploration and development of the Ambler Mining District and is referred to as the Ambler Mining District Industrial Access Road (AMDIAR). The Final EIS (FEIS) and Section 810 Evaluation, published in March 2020, analyzed the potential impacts of the road on physical characteristics, biological resources, and social systems, including subsistence uses and resources. The BLM and the U.S. Army Corps of Engineers issued a Joint Record of Decision (ROD) in July 2020, subsequently, two groups of plaintiffs challenged the decision in U.S. District Court for the District of Alaska (District Court). In February 2022, the U.S. Department of the Interior (DOI) sought a voluntary remand of the decision in part due to identified deficiencies with the Section 810 evaluation, which was granted by the District Court in May 2022. The BLM has prepared this analysis, on behalf of the DOI, to fulfill the departmental requirements pursuant to Section 810 of ANILCA, as part of the Supplemental EIS to address AIDEA's ROW application.

AIDEA proposes to construct, operate, and remove a 211-mile, all-season, industrial access road from the existing Dalton Highway at milepost (MP) 161 westerly to the District, located within the Northwest Arctic Borough (NAB) in the southern foothills of the Brooks Range of north-central Alaska. Under AIDEA's proposal, approximately 25 miles of the 211 miles of road would cross BLM-managed lands and approximately 26 miles would cross NPS-managed lands. According to AIDEA, the road would provide access for mineral exploration, mine development, and mining operations in the District as well as commercial commerce to communities if spur access roads are developed in the future. The proposed road would not be open to public access. There is currently no road or other surface access to the District from the existing transportation network. The District has long been recognized as containing a variety of mineral deposits, which have been explored or evaluated for more than a century (AIDEA 2016; Grybeck 1977). There are more than 1,300 active mining claims in the District vicinity (ADNR 2018). A 2015 economic analysis identified 4 major mineral deposits, with Ambler Metals' (formerly Trilogy Metals Inc.) Arctic and Bornite deposits the most active (Cardno 2015), which would benefit from an industrial access road to develop the deposits and improve economics.

The Supplemental EIS provides detailed analysis of the following three road alternatives and a no-action alternative:

- No Action Alternative: The No Action Alternative evaluates what would occur if the BLM does not grant a road ROW to AIDEA. The No Action Alternatives provides a baseline for comparison to the other alternatives and it is a potential outcome of the Supplemental EIS.
- Alternative A: Alternative A is AIDEA's proposed alternative. It starts at MP 161 of the Dalton Highway and is 211 miles long with 3,498 acres of DOI-managed lands. The distance from Fairbanks to the road terminus would be 456 miles.
- Alternative B: Alternative B is an alternate route proposed by AIDEA across NPS lands in GAAR. It is a variation on Alternative A, with the same beginning point (MP161) and termini. It

is 228 miles long with 3,083 acres of Department of Interior (DOI)-managed lands. The distance from Fairbanks to the road terminus would be 473 miles.

- Alternative C: Alternative C grew out of scoping comments. The route begins at MP 59.5 of the Dalton Highway and is 332 miles long with 19,090 acres of DOI-managed land. The distance from Fairbanks to the road terminus would be 476 miles.

In addition to the three action alternatives, the BLM also analyzed a phasing option which could be applied to any of the three action alternatives. Under the phasing option, the road would be constructed over two, rather than three, phases. Alternatives would not involve construction of a pioneer road and therefore the construction period would be reduced from 3-4 to 2-3 years.

This ANILCA 810 evaluation has been prepared to incorporate the expanded analysis contained in the associated Supplemental EIS. Namely, increased environmental effects to caribou habitat, forage, and population; the dewatering of streams and groundwater and its impact to salmon, sheefish, and other fish species; spawning areas and other aquatic habitat; and related subsistence uses. New information has been considered about declines in salmon population in the adjacent Yukon-River drainage and reduction in the Western Arctic Herd (WAH). The analysis has been expanded to include other potentially affected communities within the entire range of the WAH and down-stream communities along the Yukon River.

The ANILCA 810 evaluation is deeply informed by Indigenous Knowledge. Indigenous Knowledge, also referred to as traditional knowledge, is a body of observations, oral and written knowledge, innovations, practices, and beliefs developed by Tribes and Indigenous Peoples through interaction and experience with the environment. The information gathered as part of the Ambler Road Project is from ethnographic interviews, Tribal consultation, published and archival materials, and advisory bodies of traditional knowledge holders formed specifically to address subsistence issues.

A.1. Subsistence Evaluation Factors

Section 810(a) of (ANILCA), 16 United States Code (USC) 3120(a), requires that an evaluation of subsistence uses and needs be completed for any federal determination to “withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands.” As such, an evaluation of potential impacts on subsistence under ANILCA Section 810(a) must be completed for the Ambler Road Supplemental EIS. ANILCA requires that this evaluation include findings on three specific issues, as follows:

- The effect of use, occupancy, or disposition of public lands on subsistence uses and needs
- The availability of other lands for the purposes sought to be achieved
- Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes

Three factors are considered when determining if a significant restriction of subsistence uses and needs may result from the proposed action, alternatives, or in the cumulative case, as follows:

- Reduction in the abundance of harvestable resources used for subsistence purposes
- Reduction in the availability of resources used for subsistence caused by alteration of their distribution, migration patterns, or location
- Legal or physical limitations on access of subsistence users to harvestable resources

Each alternative must be analyzed according to these criteria. ANILCA Section 810 also requires that cumulative impacts be analyzed. This approach helps the reader separate subsistence restrictions that could be caused by activities proposed under the four alternatives, including the no action alternative, from those that could be caused by past, present, or future activities that have occurred or could occur in the surrounding area.

An alternative would be considered to significantly restrict subsistence uses if, after consideration of protection measures, such as lease stipulations or required operating procedures, it can be expected to substantially reduce the opportunity to use subsistence resources. Substantial reductions are generally caused by large reductions in resource abundance, a major redistribution of resources, extensive interference with access, or major increases in the use of those resources by non-subsistence users.

If the analysis determines that the proposed action, alternatives, or the cumulative case may significantly restrict subsistence uses, the head of the Federal agency having jurisdiction over the federal public lands in question is required to notify the State of Alaska and appropriate regional and local subsistence committees. It also must conduct ANILCA Section 810 hearings in potentially affected communities.

It is possible that the finding may be revised to "will not significantly restrict subsistence uses" based on changes to alternatives, new information, or new mitigation measures resulting from the hearings. If the significant restriction remains, the head of the Federal agency having jurisdiction may prohibit the action or finalize the evaluation by making the following determinations:

- A significant restriction of subsistence uses would be necessary, consistent with sound management principles for the use of public lands
- The proposed activity would involve the minimal amount of public land necessary to accomplish the purpose of the use, occupancy, or other disposition
- Reasonable steps would be taken to minimize adverse effects on subsistence uses and resources resulting from such actions (Section 810(a)(3))

The head of the Federal agency having jurisdiction can then authorize use of the public lands.

B. ANILCA Section 810(A) Evaluations and Findings for All Alternatives and the Cumulative Case

Chapter 2 of the Supplemental EIS includes a detailed description of the sequencing of construction, operation and maintenance and decommissioning of the road. Road construction includes procurement and use of gravel resources, timing of construction, construction equipment and uses, personnel camps and support logistics, including air traffic support for personnel and material. Construction of the road would be in three separate phases, projected to span 10 years, except under the phasing option which would construct the road over two phases and would reduce overall construction time by 1 to 2 years. Operations and maintenance include mine operations, material and ore transport, transport of fuel and chemicals, maintenance of material sites and facilities and communications. Decommissioning includes the proposed decommissioning of the project and potential reclamation. The evaluation and findings following this introductory section include short summaries of the alternatives descriptions otherwise described in detail in the SEIS.

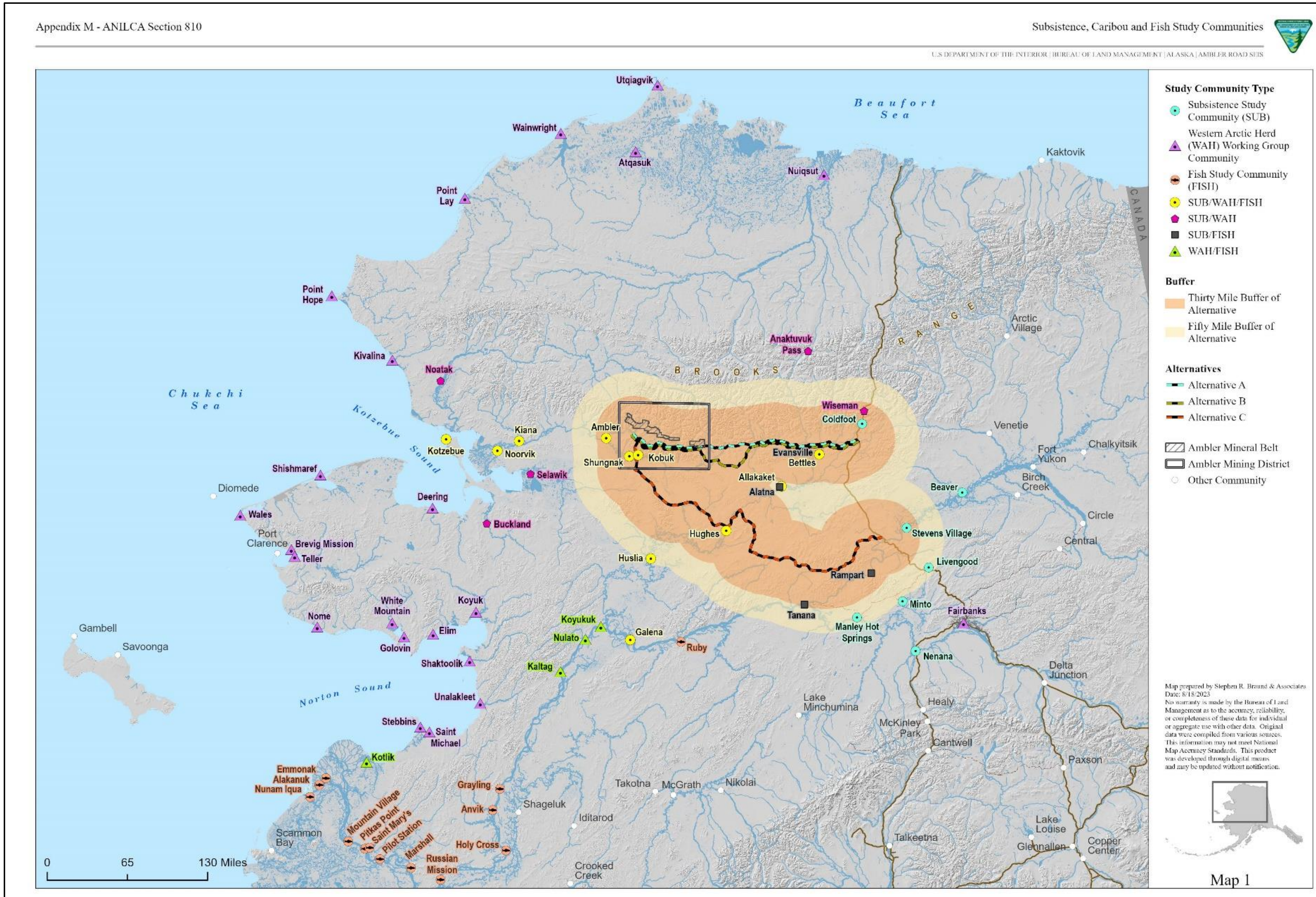
Chapter 3 of the Ambler Road Supplemental EIS describes the current environmental status of the project area and potential effects of the alternatives to subsistence and subsistence resources in addition to the indirect and cumulative impacts of the road. Appendix L of the Ambler Road Supplemental EIS: Subsistence Technical Report provides detailed information regarding subsistence uses for the study communities and in the project area. This Section 810 analysis uses the above information from the Supplemental EIS to evaluate potential impacts to subsistence pursuant to Section 810(a) of ANILCA.

While the original EIS analyzed impacts to 27 primary study communities, the Supplemental EIS analyzes impacts on 66 study communities, including primary subsistence study communities, caribou subsistence study communities, and fish subsistence study communities. These are shown in Appendix F, Table 23 of the Ambler Road Supplemental EIS and on Map 1. Primary subsistence study communities are those located within 50 miles of the project alternatives, or with subsistence use areas documented within 30 miles of the project alternatives; there are 27 of these primary study communities. In addition to the primary subsistence study communities, the Supplemental EIS analyzes communities who may experience indirect and/or downstream impacts resulting from changes in caribou and fish abundance, distribution/migration, and health. For caribou, these are the 42 communities who are members of the Western Arctic Caribou Herd Working Group (WAH WG). For fish, these are the 32 communities who are located downstream from where the project crosses tributaries in the Kobuk, Selawik, Koyukuk, and Yukon River basins. The caribou and fish study communities include overlap with one another and with the primary subsistence study communities. Subsistence is a fundamental component of maintaining the study community's traditional cultural connection with the natural world. To these communities, subsistence is more than an act of sustaining themselves, it is a part of their well-being, it serves as a connection to their ancestors, and ensures that cultural knowledge is being transmitted to the next generation. As indicated by anthropologist Richard Nelson regarding subsistence on the Koyukuk River,

> *Perspectives of nature are aligned on two interconnected levels. The first is empirical knowledge. The practice challenges of survival by hunting, fishing, and gathering required a deep objective understanding of the environment and* the methods for utilizing its resources….But their perception of the natural environment extends b*eyond what Westerners define as the empirical level, into the realm of the spiritual….Ideology is a fundamental element of subsistence, as important as the tangible practicalities of harvesting and utilizing natural resources. Most interactions with natural entities are governed in some way by a moral code that maintains proper spiritual balance between the human and nonhuman worlds* (Nelson 1983;15-16).

For the Koyukuk River Dene and Kobuk River Iñupiaq, the indigenous populations which compose much of the study region, traditional stories begin in the "distant or before time" known as *Kk'adonts'idnee* (Koyukon Dene) and *Taimani* (Kobuk River Iñupiaq) (Attla 1990, 1996; Attla and Davis 1983; Cleveland and Foot 1980; Nelson 1983; Watson 2018). During the distant time, the natural world (rocks, flora, water, etc.), animals, and humans were all the same, and shared similar personalities and attributes. When distant time ended, the natural beings were unable to transform back into their human-like forms, however these beings retained the vestiges of their former personalities within their spirit (Cleveland and Foote 1980; Nelson 1983). Indigenous peoples of the study region recognize how to properly treat the natural world according to the different personality types from the before time. They also know how these spirits may interact with them and this is vital for retaining subsistence practices, cultural norms, and spiritual well-being. For example, in Koyukon Dene children should not eat blackfish because it is said blackfish are slow and lazy and if children eat blackfish they will too become slow and lazy (Attla 1996). Thus, in Dene and Kobuk River Iñupiaq subsistence also is an act of respecting and honoring their ancestor's knowledge and carrying on this knowledge regarding the natural world to the next generation. During Government-to-Government consultation, communities stressed that without the ability to subsist, these deep-rooted religious beliefs would be impacted.

The evaluation of potential impacts to subsistence resources was conducted by identifying impact indicators and analyzing potential impacts of the proposed road and its alternatives on subsistence uses.



Map 1. Subsistence, Caribou, and Fish Study Communities

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These impacts were compared to the three subsistence impact categories according to Section 810 of ANILCA: resource abundance, resource availability and user access. Two impact indicators were identified that could be quantitatively measured for the primary subsistence communities: resource importance and subsistence use areas. Resource importance is measured in three categories: high, moderate, and low. Resource importance is established by analyzing harvests from the potentially affected communities based on available subsistence harvest data. Subsistence use areas were quantified from years of subsistence use data collected primarily by ADF&G. A detailed discussion of this methodology is available in Appendix L of the Ambler Road Draft Supplemental EIS: Subsistence Technical Report, Section 5. For the caribou and fish study communities, the focus more on the importance of the resource to the study communities, as these study communities have been included to address more indirect or downstream impacts on the community, and less on project overlap with subsistence use areas.

These impact indicators are based on NEPA guidance, which requires consideration of both context and intensity when assessing significant impacts (40 CFR 1508.27). By understanding the relative importance of each subsistence resource and/or the location of where these subsistence resources are used, as well as the context and intensity of impacts to subsistence resources and activities, vulnerable impacts from the proposed project can be better analyzed.

Subsistence uses and resources are discussed in detail in the Ambler Road Draft Supplemental EIS Section 3.4.7 and in Appendix L (Subsistence Technical Report). Tables 43-46 in Appendix L of the Ambler Road Draft Supplemental EIS illustrate the resource importance to each community whose subsistence use area would potentially be affected by the proposed road, by alternative. Table 47 (Appendix L) summarizes the number of communities with use areas crossing the project, by alternative, and Tables 48 and 49 (Appendix L) provide the resource importance of caribou and key fish species (Chinook salmon, chum salmon, and sheefish) to the caribou and fish study communities. Each alternative of the proposed road is evaluated for the availability, abundance and access to subsistence resources of importance to communities: caribou, moose, fish (salmon and non-salmon), vegetation and other resources (large land mammals, marine mammals, migratory birds, etc.).

B.1. Evaluation and Findings for No Action Alternative

Under the No Action Alternative, the BLM would not grant a ROW. The No Action Alternative provides a baseline against which impacts under other alternatives can be evaluated.

B.1.1 Evaluation of the Effect of Use, Occupancy or Disposition on Subsistence Use and Need

Under the No Action Alternative, there would be no reduction in the abundance of harvestable resources (caribou, moose, salmon, non-salmon fish, vegetation and other) used for subsistence purposes. There would be no adverse impacts on wildlife habitats, direct impacts on subsistence resources, or increased harvest and increased competition from non-subsistence users resulting from construction of a large industrial road. There would be no reduction in the availability of subsistence resources caused by an alteration in their distribution, migration, or location. There would be no limitation on the access of subsistence users to harvestable resources, including physical and legal barriers. Under the No Action Alternative, small scale mining exploration and development would likely continue to occur in the area but at much lower levels than under the action alternatives. Air traffic to support mineral exploration would continue at lower levels under the No Action Alternative and may cause deflection of subsistence resources such as caribou and moose, but at lower levels than under the action alternatives.

B.1.2 Evaluation of the Availability of Other Lands

Under the No Action Alternative, construction and operation of the road would not occur on federally managed public lands. Therefore, there would be no need to evaluate other lands for the access road.

B.1.3 Evaluation of Other Alternatives That Would Reduce or Eliminate the Use, Occupancy or Disposition of Public Lands Needed for Subsistence Purposes

Under the No Action Alternative, construction and operation of the road would not occur. Therefore, there would be no need to evaluate other ways to accommodate the proposed action.

B.1.4 Findings

The No Action Alternative would not result in a significant reduction in the availability or abundance of subsistence resources, nor would it alter or restrict subsistence uses. A positive determination pursuant to ANILCA Section 810 is not required.

B.2. Evaluation and Findings for Alternative A (AIDEA Proposed Route (GAAR North) to the Dalton Highway)

Alternative A is AIDEA’s proposed route. This Alternative is a 211-mile alignment, accessing the District from the east, with its eastern terminus at MP 161 of the Dalton Highway. It is a total length of 456 miles to Fairbanks. It runs almost directly west to the District across primarily state-managed, BLM-managed, and NPS-managed lands. The ROW would traverse the south side of the Brooks Range, following a series of stream and river valleys oriented roughly east-west, separating the Schwatka Mountains from a series of smaller mountain ranges and foothills, including the Ninemile Hills, Jack White Range, Alatna Hills, Helpmejack Hills, Akoliakruich Hills, Angayucham Mountains, and Cosmos Hills. This route crosses GAAR farther north than Alternative B. See Ambler Road Supplemental EIS, Volume 4, Map 2-3.

B.2.1 Evaluation of the Effect of Use, Occupancy or Disposition on Subsistence Use and Need

Subsistence Resource Abundance

Construction and operation of Alternative A could result in impacts to the abundance of subsistence resources. Construction activities could affect resource abundance through removal or disturbance of spawning, calving, foraging, and nesting habitat. These activities include blasting/mining, operation of construction equipment, excavation, placement of gravel, construction noise, human presence, water withdrawal, installation of bridges and culverts, placement of a winter construction access trail (e.g., ice roads, bridges, and ice pads) during initial road construction, and air and ground traffic. Operation activities that could affect resource abundance include the presence of roads and bridges (e.g., habitat fragmentation), the presence of other infrastructure (e.g., communications towers, culverts), fuel or other contaminant spills, dust deposition, road and air traffic, and human activity. Road construction and operation activities may cause direct mortality to individual animals (e.g., caribou, fish, moose, waterfowl) through vehicle and aircraft collisions, pile driving, and blasting. Construction and operation activities as described in the proposed road Supplemental EIS Section 3.4.7 could affect abundance by causing:

- direct mortalities
- loss, degradation, and fragmentation of habitat
- contamination

Alternative A crosses subsistence use areas for 12 subsistence communities (Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Kobuk, Selawik, Shungnak, and Wiseman). The communities of Bettles, Evansville, Shungnak, Ambler, Coldfoot, Kobuk, and Wiseman all have five or more resource uses crossed by the Alternative A project area.

Potential impacts to resource abundance for individual subsistence resources are discussed below.

Caribou

Caribou is the most commonly harvested large land mammal available to many of the potentially affected communities (Supplemental EIS Section 3.3.4, Mammals). The WAH is the primary herd that occurs in the project area, with seasonal migrations occurring during the spring and fall, as well as wintering habitat occurring in the project area. The WAH population has declined substantially in recent years, adding to concerns about the potential impact of a road on the health of the population (Government-to-Government and Village Public Meetings). The 2022 census estimated the WAH population at 164,000 caribou, its lowest point in decades (Supplemental EIS Section 3.3.4, Mammals). During Government-to-Government consultation, all WAH communities expressed deep concern over the population decrease and stressed their fears that construction and use of the proposed road may further decrease the population. WAH communities indicated if the caribou disappeared from their resource use areas it would cause loss of traditional knowledge and fragmentation in the community as more people would leave to find jobs in urban areas.

Because of the large range of the WAH, impacts to resource abundance could extend beyond the project area to other communities who hunt from the WAH; this could include any of the 42 caribou study communities but would be particularly likely for communities for whom caribou is a resource of high importance (Appendix L, Table 48). Of the 42 caribou study communities, 30 have over 50 percent of households using caribou. On average, caribou contributes approximately 25 percent of the total annual subsistence harvest for the study communities (see Appendix L, Section 5.6). In 27 of the 42 caribou study communities, caribou is a resource of high importance (Appendix L, Table 48). Some communities have reported a decline in resource harvests in recent years due to changes in the distribution and migration of the caribou herd. These communities may increase their reliance on caribou in the future if the WAH becomes more available within their traditional harvesting areas.

Alternative A passes through key migratory range of the WAH, including fall migratory and wintering habitat. Alternative A does not occur within the range of the Ray Mountain Herd (RMH) or the Hodzana Hills Herd (HHH), although increased traffic along the Dalton Highway may result in an increase in mortalities for the HHH. Direct mortalities of WAH caribou could occur as a result of vehicle strikes, with up to 168 trips per day expected during peak mine production. This would be most likely in the western portion of the road corridors, where caribou density is highest. While direct mortalities may occur, the significance of individual collisions on the herd population would be minor.

In addition to direct mortalities, habitat fragmentation could result in decreased abundance of caribou over time. The proposed road runs perpendicular to the primary direction of movement (north/south) for the WAH, making it more likely to affect caribou migration. Caribou would cross Alternative A during both the fall and winter. While the project represents a small proportion of the total WAH range, a substantial portion of the WAH encounter the project area annually. Fragmentation of the range resulting from a road may be more pronounced because the WAH has had less exposure to development infrastructure and activities than other herds such as the Teshekpuk and Central Arctic herds (see Supplemental EIS Section 3.3.4, Mammals). Caribou may see the road as a physical barrier that may alter their behavior or shift their migratory patterns. This may lead to a change in body condition due to increased energy expenditure (Sullender 2017). Increased energy expenditures may result in reduced foraging rates and, ultimately, decreased breeding success/pregnancy rates. In addition, caribou migration may be altered to the point where winter survival and calving success are affected. These would both have major impacts on the herd population. Contamination may also affect caribou abundance. Individual caribou may become ill through ingestion of chemicals used during construction or mining. In particular, declines in lichen cover as a result of fugitive dust along the road could affect foraging rates for caribou.

Moose

Under Alternative A, the proposed road corridor crosses subsistence moose hunting areas for nine communities. Moose is considered a resource of high importance for five of the subsistence study communities (Alatna, Allakaket, Bettles, Evansville and Wiseman), and of moderate importance for three communities (Ambler, Kobuk, and Shungnak) (Appendix L, Table 42). In some caribou study communities, moose have supplanted caribou as the primary large land mammal harvested, as caribou have become less available (Appendix L, Section 6.4.1). Since moose have smaller ranges than caribou, impacts to resource abundance of moose would be more localized and most likely to affect communities whose use areas are crossed by the proposed road corridor.

Direct mortalities could occur during construction and operation from vehicle-moose collisions. An estimated 168 trips on the road daily would substantially increase the probability of a collision. This probability would be the same all year long. Moose may also be attracted to the ROW as a movement corridor, particularly during periods of deep snow, or because of the availability of new vegetation in maintained areas of the ROW (Section 3.3.4). This could result in higher rates of injury or mortality due to traffic collisions. Construction would also affect moose through removal or disturbance of habitat; however, some habitat disturbance can be beneficial to moose as it encourages successional growth.

Fish

Key fish species within the project area include multiple species of whitefish, sheefish, Chinook salmon, and chum salmon and, to a lesser extent, cisco, northern pike, grayling, and burbot. Under Alternative A, the proposed ROW would cross subsistence fishing areas for seven communities: Shungnak, Ambler, Kobuk, Alatna, Allakaket, Bettles, and Evansville. Fish is considered a resource of high importance to all these communities (Appendix L, Table 46; Government-to-Government; personal communication). In addition to the above communities for who the proposed ROW would cross subsistence fishing areas, communities upstream and downstream that rely on salmon, sheefish, and other fish species (Hughes, Huslia, Anaktuvuk Pass, Wiseman, Buckland, Kiana, Noorvik, Selawik, Noatak and Kotzebue) could experience impacts to the abundance of fish harvest if larger impacts to fish movement, reproductive success, or health occur (Supplemental EIS Section 3.3.2, Fish and Aquatics). Traditionally certain members of these communities spent their entire summers fishing along the Kobuk and Koyukuk River and tributaries, including rivers crossed by Alternative A (Anderson et al. 1998; Nelson 1983; Nictune 1988). Fishing and preparing dried and smoked fish are cornerstones of the traditional diet and continue to play a major role in the subsistence lifestyle of these communities (Georgette and Shiedt 2005).

Salmon are particularly important to communities along the upper Kobuk River. According to “fish stories” told by the late Elder Nasruk (Robert) Cleveland of Shungnak, salmon travel up the Kobuk River to their spawning spots to “leave their old boats (or bodies) there.”

> *As soon as they finish spawning, they age and their teeth become bared. It may be that this isn’t so noticeable as they migrate, but when they age, their teeth do become bared…The old people also said that the salmon don’t actually die. This knowledge must have been passed down for many many generations by word of mouth. They said that salmon leaves its old boat, or physical body, and enters the body of a land animal* [typically bear]. *They then travel overland to the north until they reach the ocean, where*

> *they depart from the shore, once again in the form of a salmon. This is what they people said about them long ago* (Cleveland and Foot 1980; 55).

Stories told by Elders of the Upper Kobuk identify salmon as a fundamental aspect of the yearly cycle, as salmon bodies are primarily consumed by bear and then carried back to the coast to begin the cycle anew; without access to salmon the large land animals in the region would also suffer (Cleveland and Foot 1980). Kobuk residents also rely heavily on whitefish and sheefish runs, during Government-to-Government, the Upper Kobuk communities shared concern about key spawning rivers and lakes which would be downstream of the proposed Alternative A corridor. Additionally, late Elder Joe Sun of Shungnak recalled the importance of the Ambler, Kogoluktuk, and Mauneluk rivers for grayling; stating,

> *You can stop anyplace along the way on one of those rivers and fish for grayling..we would have to carry hooks with us to at all times because there's always grayling* (Sun 1983).

Residents of Alatna, Allakaket, Bettles, and Evansville rely less on salmon because salmon are infrequent and 'spawned out' when they reach the upper Koyukuk River communities. Instead, these communities have come to rely heavily on whitefish, sheefish, and grayling. As stated by multiple Allakaket residents in Government-to-Government consultations:

> *Can we add different species of fish to our concerns (regarding the SEIS)? We started getting low salmon counts over 15 years ago…Grayling stay here through the winter.*
>
> *I understand that for whitefish, all measures would be taken to protect the whitefish. I hope that can be added because this has been expressed before, the people are not dependent on king salmon, but they are on whitefish.*
>
> *My dad was ice fishing and he started to do that back in November, and in the span of a month he only caught 20 fish; that's not much. That's a very grave concern for us.*
>
> *Every year I catch 10-15 sheefish during the sheefish run, this year I didn't catch any.*

In addition to the above communities who have documented use of the rivers crossed by the proposed project corridor, impacts to resource abundance could extend to other fish study communities that harvest whitefish, sheefish, Chinook salmon, or chum salmon downstream from the road corridor (Supplemental EIS Section 3.3.2, Fish and Aquatics). Twenty-four of the 32 fish study communities have a high material and cultural reliance on one or more of the key fish species (whitefish, sheefish, Chinook salmon, and chum salmon) (Appendix L, Table 49).

The Native Village of Kotzebue commented that these resources are essential to the livelihood of the community of Kotzebue, particularly due to the fact that they are inexpensive to harvest and are available throughout the year:

> Healthy and abundant sheefish and salmon require pristine watersheds free from silt and contaminants, in addition to sufficient water flows and unfettered access to the most remote parts of the Kobuk River for their annual spawning runs. Salmon are critical to our members, representing a major source of income and subsistence resources necessary for their continued quality of life and livelihood. Sheefish are a major part of the annual cycle of subsistence for our members as they are commonly harvested near Kotzebue for the majority of the year. They somewhat uniquely represent an egalitarian resource, in that they are easily harvested for much of the year by the entire community because of their proximity and without requiring scarce, or expensive, methods and means.

> Whitefish that feed in the summer in coastal lagoons of Kotzebue Sound and continue to be harvested as a treasured food by our members, also use the Kobuk River and its tributaries for spawning and overwintering purposes, as do Dolly Varden char. (Native Village of Kotzebue 2018)

Impacts to fish under Alternative A could include:

- direct mortality
- spawning habitat loss and degradation
- increased turbidity from sedimentation and erosion
- contamination from accidental spills
- introduction of invasive species

Fish may experience direct mortality through certain activities such as pile driving, sedimentation, and stream diversions. These actions may alter or degrade fish habitat thereby reducing egg survival downstream. Large amounts of water would be required for temporary ice roads and pads and other construction and maintenance activities and would be withdrawn from lakes or large rivers near the proposed road corridor. The late Elder Nasruk (Robert) Cleveland remarks on his observations of water level drop and salmon decline throughout his life on the Upper Kobuk River. He states that once water levels start to drop the salmon start to spawn in *tunuġutit* (waterways behind sandbars) and that the eggs then die when the water levels drop any amount.

> *I journeyed up the river and saw many salmon die. I think that the number of salmon decreased when they started entering the creeks behind the sandbars because that is where they spawned upon entering. However, the water level goes down and the eggs end up on the dry creek bed. Although water level fluctuates, the eggs do not have a chance to develop properly, thus resulting in less number of salmon. I have seen what happens to the salmon that migrate up the Kobuk River and die in the Upper Kobuk area (Cleveland and Foot 1980; 56).*

Water withdrawal in itself may kill individual fish but would likely not have large effects on the abundance of resident and anadromous fish populations, as ADF&G's fish habitat permits include requirements for water intakes to avoid fish injury and maximum amounts of water withdrawn from each water source (see Supplemental EIS Section 3.3.2, Fish and Aquatics). Sedimentation, especially when increased over naturally occurring levels, adversely affects habitat quality and function. Increased fine sediments can smother incubating eggs, decrease fry emergence, reduce the amount of suitable habitat for juvenile fish, and decrease benthic community production (Limpinsel et al. 2017). Elevated turbidity from suspended solids diminishes habitat quality, and may decrease primary production, elevate water temperatures, and affect feeding behavior; large plumes can damage gills and impair organ function (Limpinsel et al. 2017). Road construction and operation can contribute to thawing of permafrost which could cause thaw slumps along river and stream banks. Increased thawing of permafrost along the road could result in slumping along riverbanks which could also degrade water quality and affect fish abundance. Slumping could increase sedimentation, degrade water quality, and affect fish spawning habitat (Section 3.3.2, Fish and Aquatics). Tribal councils remarked on the increased slumping occurring along the Koyukuk, Alatna, and Kobuk Rivers occurring in their lifetime. The councils attributed the slumping to global warming and also tied the slumping to the declining fisheries in their regions. The councils were concerned that further slumping would harm spawning fish particularly along the Alatna and Upper Kobuk Rivers. Overall, increased sedimentation from construction and operation activities and infrastructure, particularly in spawning grounds, can smother eggs, alter feeding habitat, and decrease fish production. If sedimentation increased in any of the spawning areas, there would be a significant impact to spawning success.

Removing gravel from a stream channel changes the structure of its natural habitat for aquatic species, sediment transport dynamics and flow processes; degrades quality and habitat function upstream and downstream of mined areas; and alters fish and invertebrate communities (Brown et al. 1998). Removing streambed gravel from relic channels in the floodplain would degrade habitat quality by reducing habitat complexity and altering dynamics, which may affect survival rates of incubating eggs (Kondolf et al. 2002). Adverse impacts to fish may be fairly localized during the activity, although the full magnitude of effects is difficult to quantify given the lack of specific gravel extraction methods and plans. Studies have shown that attempts to mitigate or restore streams impacted by gravel mining may be ineffective because impacts often extend kilometers upstream and downstream of mined sites (Brown et al. 1998). Gravel mining near sheefish and other whitefish spawning areas would have especially negative consequences to fish populations, since these fish have specific spawning requirements and large numbers of fish spawn in relatively small, distinct areas.

The presence of the road in addition to related culverts, bridges, and gravel infrastructure would also alter and degrade fish habitat both upstream and downstream from the road, which could affect fish abundance for subsistence users in certain waterways crossed by the road corridor. Bridges and culverts would eliminate and alter fish habitat (see Supplemental EIS Section 3.3.2, Fish and Aquatics). Culverts would eliminate portions of natural stream channels by routing flow underneath the roadway embankment. The project proponent proposes to use stream simulation design principles that more replicate natural stream conditions, which will minimize but not eliminate impacts to waterways. Replacing natural habitat with culverts and confining flow through culverts and bridges would reduce habitat complexity, increase sedimentation and scour potential, and degrade habitat quality both upstream and downstream throughout the life of the road.

The Kobuk and Alatna rivers are key spawning grounds for sheefish and whitefish and are also important fishing areas. The upper Kobuk River supports the largest spawning concentration of sheefish in Alaska. Sheefish habitat is limited with only 13 documented spawning areas in Alaska (Underwood et al. 1998; Brown et al 2012; Savereide and Huang 2016; Stuby 2018). Sheefish require specialized spawning habitat limited by water temperature, substrate composition, and specific water quality characteristics influenced by geologic features (Alt 1994; Braem et al. 2015; Savereide and Huang 2016) (see Volume 4, Map 3-18). They typically exhibit a high degree of spawning site fidelity, not only to spawning streams but to specific areas within a reach of stream (Savereide and Huang 2016). Maintaining spawning habitat is critical to the survival of the Kobuk and Yukon rivers sheefish and whitefish populations because a large fraction of any given spawning population may spawn in a small, distinct geographic area. When the BLM visited the Native Village of Kobuk in early June 2023 for a public meeting, multiple community members remarked that they wished their oldest community member would attend, but she likely wouldn’t because she was out by the river getting her nets ready for fishing. Surprisingly, the 88-year-old Elder took a break from net fixing and joined the meeting. Speaking in Iñupiaq, while her niece translated, the Elder remarked that her childhood was spent living on the Upper Kobuk with her family at summer fish camp and then in the winter moving to the Ambler Lowlands to hunt caribou. The Elder commented particularly on the extensive use of fish including salmon, whitefish, and sheefish by the community and her concern for the future health of the species. She remarked if these fish were impacted it would impact her children’s ability to continue the traditional subsistence lifestyle.

The Alatna River is the most important spawning area for sheefish and other whitefish species in the upper Koyukuk River drainage (see Supplemental EIS Section 3.3.2, Fish and Aquatics). The ROW would cross both the Kobuk and Alatna river drainages under Alternative A. If construction removed suitable spawning habitat directly, the loss would cause a decrease to spawning success. Alternative A also crosses streams in the Upper Koyukuk drainage (Alatna River, Henshaw Creek, North Fork Koyukuk River, Wild River, John River), which support spawning for Chinook, chum salmon, and whitefish. Chum salmon is a resource of high importance in most communities in the Kobuk-Selawik, Koyukuk, and Yukon river basins. For many Yukon River communities, Chinook salmon is a resource of high importance (see Supplemental EIS Appendix F, Table 22) and is also a resource of yield concern to the ADF&G. A member of the Western Interior Regional Advisory Council provided the following observations about water quality, salmon spawning, and the importance of smaller clearwater tributaries:

> All my life I never did catch a fish in the silt water at all. So it's something to think about. I hope they think about it because you come in here and older Natives that are alive right now they always say they don't know what they're talking about. For them to be 70, 80 years, they know what they're talking about. They never did catch a salmon in those silt water places. It's all flats, so there's no drainages that run up into the mountains. Once you start going into elevation, that's where you're going to find your salmon. (Western Interior Federal Subsistence Regional Advisory Council 2022b)

Potential contamination of sheefish, whitefish, salmon, and other fish species spawning grounds and other habitat are of particular concern to the study communities. Spills have the potential to substantially degrade habitat quality and affect the long-term health of individual fish and fish populations. Habitat located in the vicinity of road crossing sites, which includes spawning, rearing, feeding, wintering and migratory habitat, would be most susceptible to contamination from potential spills. Such a spill, particularly if near a stream, would substantially alter water chemistry, cause fish mortality, substantially degrade habitat quality and function, and cause population-level effects.

The introduction of invasive species could also impact fish habitat and/or productivity. Unlike other ROW impacts that are expected to be more short-term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled. This would cause a significant effect because of the long-term nature of the impact.

While it is not possible to predict the exact location and magnitude of impacts to fish resulting from road construction and operation, sheefish may be particularly vulnerable to population-level impacts as their spawning grounds are particularly sensitive to changes in water velocity, temperature, pH, and other factors. Salmon spawning habitat is also vulnerable in changes to water chemistry.

Vegetation

Alternative A crosses vegetation subsistence use areas for seven study communities (Bettles, Coldfoot, Evansville, Alatna, Kobuk, Shungnak, and Wiseman), and is a resource of high importance to all of these communities. The Wiseman and Coldfoot subsistence use areas are located on the periphery of the project area or are isolated use areas. Subsistence and usable vegetation of primary concern (as indicated in Government-to-Government and personal communication with the BLM) include multiple berry species (raspberries, blueberries, cranberries), wild edible plants still used by the communities such as *masu* (Hedysarum *alpinum*: alpine sweetvetch), and wood (spruce and birch) used for construction of traditional use items and firewood.

Residents of the Native Village of Kobuk indicated that they traverse up the Kogoluktuk River and across the Ambler Lowlands for berry picking. One Kobuk Elder also indicated that she and her family pick berries along the mountain ridge overlooking Kollioksak Lake and within the Alternative A corridor. On the eastern extent of Alternative A, during a trip to the Alatna River with BLM personnel, two Alatna Village residents reminisced on their grandmother's multiple solo journeys on the Alatna River. When

BLM employees asked what their grandmother subsisted on along the way, the cousins were quick to point out she knew which bend of the rivers contained edible wild plants especially blueberries and raspberries. Within the Alternative A corridor, the Alatna residents pointed to multiple raspberry patches they still gathered from during hunting trips. Alatna and Allakaket residents also talked about gathering *masu* on the Alatna River during the early spring and fall. Additionally, along the project corridor there are multiple Iñupiaq Place Names indicating the area is a good place for gathering wood (NPS placename database), including south of Walker Lake and along the Reed River. When the BLM visited the Native Village of Kobuk in spring 2023 residents were travelling up the Kogoluktuk River to the Alternative A corridor to collect firewood.

Construction and operation activities which may affect the abundance of vegetation, including berries, wild plants, and wood include:

- clearing of the ROW
- fugitive dust
- contamination from accidental spills

ROW construction would result in the removal of vegetation harvesting areas for residents. Communities along the proposed road corridors may also experience reduced availability of vegetation in traditional harvesting areas during and after construction of the road. This may lead to an overall decline in the abundance of harvestable vegetation. Permanent loss of native vegetation would occur from construction of the main road, landing strips, material and rip-rap sources, and construction access roads, due to vegetation clearing and the placement of gravel fill. Loss of vegetation through an undisturbed landscape would result in several effects to the surrounding environment, including alteration of adjacent vegetation community composition and loss or alteration of fish and wildlife habitat. Removal of native vegetation in this area, particularly in boreal forest, could take decades to recover (Supplemental EIS Section 3.3.1, Vegetation and Wetlands).

Spills have the potential to substantially degrade vegetation. Vegetation located in the vicinity of road would be most susceptible to contamination from potential spills. Introduction of toxicants from petroleum products associated with vehicle use and road run-off can impact vegetation (see Supplemental EIS Section 3.3.1, Vegetation and Wetlands). Accidental spills along the ROW may reduce harvestable vegetation in the direct vicinity of the road.

Other Resources

Other subsistence resources such as Dall sheep, bear, muskoxen, small land mammals, marine mammals, migratory birds, upland game birds and eggs are considered of moderate or low importance or have fewer communities depending on them for subsistence (Supplemental EIS Section 3.4.7, Subsistence Uses and Resources). Despite the relatively low harvest counts for these resources, subsistence activities associated with the resources remain integral for cultural transmission and the well-being of the study communities. Impacts to availability of these resources in traditional subsistence locales may impact communities' ability to transmit cultural knowledge.

To the Koyukon Dene, bears are spiritually powerful and acquiring bear meat is integral to potlaches in honor of the deceased. Black bears and brown bears are considered mostly equal in their spiritual power, but black bears are far more significant to the subsistence economy. Black bears rank high as an esteemed food and as ceremonial delicacy. If a black bear hunt is successful there is a ceremonial feast or "bear party" held, additionally this bear meat is saved for potlaches and is used in communication with the dead (Nelson 1983). Bears are held in extremely high regard and never spoken of casually, women generally don't talk about bears or mention their name (Nelson 1983; Allakaket personal communication). Bears are traditionally hunted while hibernating in the den however, more often today they are hunted in the late fall before hibernation. Alatna and Allakaket residents relayed that they find a bear trail to the river and hide by the trail at night until the bears come down to the water. As the bear walks the trail they are shot. Bears are regularly hunted along the Upper Koyukuk and Alatna Rivers.

Bears are also hunted along the Upper Kobuk. One Native Village of Kobuk resident indicated he participates in bear hunting trips traveling by boat in the late fall up the Kobuk River towards the Walker Lake headwaters. Effects from construction and operation activities from the proposed road may impact the availability of bears to be taken in traditional hunting areas like the Upper Kobuk, the Koyukuk, and Alatna Rivers. The lack of availability of these resources in traditional hunting locations may impact the subsistence and ceremonies associated with hunting bear.

Similarly, Dall sheep are considered culturally powerful entities especially to the Upper Kobuk and Alatna Village residents. Sheep are hunted in the fall in the Brooks Range and are used for ceremonial potlaches. Boys participating in their first sheep hunt with the older men is an extremely important rite of passage (Nictune 1988). One Alatna village resident recalls killing his first sheep and taking the sheep's horns to a special mountain where all the men in the community had been taking the horns for generations. He recalled the horns are lined up overlooking a valley and the first horn is so old and degraded it is no longer visible. This was how long his family had been hunting sheep in the area (Alatna resident personal communication). Sheep are generally hunted to the north of the proposed road, and the construction and operation of the road would likely have little immediate impact on the availability of sheep.

Winter trapping of furbearers is important to the subsistence round of the study communities and provides products for making traditional clothing and can contribute to the local cash economy. Local traplines are likely to occur along the Alternative A route and the construction and operation could impact the availability of the resource by direct mortality or contamination. Additionally, the lack of availability of these resources in traditional trapping locations may impact the overall use of the small furbearing animals.

Overall the likelihood of large-scale impacts to the abundance of these resources is relatively low. Impacts from construction and operation could occur and would be similar to those discussed for the resources above. Potential impacts to resource abundance of other resources include direct mortality or contamination of resources such as waterfowl and small land mammals.

Subsistence Resource Availability

Subsistence activities and harvests are key to rural residents' ability to remain in their communities and continued cultural transmission despite high unemployment rates, low incomes, and food insecurity. Because of the importance of subsistence harvests to the mixed economy, a key component of rural life, rural communities are particularly vulnerable to changes in subsistence resource availability. Residents may adapt to changes in resource availability by increasing harvests of other resources; however, in the face of large-scale changes, residents may be less able to adapt.

Construction activities that could affect subsistence resource availability include excavation, blasting, mining, ROW clearing, installation of bridges and culverts, gravel placement, water withdrawal, construction of ice roads, bridges and ice pads, heavy equipment operation, noise, human activity, vehicle and air traffic, sedimentation, and fuel or other contaminant spills. Operation activities that could affect resource availability include the presence of roads and bridges, the presence of other infrastructure (e.g., communications towers, culverts), fuel or other contaminant spills, dust deposition, road and air traffic, and human activity. The above construction and operation activities could affect availability by causing changes in resource migration or distribution, changes in resource behavior, or changes in resource health or quality.

While certain local changes to resource movement or distribution may seem minimal from a biological perspective (i.e., not affecting overall population levels, body condition, herd ranges, etc.), local changes can have much larger impacts on resource availability to local hunters. Subsistence harvest success depends on resources being available within traditional hunting areas at the expected time, and that the resources are accessible from a subsistence user's community using available transportation.

Since the 1990s, chum and Chinook salmon returns have declined. Chum and Chinook salmon runs have declined even further since publication of the Final EIS, leading to subsistence closures in the Yukon River watershed (see Supplemental EIS Section 3.4.7, Subsistence Uses and Resources). Recent harvest trends within the region observed by local residents and wildlife biologists include changes in the distribution of the WAH and reduced availability for certain communities; an increase in moose hunting in communities with less access to caribou; and recent declines in the availability of moose in the Upper Koyukuk region, with increased availability in the Kobuk River region (Watson 2019). A decline in multiple resources at once would reduce a community's ability to adapt to these changes and to find suitable substitutions for the declining harvests. Evansville tribal member commented that the Upper Koyukuk is starvation country and without continued moose harvest everyone would leave.

As discussed above (Section B.2.1.1, Subsistence Resource Abundance), Alternative A crosses subsistence use areas for 12 subsistence communities (Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Kobuk, Selawik, Shungnak, and Wiseman). The communities of Bettles, Evansville, Shungnak, Ambler, Coldfoot, Kobuk, and Wiseman all have five or more resource uses crossed by the Alternative A project area. Smaller-scale impacts to resource availability are most likely to occur for communities who use the project area, while larger-scale impacts could affect communities outside the project area who use migratory resources such as caribou and fish. See below for a resource-specific discussion of potential impacts to resource availability.

Caribou

The proposed route under Alternative A crosses caribou subsistence use areas for nine subsistence study communities: Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Kobuk, Selawik and Shungnak. Caribou is considered a resource of high importance for all but two of these communities (Alatna and Bettles). Both of these communities are on the periphery of the WAH range and once harvested caribou in larger numbers; however, in recent years the availability of caribou has declined in their traditional use areas. Wiseman, Selawik, and Hughes subsistence use areas for caribou are on the periphery of the proposed project, and caribou is a resource of moderate (Hughes) to high (Wiseman and Selawik) importance for these communities. While direct impacts may be less likely for these and other caribou study communities, they may still experience indirect impacts resulting from a change in caribou migration or distribution.

Some residents from the northern and eastern portions of the project area travel to the southwest of the community toward Buckland into WAH wintering grounds to harvest caribou. In addition, residents from communities with limited access to caribou often rely on sharing from communities with more access. A lack of caribou harvests does not mean that caribou is no longer culturally important to these communities; if caribou became more available within their hunting area, residents would likely resume previous levels of harvesting. As noted above, large-scale changes to migration or distribution resulting from a road corridor could have impacts extending to some or all of the 42 WAH WG communities. However, while localized changes to movement patterns are likely, with potential impacts to caribou energetics and subsistence harvest, the migratory patterns of the WAH as a whole would likely remain intact unless the road creates a barrier to movement (see Supplemental EIS Section 3.3.4, Mammals).

The primary construction and operation activities which may affect caribou availability to local communities include:

- air and ground traffic
- construction noise (e.g., blasting, machinery)
- presence of linear infrastructure (e.g., road)
- human activity

Air traffic has been a commonly reported and observed impact on caribou on the North Slope and in Northwest Alaska (SRB&A 2009, 2018, Georgette and Loon 1988, Sullender 2017). Air traffic is observed to cause behavioral changes, skittish behavior, and delayed or diverted crossing behavior, which in turn has impacts on caribou hunting success. These types of behaviors are most observed in response to helicopter traffic, although fixed-wing aircraft have also been observed to elicit similar responses.

Roads, road traffic, and construction noise are also believed to cause behavioral and migratory changes in caribou which can affect hunting success. Alternative A crosses through key migratory range for the WAH and could affect availability of the WAH to the north and south of the road. The road runs perpendicular to the primary direction of WAH movement during migration which increases the likelihood of delays and deflections, and caribou cross the road corridor during the fall and winter.

Deflections or delays of caribou movement from roads and associated ground traffic and human activity has been documented in the traditional knowledge of harvesters (SRB&A 2009, 2014, 2018a) and during behavioral studies on caribou, particularly for maternal caribou (ABR and SRB&A 2014 and Johnson et al 2019). During Government-to-Government, subsistence users from the WAH region compared the proposed road to large waterways like the Kobuk River. Community members indicated that caribou will linger along the northern edge of the river for days waiting for the lead caribou to cross. Once the lead caribou crosses, the rest follow. The subsistence hunters always camp from the south side of the river, and they wait until the lead caribou is across before commencing any hunt. If the subsistence hunters scare the caribou before the lead has crossed the river, there is potential for the whole migration to be rerouted away from the area for years. Several elders expressed the importance of adhering to these practices and teaching young hunters to let the first caribou pass through before beginning to hunt. Subsistence users expressed concern that human activity on the road would scare away the lead caribou before the lead had a chance to cross the road. If the lead caribou is scared back to the north of the proposed road, this would impact the migration to the Kobuk River region.

On the North Slope, caribou have been found to reduce their use of habitat within areas of development. In recent years, reports of ground traffic–related impacts on the North Slope caribou hunting, particularly in the vicinity of Nuiqsut, have increased with the construction of gravel roads in the area (SRB&A 2016, 2017, 2018a, 2022). Impacts of roads have also been observed by Noatak and Kivalina caribou hunters regarding the Red Dog Delong Mountain Transportation System (DMTS) (SRB&A 2014). Residents have observed that some caribou may stop once they reach the DMTS, sometimes traveling alongside the road before crossing, and other times bypassing the road altogether. Such behavior has also been documented through radio collar observation. Wilson et al. (2016), found that the DMTS influenced the movements of approximately 30 percent of radio-collared WAH caribou, and the average delay in crossing was 33 days. These delays were often accompanied by notable changes in movements rates by collared caribou. Animals would linger north of the road through much of migration, but then would cross the DMTS and move quickly through migration corridors, arriving on the winter range in a shorter amount of time compared to animals that did not encounter the road (Dau 2023). Caribou from the Teshekpuk Herd (TH) were not similarly affected, which could be due to greater exposure of the TH to industrial development in the eastern portion of its range. In general, observed caribou behavior in response to the DMTS is variable: in some cases, caribou cross seemingly without delay, while in other cases herds scatter and migration is delayed for multiple days or weeks (Wilson et al. 2016, ABR and SRB&A 2014). Responses to roads also seem to vary from year to year based on the context in which roads are encountered. The Native Village of Kotzebue noted the differences between the Red Dog Road and the Ambler Road, indicating that the longer length and different topography of the Ambler Road may make mitigation less effective:

> It has also to be kept in mind that even with the proactive approach taken along the relatively short Red Dog road in regards to stopping traffic while caribou are near the road there are still demonstrable impacts. It is unknown if such a strategy will, or even could, be put in place on the Ambler road, given the differing ownership and political affiliations of the mine developers in the Ambler District, in addition to the totally different logistical challenges in regards to the hauling season and distances that would be covered by the trucks. It also needs to be kept in mind that while it is practical to stop trucking on the Red Dog road due to its short length and nearby facilities on both ends, which would be totally different on the Ambler road, it also is exclusively tundra/willow habitat and herds of caribou can be relatively easily spotted at a distance. This will not be the case on the Ambler road, where both the topography and the spruce dominated areas will make it impossible in many places along the road to even observe caribou until they are right next to the road, but of course the caribou will still be able to smell, feel and hear the road and its associated traffic well before they reach it. (Native Village of Kotzebue 2018)

During operations, the final two-lane road combined with an increase in traffic would likely increase the potential for deflection or delay of caribou movements, particularly during the fall migration south (Appendix L, Section 6.4.1). Over time, local caribou distribution may be altered to the extent that residents no longer find caribou within their usual hunting areas or experience reduced hunting success in those areas. The upper Kobuk River communities observed that the WAH are migrating to the Kobuk River up to two months later than normal, and this is already straining subsistence. During Government-to-Government some residents of the Upper Kobuk were concerned that if the road were built the increased delay would stop the WAH from coming to the Kobuk River all together. Some industrial road projects in the state of Alaska provide for access to roads for local residents. In other communities where roads have been built, access to private roads has in some way offset some of the impacts to resource availability; however, lack of access to local hunters for the AMDIAR would introduce subsistence impacts with no offsetting subsistence benefit. The Western Interior Alaska Subsistence Regional Advisory Council noted that noise disturbances resulting from increased traffic will decrease availability of key terrestrial and aquatic resources within at least a 50 mile radius of the Project:

> The Council emphasizes that the impacts of developing the Ambler Road Project will have adverse and far reaching effects within at least 50 miles of each side of the road. These impacts include noise disturbance to terrestrial and aquatic wildlife resulting from increased motorized off-road vehicle traffic and boat use extending up the coast and into the Kobuk River Drainage. The increased motorized off-road vehicle traffic and boat use resulting from development of the Amber Road will also have significant adverse impacts up and down the Koyukuk River, John River, and Alatna River drainages. (Western Interior Alaska Subsistence Regional Advisory Council 2018)

In addition to causing physical obstructions to hunters and caribou, roads and related infrastructure would also introduce visual disturbances in an area where existing infrastructure is limited to small communities, camps, and cabins. A large industrial road is more likely to stand out on the landscape and cause displacement of wildlife. Caribou may also react to changes in smells. Animals use odor when selecting feeding grounds, water sources, and when traveling (see Supplemental EIS Section 3.4.7, Subsistence Uses and Resources). Changes in smells resulting from construction activities, vehicle emissions, introduction of new materials, and accidental spills could affect caribou distribution and behavior thus reducing their availability to hunters in certain areas.

Habitat alteration may also affect the distribution of the WAH. Construction of the proposed road would result in direct habitat loss for the WAH, including habitat in the winter, migratory, and peripheral ranges of the WAH. There would be a loss of lichen-dominated vegetation which is a particularly important food source for the WAH. In winter, low abundance of forage may result in caribou migrating farther in search of suitable habitat.

Although public access to the area would be prohibited, it is possible that unauthorized use the ROW and road would occur. Unauthorized use of the project area by non-local hunters could increase disturbances, as well as increasing competition for the resource between non-local and local hunters.

Impacts to resource availability of the WAH could result in subsistence users having to travel farther and longer to harvest caribou than they previously did. It could also cause less overall hunter success, meaning subsistence users would have to increase their reliance on other subsistence resources or other non-traditional food sources (e.g., store bought food).

Subsistence study area communities along the eastern side of Alternative A including Alatna, Allakaket, Evansville, and Hughes have repeatedly indicated to the BLM that their ability to harvest caribou from the WAH and Central Arctic Herd (CAH) was impacted by the construction of the Dalton Highway. Traditionally the CAH moved through Anaktuvuk Pass down the Alatna and John River corridors to south of the Brooks Mountain Range where they were hunted by the forementioned communities. Tribal councils from these communities have attributed the lack of caribou migration to their region to the construction of the Dalton Highway running east of the proposed Ambler Road.

During a meeting with the BLM in Allakaket an Elder held up a pair of caribou boots and indicated they were from the last caribou she had seen in the region since the 1970s. Another Elder from Alatna recounted hunting caribou for the first time as a boy right outside the community and grieved that children in the region would not have the same experience. A couple who maintain a subsistence camp along the Alatna River, and along the proposed Alternative A corridor, tie a caribou antler to a tree along the river. the couple Indicated the antler is hung on the tree to symbolize the caribou which still infrequently migrate to the region, and to remind their children of the resource. If the proposed road is constructed there could be further fragmentation of the caribou herds which according to the communities, still infrequently travel down the Alatna and John River corridors.

Moose

The proposed route under Alternative A crosses moose subsistence use areas for nine subsistence study communities: Alatna, Allakaket, Ambler, Bettles, Coldfoot, Evansville, Kobuk, Shungnak, and Wiseman. Moose is considered a resource of high importance for five of these communities (Alatna, Allakaket, Bettles, Evansville, and Wiseman). Impacts to moose availability would be most likely to occur for these communities.

Impacts to moose availability would generally be on a smaller geographic scale than for caribou, as moose have smaller ranges and residents do not rely on seasonal migratory movements when hunting them. Thus, impacts to moose hunting from construction and operation of the road would occur primarily in the vicinity of the road where moose could exhibit avoidance or other behavioral changes. Sources of impacts to moose availability are similar to those discussed above under Caribou. Because a majority of moose hunting in the region occurs along rivers during the fall months, impacts would be most likely to occur in areas where the road corridor crosses key moose hunting rivers such as the Koyukuk and Kobuk rivers, and smaller drainages such as the Alatna, John, and Wild rivers. Residents may experience decreased success in these areas due to moose remaining in deeper brush (Appendix L: Section 6.4.1). Because intersections with the road are a very small portion of the rivers, this would not have a significant effect on overall hunter success.

Moose tend to habituate quickly to disturbances. The cleared area within the ROW and road may create a travel corridor for moose which could lead to a two-fold effect on resource availability. First, if the cleared area draws large land mammals to the corridor there could be a corresponding decline in large land mammals in areas they were previously found. Furthermore, a cleared area within the ROW with a high concentration of large land mammals could be a draw for local hunters traveling overland in the winter by snowmachine or by off-road vehicle during other times of the year. Unauthorized use of the ROW by non-local hunters may also occur, thus increasing local competition. Unless large scale changes in moose distribution occur, impacts to moose resource availability would likely be temporary and affect individual hunters rather than reducing overall availability for the study communities.

Fish

The proposed route under Alternative A crosses salmon and non-salmon fish subsistence use areas for seven subsistence study communities: Alatna, Allakaket, Ambler, Bettles, Evansville, Kobuk, and Shungnak. These are the communities most likely to experience direct impacts to fish availability. Non-salmon fish are a resource of high importance to all of these communities, and salmon is a resource of high importance to all but one community (Bettles). Fish migrate seasonally between mainstem, tributary, and connected off-channel habitats to access preferred feeding, rearing, spawning, or overwintering areas resulting in fish moving between subsistence use areas in and out of the project area. If impacts to fish availability extend outside the project area, then additional upstream and downstream communities could experience impacts. In particular, communities upstream and downstream from the corridor along the Koyukuk and Kobuk river drainages (Ambler, Anaktuvuk Pass, Hughes, Huslia, Kiana, Noorvik, Shungnak, and Wiseman) could experience indirect impacts to fish availability.

Construction activities which may affect fish availability to subsistence communities include:

- installation of bridges, culverts and related pile installation
- stream diversion and excavation
- water withdrawal
- gravel mining
- Contamination

Fish could be diverted, displaced, or obstructed due to culvert placement, excavation, or stream diversion. Ice roads and pads may also temporarily block fish passage if the compacted ice takes longer to melt. Water withdrawal may kill individual fish but would likely not have population-level effects, as ADF&G’s fish habitat permits include requirements for water intakes to avoid fish injury and maximum amounts of water withdrawn from each source (see Supplemental EIS Section 3.3.2, Fish and Aquatics). Water withdrawals for ice roads would alter water quality and water flows, and could potentially affect fish habitat, although these impacts are expected to be temporary and short term. Temporary changes to habitat resulting from water withdrawals, runoff from melting ice roads, and construction activities, could affect fish distribution. In addition, areas with increased sedimentation or recent evidence of runoff may be perceived as unsuitable for fishing by local residents.

The impacts of erosion and beaver dams on salmon spawning grounds was a topic discussed during a recent meeting of the Northwest Arctic Subsistence Regional Advisory Council (2022), highlighting the importance of access to spawning grounds:

> I think some of them creeks are dammed up, pretty much dammed with the beaver and that's one thing that's causing the fish not to come out, and no air and stuff like that happening statewide, It's not just happening here. But salmon spawning, man, I tell you the erosion that's happening, and it's turning the river shallower, seems like, and I haven't gone up river for quite a while it seems like the river's changed above Kobuk; it's 'eally changing... But salmon spawning, oh, man, they're going to be lower and lower down this way for salmon spawning because– -- a lot of dead salmon on the sides after spawning.

While direct impacts to fish availability resulting from construction activities are expected to be localized, subsistence users often harvest fish in specific locations along rivers; thus, localized changes in fish distribution could have impacts on resource availability for individual harvesters, particularly for the seven communities with use areas overlapping the Alternative A corridor.

Potential effects of construction and operation activities on resource availability also include contamination resulting from fuel and other chemical spills, dust deposition, sedimentation due to erosion along river and stream banks, and increased emissions. NOA and acid-generating rocks occur throughout the study area. There is the potential that NOA released into rivers could lead to higher concentrations of some trace metals in fish tissues (Schreier et al. 1987). Contamination or perceived contamination can have indirect effects on subsistence, as subsistence users may reduce their consumption of a resource if they fear contamination; therefore, resources perceived as unhealthy or contaminated are considered unavailable to local residents. This response has been systematically documented in household harvest surveys and hunter interviews on the North Slope of Alaska, with between 22 and 54 percent of respondents indicating that they had avoided eating certain subsistence foods in the previous year because of concerns about contamination (SRB&A 2017). Concern for contamination of waterways and fish has been a key issue during Government-to-Government meetings with the high impact communities.

Changes in the availability of fish species could affect subsistence users throughout the project area and upstream and downstream from the project area, particularly if the project results in changes in fish distribution or the timing of fish migrations. Subsistence users often harvest specific resources at specific times and places, and if these patterns are disrupted they may experience declines in harvest success or have difficulty accessing traditional use areas when resources become available in those areas (e.g., if the fish arrive late and subsistence users cannot use boats to access them). The impacts of changes in the timing of fish migrations on harvest success have been reported by local subsistence users in recent years (Northwest Arctic Subsistence Regional Advisory Council 2022).

Vegetation

Potential impacts to resource availability of vegetation are the same as those discussed above (Section B.2.1.1, Subsistence Resource Abundance). Clearing of the ROW, dust deposition, and contamination would reduce the local abundance and availability of plants and berries along the road corridor for six study communities.

Other Resources

Availability of all other subsistence resources would vary from season to season and resource to resource. Construction activities may impact hunting for land mammals (bears, sheep, furbearers, small land mammals) and birds (waterfowl and upland), and harvesting of eggs. In most communities, these are resources of low to moderate importance based on selected measures, and do not contribute a large amount to the communities' annual subsistence harvest. Despite the relatively low harvest counts for these resources, subsistence activities associated with the resources remain integral for cultural transmission and the well-being of the study communities. The lack of abundance of these resources in traditional hunting locations may impact the subsistence and ceremonies especially those associated with bear and sheep.

Activities that may affect resource availability for other subsistence resources include:

- construction noise and activity
- physical obstructions from infrastructure
- vehicle and air traffic
- accidental fuel or other contaminant spills

In the short term, construction activity may displace or divert resources such as large land mammals (e.g., bear), small land mammals (including furbearers), and waterfowl. Clearing of trees and brush for the ROW and stripping of topsoil and organic material may alter or degrade resource habitat, particularly for herbivores that depend on surface vegetation. Habitat alteration can affect resource distribution, thereby reducing the availability of those resources to subsistence users in traditional hunting or harvesting areas. Equipment, material storage sites and related infrastructure associated with construction, may act as a physical barrier to wildlife. During construction and operation, the availability of subsistence resources would be affected through air and ground traffic, resulting in changes in behavior, changes in local distribution of resources, and/or avoidance of the ROW.

Specifically, furbearers are particularly sensitive to noise and human activity and tend to avoid developed areas (SRB&A 2009). Thus, furbearer hunters and individuals with traplines may experience reduced success along the ROW during the construction season or even during operation, depending on traffic levels. Waterfowl may experience a reduction in nesting habitat and would also be displaced by blasting, construction noise, and traffic.

This general disturbance of wildlife could result in subsistence resources being unavailable at the time and place that subsistence users are accustomed to finding them. Effects from the road on other subsistence resources would likely be more localized to the general vicinity of the ROW.

Subsistence User Access

Alternative A crosses subsistence use areas for 12 subsistence study communities: Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Coldfoot, Evansville, Hughes, Kobuk, Selawik, Shungnak, and Wiseman (Appendix L: Table 43). Bettles, Evansville, Kobuk and Shungnak would have their hunting areas bisected by the project. Allakaket, Alatna and Ambler would have their subsistence hunting area partially intersected, while Selawik would be on the periphery of the project. The communities that would have their use areas bisected or partially intersected would likely see the largest impact on their subsistence activities. However, there may be instances where peripheral use areas are particularly important for a specific resource.

The subsistence activities that most commonly occur in the direct vicinity of the Alternative A corridor include caribou and moose hunting (nine communities each), small land mammal hunting/trapping (eight communities), Dall sheep (likely in the higher elevations) and waterfowl hunting (six communities each), and bear hunting (five communities). Impacts to individual resource uses are discussed above in Sections B.2.1.1 (Subsistence Resource Abundance) and B.2.1.2 (Subsistence Resource Availability).

Impacts to harvester access would occur within the vicinity of the road corridor. Potential sources of impacts to user access include:

- physical barriers: road, construction laydown materials, pilings and heavy equipment, other infrastructure
- diversion: avoidance of material sites and other areas which are unsafe for travel; rerouting previously used travel routes, trails, and traplines.
- security restrictions

The degree of user access impacts would depend on whether the timing of activities conflicts with subsistence use areas and activities for a community. Because construction would occur year-round, it is likely that there would be direct conflicts with construction activities for certain subsistence uses. Based on available data, subsistence activities occur year-round, peaking in the fall (August-October) and again in the spring (April-May) for most study regions (Appendix L: Section 5). The project corridors cross areas used for both riverine and overland travel, and construction and operation activities would occur year-round; thus, residents may experience impacts to user access for all subsistence activities which are overlapped by the proposed ROW.

The road itself, in addition to ice and snow roads, gravel mine sites, and other material sites, would act as a physical barrier to overland use. Most residents of the region use boats and snowmachines to access subsistence use areas, although some communities in the eastern portion of the project area (Wiseman and Coldfoot) also use road vehicles as they are road-connected communities. Hunters may not be able to cross over a high road or snow berm on their snowmobiles, particularly if they are pulling a heavy load. In addition, individuals traveling overland may have to divert around material sites and other areas that are unsafe for travel. Overland trails, travel routes, subsistence camps, and traplines would be bisected by the project (see Supplemental EIS Section 3.4.7, Subsistence Uses and Resources).

Residents of the Native Village of Kobuk identified a traditional caribou hunting trail, The Kogoluktuk Trail, which would bisect the Alternative A and B route by approximately 25 miles from the Kogoluktuk River to the Selby River. Residents from Kobuk indicated that they and Shungnak residents, use snowmachines to travel north along the Kogoluktuk River and then would hunt in the Ambler Lowlands following the Kogoluktuk Trail to the east, and then down the Mauneluk or Selby Rivers back to the Upper Kobuk River. The residents indicated that this trail is often used in the winter and early spring for caribou hunting and can be a day trip or broken into multiple days. Residents of the Upper Kobuk also use the Kogoluktuk Trail from the spring to the fall to travel via ATV into the Ambler Lowlands and access berry picking areas and to hunt migrating waterfowl.

The Kogoluktuk Trail would be directly impacted by the construction and use of the proposed road. The trail likely would cross the road, or follow the road, in multiple segments and during construction and operation of the road the trail would likely no longer be usable by the local subsistence users. Abandoning previously used trails could result in greater risks to hunter safety as residents may travel farther or through unfamiliar terrain to access harvesting areas.

Additionally, residents may abandon or alter traplines to avoid regular crossing of the road and may reroute around the road system or use areas that require crossing the road less often. Subsistence users of the Upper Kobuk indicated that they had traplines in the Ambler Lowlands (likely accessed via the Kogoluktuk Trail) or along the hillsides just south of the Alternative A and B route. While Alatna Village residents indicated there were traplines near the Malamute Fork of the Alatna River and within the Helpmejack Hills. Residents of Evansville Village indicated there were traplines near the Koyukuk River. These traplines could intercept with the proposed road and would be unusable due to the construction and operation of the road.

In addition to trails and travel routes, the road corridor would cross near community and family camps (e.g., traditional caribou, moose, and fish camps). If the road crosses too close to an existing camp, subsistence users may abandon the camp altogether due to avoidance by subsistence resources, concerns about safety, or difficulty accessing the area. Subsistence communities have notified the BLM about three subsistence camps which would be directly impacted by the construction and operation of the proposed road on Alternative A and B, though it is highly likely that there are more subsistence camps along the route not yet known by the BLM especially along Alternative C. Evansville Village resident identified his moose hunting camp which he has been using for about 50 years, and his direct family has been subsisting in the area for over 100 years. The moose camp is about 500 ft from the proposed Alternative A and B, and if the road is constructed, the resident indicated he would no longer use the camp due to the road’s physical barrier to the moose hunting territory.

Another moose camp is located about three miles south of the proposed Alternative A on the confluence of the Alatna and the Malamute Fork of the Alatna River. The Alatna resident and his children use this camp for hunting moose and indicated if the road was constructed the individual would no longer use this camp due to proximity. Another subsistence camp along the Alatna River is in use by an Allakaket Family, and is directly in the path of Alternative A and B. The family said this camp is used for moose hunting, fishing, and as a staging point for sheep hunting further in the Brooks Mountain Range. This is the same family who have an antler tied to a tree to show their children this is a place caribou occasionally still migrate to. This camp would be demolished by the construction of the road.

While travelling in the area along the Alatna River, an Alatna resident indicated to the BLM that the foothills of the Brooks Mountain Range between the John River and Walker Lake is a very important location because it’s at the confluence of the three major animal resources: moose, sheep, and caribou. Additionally, directly to the west of the Alatna River, within Alternative A, along the Helpmejack hills is an important bear hunting area, though no direct camps were identified (Nictune 1988).

Within the Ambler Lowlands, Native Village of Kobuk residents identified a caribou hunting area with associated camps just south of Alternative A and B. The placename for this area is Kangingiiqsivik and it means “To Drive Caribou” (NPS Placename Database). Residents of Kobuk also call it California Ridge and identified it as a narrow canyon through which migrating caribou will get stuck for the winter. Historically Upper Kobuk residents used caribou drivelines throughout the canyon, but now subsistence users will travel north with snowmachines along the Kogoluktuk River and then into the narrow valley to check for caribou. This caribou hunting location was told to BLM by multiple Upper Kobuk residents in different contexts, and it is also important to the residents as a place where their ancestors subsisted (Cleveland and Foot 1980). The proposed Alternative A and B route would cut off the trail from the Kogoluktuk River to the California Ridge and may stop people from traveling back into the valley due to physical barriers and from security restrictions.

While most direct impacts to user access would involve overland travel, there may be periods of time during construction where access along certain river drainages is obstructed due to bridge construction activities. This would block subsistence users from accessing upstream fishing, caribou hunting, and sheep hunting areas. It is anticipated that bridges would be designed with adequate clearance. However, it is possible that bridges may also obstruct boat travel along certain smaller waterways; the likelihood of this impact depends on individual bridge height and design.

In addition to physical barriers to subsistence users during construction, residents may also experience reduced access due to security restrictions around construction work areas and along the road. Residents may not hunt near the road due to restrictions on discharging firearms near roads (shooting from or across a road is contrary to Alaska law) and lack of knowledge or communication regarding security protocols.

The proposed ROW would not permit access for residents to use the road for subsistence purposes but would allow residents to cross the road at established crossing areas. The efficacy of crossing ramps to reduce access impacts for local hunters would depend on the location, design, and frequency of the ramps along the ROW. In addition, ramps would likely not be built immediately. During construction, there would likely be times (e.g., during active construction) where hunters may not be permitted to cross roads at all. Subsistence users do not always use or follow established trails when pursuing resources overland; instead traveling in various directions based on environmental factors (e.g., weather, snow and ice conditions) and traditional knowledge of resource distribution and behavior. Therefore, the presence of crossing ramps would not eliminate impacts to user access. Subsistence users may have to travel additional distances when pursuing resources to locate approved crossing areas, or they may take safety risks by crossing in areas not approved for crossing. In addition, despite the presence of crossing ramps, some individuals may still have difficulty using crossing ramps, especially when hauling sleds. Subsistence users in the community of Nuiqsut have reported difficulty under certain conditions when using crossing ramps on industrial roads near their community, although recent upgrades to the ramps have addressed some of these concerns (SRB&A 2018a). AIDEA has established a Subsistence Advisory Committee (SAC) made up of local residents who will provide input on road design, operations, and maintenance, and identify and communicate potential impacts to subsistence.

While road access for local subsistence users would not be permitted, it is possible that residents from local communities would use the cleared area of the ROW alongside the road as a travel corridor, particularly if game such as moose concentrate in these corridors. In addition, it is reasonable to assume that some unauthorized use of the road or ROW may occur, particularly where the road meets the main road system. Use of the ROW may facilitate access to hunting areas farther from the community as well as between communities. AIDEA indicates that ROW travel would be prohibited, and security would patrol the roads to prevent violations. Enforcement measures would reduce but not eliminate use of the ROW. Restrictions on use of the ROW, particularly by residents when certain areas of the road would be crossable, may be difficult to enforce.

B.2.2 Evaluation of the Availability of Other Lands

Alternative A and B are both similar in the amount of federal land used by the ROW (3,498 and 3,083 acres respectively). The only variation in public land between the alternatives would occur within GAAR. The remainder of the two routes would be located on State and Native Corporation land. Alternative C proposes to use BLM managed land for most of the route (19,090 acres), with Native Corporation land and State of Alaska land managing less. Other DOT&PF previously identified alternative corridors considered include the Original Brooks East, Kanuti Flats, Elliot Highway, Parks Highway Railroad, DMTS Port, Cape Blossom, Selawik Flats and Cape Darby. These routes did not meet screening criteria and were not considered further (see Supplemental EIS, Appendix G for further discussion).

Of the feasible alternatives carried forward for evaluation, the proposed route was designed and engineered to optimize many environmental and economic considerations. Alternative A is the most economically feasible route and while it crosses more waterbodies requiring culverts or bridges, it has a smaller overall footprint than the other proposed routes. The National Park Service, in their Ambler Mining District Industrial Access Project Environmental and Economic Analysis (EEA), found Alternative B to have less of an impact to caribou habitat than Alternative A within the boundary of Gates of the Arctic Park and Preserve (GAAR). While Alternative A would have more suitable lichen habitat removed for construction and there would be an increased chance of a caribou vehicle strike within GAAR boundaries, Alternative A would have a lesser impact to resources over the entire Ambler Road Project footprint. While Alternative C crosses the subsistence use area of 12 communities, A and B both cross only subsistence use areas of 11 communities[1]. Alternatives A and B both have the largest project area in the WAH habitat (4,161 and 4,775 acres respectively), while Alternative C has an area of 4,120 total acres. Alternative C, unlike Alternatives A and B, would also intersect the range of the RMH, a small, non-migratory herd centered on the Ray Mountains.

The purpose of constructing and operating the proposed road would be to access the District. As such, there is no other feasible terminus for the road. Therefore, the only options are the starting point and the route the road would follow.

B.2.3 Evaluation of Other Alternatives That Would Reduce or Eliminate the Use, Occupancy or Disposition of Public Lands Needed for Subsistence Purposes

AIDEA and DOT&PF considered numerous transportation modes and route alternatives for accessing the District. Their screening process eliminated many of those options as either not physically or economically feasible. Consideration was given to the environment as air travel only was an option; a rail system was another. Using existing infrastructure, such as the DMTS, for part of the route was considered. These options did not meet the criteria established for this project. Only physically and economically feasible alternatives were carried through for analysis in the Supplemental EIS.

B.2.4 Findings

Alternative A would not result in a significant restriction to subsistence uses for the communities of Beaver, Coldfoot, Livengood, Manley Hot Springs, Minto, Nenana, Stevens Village, Rampart, Tanana, Galena, Alakanuk, Anvik, Emmonak, Grayling, Holy Cross, Marshall, Mountain Village, Nunam Iqua, Pilot Station, Pitka's Point, Ruby, Russian Mission, St. Mary's, Atqasuk, Brevig Mission, Nuiqsut, St. Michael, Stebbins, Teller, Utqiagvik, Wales, Kaltag, Kotlik, Koyukuk, and Nulato.

Alternative A may result in a significant restriction to subsistence uses for the communities of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Wainwright, and White Mountain.

This is based on the following findings:

- The construction and operation of the Ambler Road could cause population level impacts to the WAH and a reduction in the abundance of caribou available for residents of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Wainwright, and White Mountain. The road could delay and deflect migrating caribou, which could increase energy expenditure, impact body condition, reduce foraging rates, increase winter mortality, and decrease breeding

[1] Note: For Alternatives A and B the only resource used by Hughes that could be affected would be Dall sheep. The importance of Dall sheep to the community of Hughes is not known. Only high and moderate valued resources were analyzed in detail for in this Section 810 Analysis.

success, pregnancy rates, and calf recruitment. Such impacts could exacerbate or prolong population declines and hinder the herd's ability to naturally recover from low population levels. Impacts to WAH abundance would affect communities throughout the herd's range; particularly those to which caribou are of moderate and high importance.

- The construction and operation of the Ambler Road could cause a reduction in the availability of caribou for residents of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Selawik, Shungnak, and Wiseman. A portion of the herd would likely be delayed or deflected by the road. If the lead caribou are disrupted then the majority of the herd could be impacted. Caribou could reduce their use of habitat within seasonal ranges, limiting availability of the resource for residents in the periphery of the herd's range. Disrupted migratory groups could scatter, reducing subsistence hunters' ability to harvest adequate numbers of caribou efficiently. Deflected caribou would remain north of the road and would not be available for harvest in subsistence use areas for communities in the migratory or winter ranges. Delayed caribou could move through traditional hunting areas later in the year, which could preclude the availability of bulls for subsistence harvest due to the timing of the rut. Delayed animals could move through areas faster, limiting their availability for communities along migratory routes. Caribou movements and migration are often predictable but are also inherently variable. As such, the magnitude of impacts to caribou availability would likely vary from year to year but would not affect all communities equally. It is likely these communities would experience long term reductions in caribou availability if historic migratory routes and movement patterns are disrupted due to delays or deflections as described above.
- The construction and operation of the Ambler Road could cause population level impacts to fish and a reduction in the abundance of harvestable fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Wiseman. Increased sedimentation from construction and operation activities and infrastructure, particularly in spawning grounds, could smother eggs, alter feeding habitat, and decrease fish production. If sedimentation increased in any of the spawning areas, there could be adverse impacts to spawning success of sheefish, salmon, whitefish, and other resident species. The presence of the road in addition to related culverts, bridges, and gravel infrastructure could also alter and degrade fish habitat both upstream and downstream from the road, which could affect fish abundance. Spills could substantially degrade habitat quality and affect the long-term health of individual fish and fish populations.
- The construction and operation of the Ambler Road could cause a reduction in the availability of fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Wiseman. Changes in the availability of fish species from the proposed action could affect subsistence users throughout the project area upstream and downstream from the project area, particularly if the project results in changes in fish distribution or the timing of fish migrations. Fish could be diverted, displaced, or obstructed due to culvert placement, excavation, or stream diversions. Temporary changes to habitat resulting from water withdrawals, runoff from melting ice roads, and construction activities, could affect fish distribution. Potential contamination from dust deposition, spills, or perceived contamination from asbestos and other toxic chemicals could have indirect effects on subsistence, as subsistence users could reduce their consumption of a resource if they fear contamination; therefore, resources perceived as unhealthy or contaminated are considered unavailable to local residents.
- The construction and operation of the Ambler Road could cause a reduction in access for the communities of Alatna, Allakaket, Ambler, Bettles, Evansville, Kobuk, and Shugnak. Overland access to subsistence use areas would likely be impeded by the road. If delayed or deflected

caribou migrate through areas later in the year, access to these animals could be impossible due to ice conditions on river systems that subsistence hunters use to access traditional caribou crossing and hunting areas. Road and bridge construction could result in subsistence users being unable to access subsistence use areas.

B.3. Evaluation and Findings for Alternative B (AIDEA Alternative Route (GAAR South) to the Dalton Highway)

Alternative B is similar to Alternative A, but it differs in the route through GAAR. It is 228 miles long with a total distance to Fairbanks of 473 miles. This routes crosses GAAR further south than Alternative A.

B.3.1 Evaluation of the Effect of Use, Occupancy or Disposition on Subsistence Use and Need

Impacts to subsistence uses under Alternative B are similar to those described under Alternative A (see Section B.2.1.1 of this evaluation), with differences discussed below.

Subsistence Resource Abundance

The route chosen through GAAR for Alternative B would place a river crossing on the Reed River approximately 7 miles from sheefish spawning habitat on the mainstem of the Kobuk River and closer to sheefish spawning habitat than any other alternative. This may increase the likelihood of resource abundance impacts to the resource. Moving a crossing closer to sheefish spawning habitat, especially with the concentrated spawning area located there, would increase impacts related to sediment from construction, erosion, and potential degradation and contamination of the habitat from accidental spills. This may impact reproductive success of sheefish in the Kobuk River. As stated in B.2.1.3 of this evaluation, this particular stretch of the Kobuk River has the highest concentration of sheefish spawning habitat in Alaska. Any effect on spawning success may affect sheefish abundance. Impacts to the sheefish population would affect any community along the potentially affected drainages who harvest sheefish. Impacts would be particularly severe for communities in the Kobuk River watershed for which sheefish are a resource of high importance (Ambler, Kiana, Kobuk, and Noorvik).

Subsistence Resource Availability

Impacts to subsistence resource availability under Alternative B are the same as those discussed under Alternative A, but with a potentially greater amount of direct impacts to sheefish availability resulting from its greater proximity to key sheefish spawning habitat (see Section B.3.1.1, Subsistence Resource Abundance).

Subsistence User Access

The Alternative B would have direct impacts to user access for the same 12 communities listed under Alternative A. Alternative B crosses through similar subsistence harvesting areas as Alternative A, with the addition of the Hogatza River area and Norutak Lake, which are both used by Kobuk and Koyukuk River Region communities, and therefore user access would be affected for some harvesters in these areas. Alternative B also differs from Alternative A in that the ROW would overlap a portion of Ambler’s harvest area for vegetation, a resource of high importance to the community. This may lead to a direct impact by removal of harvestable vegetation or contamination (real or perceived) to harvestable vegetation by fugitive dust and accidental spills (see Section B.2.1.1). The direct loss of harvestable vegetation by construction of the road would last for the life of the project. If reclamation occurs, even after reclamation of the road, vegetation can take decades to recover.

B.3.2 Evaluation of the Availability of Other Lands

See Section B.2.2 of this evaluation.

B.3.3 Evaluation of Other Alternatives That Would Reduce or Eliminate the Use, Occupancy or Disposition of Public Lands Needed for Subsistence Purposes

See Section B.2.3 of this evaluation.

B.3.4 Findings

Alternative B would not result in a significant restriction to subsistence uses for the communities of Beaver, Coldfoot, Livengood, Manley Hot Springs, Minto, Nenana, Stevens Village, Rampart, Tanana, Galena, Alakanuk, Anvik, Emmonak, Grayling, Holy Cross, Marshall, Mountain Village, Nunam Iqua, Pilot Station, Pitka's Point, Ruby, Russian Mission, St. Mary's, Atqasuk, Brevig Mission, Nuiqsut, St. Michael, Stebbins, Teller, Utqiagvik, Wales, Kaltag, Kotlik, Koyukuk, and Nulato.

Alternative B may result in a significant restriction to subsistence uses for the communities of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Wainwright, and White Mountain.

This is based on the following findings:

- The construction and operation of the Ambler Road could cause population level impacts to the WAH and a reduction in the abundance of caribou available for residents of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Wainwright, and White Mountain. The Alternative A analysis of impacts to caribou abundance would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion.
- The construction and operation of the Ambler Road could cause a reduction in the availability of caribou for residents of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Selawik, Shungnak, and Wiseman. The Alternative A analysis of impacts to caribou availability would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion.
- The construction and operation of the Ambler Road could cause population level impacts to fish and a reduction in the abundance of harvestable fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Wiseman. The majority of the analysis of Alternative A would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion. Additionally, the route for Alternative B would place a river crossing seven miles from sheefish spawning habitat on the Reed River. Moving a crossing closer to the concentrated area of sheefish spawning habitat could increase the potential for sediment impacts from construction and erosion and degradation and contamination of the habitat from accidental spills.
- The construction and operation of the Ambler Road could cause a reduction in the availability of fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Wiseman. The majority of the analysis of Alternative A would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion.

- The construction and operation of the Ambler Road could cause a reduction in access for the communities of Alatna, Allakaket, Ambler, Bettles, Evansville, Kobuk, and Shugnak. The majority of the analysis of Alternative A would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion.

B.4. Evaluation and Findings for Alternative C (Diagonal Route to the Dalton Highway)

The BLM developed this alternative based on scoping comments. The 332-mile route is longer than the other alternatives but has a similar driving length (476 miles) to Fairbanks. This alternative would have a logical terminus connecting into the road and rail network to provide year-round access to existing port facilities.

B.4.1 Evaluation of the Effect of Use, Occupancy or Disposition on Subsistence Use and Need

Under Alternative C, the types of impacts to subsistence uses are similar to those described under Alternative A, Section B.2.1. Alternative C would affect a different set of communities and would cross through different key habitat areas. Differences in impacts under Alternative C are discussed below.

Subsistence Resource Abundance

Alternative C would be less likely to have direct impacts on sheefish spawning grounds in the Kobuk and Alatna rivers. Alternative C crosses the Kobuk River directly downstream from known sheefish spawning habitat. Alternative C would require a crossing on the Koyukuk River near Hughes in a documented sheefish spawning habitat. As discussed above (Section B.2.1.1), any changes to waterways which obstruct access to spawning grounds could have larger indirect impacts to communities who harvest sheefish upstream and downstream from the road corridor. In addition to sheefish spawning grounds, Alternative C also crosses streams which support spawning for Chinook and chum salmon. Impacts to salmon spawning grounds under Alternative C could have larger effects to communities who harvest salmon downstream from the road corridor along the Yukon and Koyukuk rivers. For many Yukon River communities, Chinook salmon is a resource of high importance (see Appendix L, Table 49), and it is also a species of yield concern to the ADF&G. Chum salmon is a resource of high importance to most communities in the Kobuk-Selawik, Koyukuk, and Yukon river basins.

Alternative C would occur within the WAH wintering grounds and affects an overall greater amount of WAH habitat. Loss of winter habitat would be particularly detrimental to the WAH due to the herd's difficulty in accessing lichen during winter. Past WAH population declines have been attributed to extreme winter weather conditions, a resulting lack of access to lichen, and high winter mortality (see Supplemental EIS Section 3.3.4, Mammals).

Subsistence Resource Availability

For several resources (caribou, small land mammals, salmon, and non-salmon fish), Alternative C would cross subsistence use areas for a greater number of communities, thus increasing the number of communities with the potential for direct effects to the availability of these resources.

Alternative C could result in direct impacts to fish resource availability for a greater number of communities (eight) compared to under Alternative A (seven communities). Alternative C would cross more fish streams than alternatives A and B, and it would construct more bridges and minor culverts which are more likely to obstruct fish passage. This would increase the likelihood of impacts to resource availability for communities both in the vicinity of the road, as well as upstream and downstream from the road. Alternative C would also have more impacts related to ice roads and water withdrawals due to more miles of ice roads under this alternative. Alternative C would more frequently be routed along floodplains and near streams, which may put waters at higher risk for spills and sedimentation (Supplemental EIS Section 3.3.2, Fish and Aquatics).

Compared to Alternatives A and B, Alternative C crosses areas of higher value moose habitat and therefore could have greater impacts to moose availability in nearby communities for whom moose is a resource of high importance (Hughes, Huslia, Alatna, Allakaket).

For caribou, Alternative C would cross caribou subsistence use areas for 10 communities (versus nine communities under Alternative A). Alternative C places the ROW through the middle of the entire RMH range; it bypasses the HHH range and passes through the peripheral and winter range of the WAH. This alternative intercepts only a small portion of the migratory area of the WAH. While Alternative C crosses more WAH habitat than the other alternatives and would be more likely to affect wintering habitat, the alternative may have a lesser impact on fall and spring migrations because it only intercepts a small portion of their migratory range. This would reduce the potential for impacts to caribou resource availability resulting from road deflection and displacement. The RMH may experience a direct impact from this alternative. However, because the RMH is a smaller herd (812 as of last census) and access to it by subsistence harvesters is currently limited, potential impacts to subsistence resource availability are low (see Supplemental EIS Section 3.3.4, Mammals).

Subsistence User Access

In terms of user access, Alternative C crosses subsistence use areas for the same number of communities as Alternative A (12 communities), but a different set of communities: Alatna, Allakaket, Ambler, Anaktuvuk Pass, Hughes, Huslia, Kobuk, Selawik, Shungnak, Stevens Village, and Tanana. Communities with the highest number of resource use areas crossed (5 or more) include Allakaket, Hughes, Kobuk, Shungnak, Ambler, Stevens Village, and Alatna. Hughes, Kobuk, and Shungnak would have their hunting areas bisected by the project. The community of Kobuk would be located directly along the Alternative C route and Hughes is within four miles of the route. Allakaket, Alatna and Ambler would have their subsistence hunting area partially intersected, while Stevens Village, Tanana, Huslia, and Selawik have use areas on the periphery of the project. The communities that would have their use areas bisected or partially intersected would likely see the largest impact on their subsistence access. However, there may be instances where peripheral use areas are particularly important for a specific resource or activity, and these communities may also experience impacts to user access resulting from the road.

B.4.2 Evaluation of the Availability of Other Lands

See Section B.2.2 of this evaluation.

B.4.3 Evaluation of Other Alternatives That Would Reduce or Eliminate the Use, Occupancy or Disposition of Public Lands Needed for Subsistence Purposes

See Section B.2.3 of this evaluation.

B.4.4 Findings

Alternative C would not result in a significant restriction to subsistence uses for the communities of Alakanuk, Anvik, Atqasuk, Beaver, Brevig Mission, Coldfoot, Emmonak, Galena, Grayling, Holy Cross, Kaltag, Kotlik, Koyukuk, Livengood, Manley Hot Springs, Marshall, Minto, Mountain Village, Nenana, Nuiqsut, Nulato, Nunam Iqua, Pilot Station, Pitka's Point, Rampart, *Ruby, Russian Mission, St. Mary's, St. Michael, Stebbins, Tanana, Teller, Utqiagvik, and Wales.*

Alternative C may result in a significant restriction to subsistence uses for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Deering, Elim, Evansville, Golovin, Hughes, Huslia, Kiana, Kivalina, Kobuk, Kotzebue, Koyuk, Noatak, Nome, Noorvik, Point Hope, Point Lay, Selawik, Shaktoolik, Shishmaref, Shungnak, Stevens Village, Unalakleet, Wainwright, White Mountain, and Wiseman.

This is based on the following findings:

- The construction and operation of the Ambler Road could cause population level impacts to the WAH and a reduction in the abundance of caribou available for residents of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Wainwright, and White Mountain. The Alternative A analysis of impacts to caribou abundance would apply similarly to Alternative C. See Section B.2.4 of this evaluation for discussion, though impacts may be lessened due to the proposed routes' orientation relative to migratory paths. The route proposed under Alternative C would bisect more of the WAH winter range and could impact access to important winter habitat. Caribou abundance could be impacted if caribou movements are impeded by the road along this route.
- The construction and operation of the Ambler Road could cause a reduction in the availability of caribou for residents of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Huslia, Kobuk, Selawik, and Shungnak. The Alternative A analysis of impacts to caribou availability would apply similarly to Alternative C. See Section B.2.4 of this evaluation for discussion.
- The construction and operation of the Ambler Road could cause a reduction in the availability of caribou for residents of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Selawik, Shungnak, and Wiseman. The Alternative A analysis of impacts to caribou availability would apply similarly to Alternative B. See Section B.2.4 of this evaluation for discussion.
- The construction and operation of the Ambler Road could cause population level impacts to fish and a reduction in the abundance of harvestable fish for the communities of Alatna, Allakaket, Ambler, Buckland, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Stevens Village. The majority of the analysis of Alternative A would apply similarly to Alternative C. See Section B.2.4 of this evaluation for discussion. Additionally, Alternative C would be less likely to have direct impacts on sheefish spawning grounds and abundance in the Kobuk and Alatna rivers and would be more likely to impact spawning grounds and abundance in the Koyukuk River. This could potentially lead to potentially greater impacts to those communities in the Koyukuk River watershed.
- The construction and operation of the Ambler Road could cause a reduction in the availability of fish for the communities of Alatna, Allakaket, Ambler, Buckland, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, and Stevens Village. The majority of the analysis of Alternative A would apply similarly to Alternative C. See Section B.2.4 of this evaluation for discussion. Additionally, due to its greater length Alternative C would have greater impacts from bridges, culverts, ice roads, and water withdrawal on fish availability than Alternatives A and B.

The construction and operation of the Ambler Road could cause a reduction in access for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Hughes, Huslia, Kobuk, Selawik, Shungnak, Stevens Village, and Tanana. The majority of the analysis of Alternative A would apply similarly to Alternative C. See Section B.2.4 of this evaluation for discussion.

B.5. Evaluation and Findings for the Cumulative Case

The goal of the cumulative case analysis presented in Appendix H is to evaluate the incremental impact of the actions considered in the, in conjunction with all past, present, and reasonably foreseeable future activities in or near the Ambler Road. Past and present actions which have affected subsistence uses and resources within the study region include mineral exploration, mineral development, infrastructure projects, scientific research, recreation and tourism, sport hunting and fishing, hunting and harvesting regulations, establishment of wildlife refuges, national parks and preserves, and environmental changes resulting from climate change. Actions included in the cumulative case analysis are listed in Appendix H Section 2 and are summarized below.

B.5.1 Evaluation of the Effect of Use, Occupancy or Disposition on Subsistence Use and Need

The cumulative impacts to subsistence resulting from the proposed road, other reasonably foreseeable developments, and climate change could result in reduced harvesting opportunities for local residents and alterations in subsistence harvesting patterns. The cumulative effects of the road, in combination with past, present, and reasonably foreseeable future actions, are discussed in detail below.

Past and Present Actions

A discussion of historic events which have affected subsistence in the region is provided in Section 3.4.7 of the Supplemental EIS and in Appendix L, Section 6.6. More recent past and present actions that have affected subsistence and resources are:

- mineral exploration inside the District (e.g., Arctic, Bornite, Smucker, and Sun projects)
- mineral exploration outside the District (e.g., South 32 mining exploration)
- Red Dog Mine, including the DMTS and port site
- oil exploration and extraction, including Trans-Alaska Pipeline System (TAPS)
- infrastructure projects, including construction of the Dalton Highway
- sport hunting and fishing
- hunting and harvesting regulations
- passage of ANILCA
- impacts of climate change

Many of these actions are ongoing and will continue into the future (see Section B.5.1.3 below).

Construction of the TAPS and Dalton Highway have affected subsistence access and resource availability for communities in the eastern portion of the project area, with many residents believing that the highway and pipeline have resulted in changes to caribou migration across the region. Impacts to vegetation within this area include construction of the Dalton Highway and other roads and airports in rural Alaska communities, which has resulted in loss of harvesting areas within the footprints, alteration beyond the footprints, and the spread and establishment of non-native invasive species (NNIS) near developments.

Mineral exploration both within and outside of the District has had effects subsistence resource availability and user access. Red Dog Mine, the largest operating mine in the region, has introduced contamination concerns for local residents, particularly Kivalina residents who are situated downstream from the mine, and have affected resource distribution and migration for resources such as caribou and marine mammals possibly resulting in decreased harvests of these resources over time (EPA 2009). These impacts are a result of the mine itself, in addition to the DeLong Mountain Transportation System (DMTS) and port site. Residents have observed that some caribou would stop once they reach the DMTS, sometimes traveling alongside the road before crossing, and other times bypassing the road altogether. Such behavior has also been documented through radio collar observation. Other mining activities have occurred in the region, and residents have reported concerns about the effects of these activities on the health of subsistence resources such as fish (see Supplemental EIS Section 3.4.7, Subsistence Uses and Resources).

In addition to mineral exploration, oil and gas exploration, development, and production is ongoing and planned within the onshore North Slope, State and Federal waters in the Beaufort Sea, and in the Western Canadian Arctic. These activities include exploration work, infrastructure development, construction, and maintenance, gravel mining, and production associated with existing wells. Effects of oil and gas development on the North Slope have included changes in the availability of resources such as caribou, furbearers, and waterfowl, and impacts to harvester access. Oil and gas activities are expected to continue under all alternatives.

Other past and present actions in the study region include sport fishing, recreation and tourism, land management changes, and regulation of hunting and harvesting activities. Increased sport hunting and fishing in the region and associated air traffic have resulted in increased competition for local subsistence users in addition to disturbance and displacement of subsistence resources such as caribou. Government regulation of hunting and harvesting activities in addition to land access have also had effects on subsistence. Hunting and harvesting regulations are sometimes at odds with the traditional timing of subsistence activities, or put limits on harvests. The establishment of Gates of the Arctic National Park and Preserve (GAAR) in the 1980s also affected access to and use of traditional harvesting areas for residents of nearby communities within the northeastern portion of the project area by limiting use of ATVs in national parkland (Watson 2018).

Climate change is an ongoing factor considered in cumulative effects analyses of the Ambler Road. Climate change could affect the habitat, behavior, distribution, and populations of fish and wildlife within the program area. Impacts of climate change include changes in the predictability of weather conditions such as the timing of freeze-up and breakup, snowfall levels, storm and wind conditions, and ice conditions (e.g., ice thickness on rivers and lakes), all of which affect individuals' abilities to travel to subsistence use areas when resources are present in those areas. In addition, subsistence users may experience greater risks to safety when travel conditions are not ideal. Changes in resource abundance or distribution resulting from climate change can also affect the availability of those resources to subsistence users or may cause subsistence users to travel farther and spend more time and effort on subsistence activities (Brinkman 2016). Impacts to key subsistence resources resulting from climate change include a loss of foraging (lichen) habitat and loss of access to winter forage for caribou (see Supplemental EIS Section 3.3.4, Mammals), as well as changes in fish distribution and productivity due to loss of habitat and warmer temperatures (see Supplemental EIS Section 3.3.2, Fish and Aquatics).

Reasonably Foreseeable Future Actions

Reasonably foreseeable actions within the region that could contribute to subsistence impacts include:

- exploration and development of mineral prospects within the District (Arctic, Bornite, Sun, and Smucker projects)
- exploration and development of mineral prospects outside the District (e.g., Manh Cho Mine, South 32 Mine)

- use of the proposed road for commercial access
- use of the proposed road for commercial use by local communities and Native Allotment owners
- secondary access roads to other mining areas and claims as well as local communities
- infrastructure projects (e.g., Dalton Highway improvements, OTZ Telephone Cooperative communication project)
- changes in land management
- eventual public use of the road

The project would introduce a large industrial road corridor into an area that was previously undeveloped and used primarily for subsistence and recreational purposes. Under any alternative, 12 communities have subsistence resource use areas impacted by the project corridor(s), and a majority of these communities are rural, low-income, non-road-connected communities that rely on subsistence to support their mixed economy.

The road and associated mineral development, in addition to other reasonably foreseeable activities, would likely contribute to cumulative impacts on subsistence resource abundance and availability. The development of mines within the District and secondary access roads would result in habitat loss, alteration, and fragmentation of WAH caribou migratory and winter range, which could affect the abundance and availability of caribou to some or all of the 42 WAH WG communities. The mines, mining roads, and secondary access roads would increase habitat fragmentation exponentially. The fragmentation of habitat would further remove usable habitat for caribou during migration and winter, which could force substantial range shifts, increased competition for resources, or increased predation (NCASI 2008). Alternatives A and B both place the ROW in more migratory habitat than Alternative C, which may spatially alter WAH migration away from subsistence use areas of Alatna, Allakaket, Ambler, Bettles, Evansville, Hughes, Kobuk, Shungnak, Selawik and Wiseman. But Alternative C places the ROW more in the winter range of the WAH. This may alter the WAH use of winter range and impact Alatna, Allakaket, Ambler, Hughes, Huslia, Kobuk, Selawik, Tanana and Shungnak. Impacts to wintering habitat and lichen availability could affect winter survival rates for the WAH. A member of the Northwest Arctic Regional Advisory Council noted that in recent years climate change has made winter foraging even more difficult for the caribou herds:

> This climate change in the past maybe five, six years and knowing the caribou and stuff, after it snows in November we usually get rain and when it snows, that rain it'll freeze on top of the tundra and the caribou are having hard time feeding so – and we lose a lot of caribou due to starvation due to this climate change, so people out there need to be aware of that because a lot of people will wonder why are we losing so much caribou. So this climate change did lots of damage on our subsistence take on caribou… And the people should know that it affects the herd. (Northwest Arctic Regional Advisory Council 2022)

Population-level impacts could extend to the 42 WAH WG communities, particularly those with a moderate to high reliance on the resource (Appendix L, Table 48).

Reasonably foreseeable future actions that would impact fish include advanced mining development and secondary access roads. The Ambler Road in addition to associated mining development and future infrastructure development would increase potential impacts to resource abundance and resource availability for key fish resources such as sheefish, whitefish, and salmon. Direct and indirect chemical stressors such as mining-related pollution, acid mine drainage, and the release of toxic materials have the potential to significantly impact aquatic life health and the survival of fish populations (Limpinsel et al. 2017). Toxic metals that bioaccumulate in fish tissue can lead to fish mortality, increased susceptibility to disease, reduced growth rates, and pose health risks to human consumers (Hughes et al. 2016). Mining related removal of groundwater would lower the water table well below natural stream or lake levels and considerably reduce flow into streams and the hyporheic zone. Depending on the location and scale of operation, dewatering has the potential to substantially reduce groundwater flows into important spawning, egg incubating, and wintering habitats relied upon by salmon, sheefish, whitefish, and other important subsistence species which could have potential population level impacts (see Supplemental EIS Section 3.3.2, Fish and Aquatics). Alternative A and B cross more key spawning habitat for sheefish compared to Alternative C. However, Alternative C crosses streams which support spawning for Chinook salmon and chum salmon, and Alternative C would have direct effects on fish subsistence use areas for a greater number of communities (eight versus four).

Sheefish typically exhibit a high degree of spawning site fidelity, not only to spawning streams but to specific areas within a reach of stream (Savereide and Huang 2016). They require specialized spawning habitat limited by water temperature, substrate composition, and specific water quality characteristics influenced by geologic features (Alt 1994; Braem et al. 2015; Savereide and Huang 2016) (see Volume 4, Map 3-18). Given the proximity of the 4 most advanced mine projects to the Kobuk River sheefish spawning grounds and the large numbers of sheefish that spawn in this habitat, sheefish may be especially vulnerable to population-level effects (see Supplemental EIS Section 3.3.2, Fish and Aquatics), from mine related dewatering, large scale spills, or leaching of acid rock into waterways (Appendix L Section 6.6). Maintaining spawning habitat is critical to the survival of the Kobuk and Yukon rivers sheefish and whitefish populations because a large fraction of any given spawning population may spawn in a small, distinct geographic area. Cumulative impacts to sheefish populations would most likely occur for fish study communities in the Kobuk-Selawik and Koyukuk river basins. In particular, sheefish are a resource of high importance to the communities of Ambler, Kiana, Kobuk, and Noorvik. If impacts to sheefish extended to the Koyukuk River basin, then communities such as Alatna, Allakaket, Hughes, Huslia, Bettles, Evansville (for whom sheefish is a resource of medium importance) could also be affected (Appendix L, Table 49).

Salmon populations are also vulnerable to cumulative impacts. Since the 1990s, chum and Chinook salmon returns have declined, and the ADF&G considers Chinook salmon as a “stock of yield concern”. Chum and Chinook salmon runs have declined even further since publication of the Final EIS, leading to subsistence closures in the Yukon River watershed (see Supplemental EIS Section 3.4.7, Subsistence Uses and Resources). If these trends continue, and in combination with the cumulative impacts of the road, mining activity, and other reasonably foreseeable future actions, communities in the Kobuk-Selawik, Koyukuk, and Yukon river basins could experience reduced harvest success for this key resource. For many Koyukuk and Yukon river communities, Chinook salmon is a resource of medium and high importance (see Supplemental EIS Appendix L, Table 49). Chum salmon is a resource of high importance throughout the Kobuk-Selawik, Koyukuk, and lower Yukon river basins.

In addition to caribou and fish, mining and its associated activities also have the potential to cause substantial impacts to vegetation. Open pit and underground mining would result in loss of vegetation within the project area and alteration of vegetation beyond project areas from disturbance of surface and groundwater flow, lowering of the water table from dewatering activities, and fugitive dust from heavy metals and accessory roads. As has been shown at Red Dog Mine, fugitive dust from heavy metals can travel thousands of feet to several kilometers in distance, particularly if strict mitigation measures are not employed or practiced. In addition, hundreds of thousands of acres of mining claims exist in the advanced mining scenario, which could result in more loss and alteration than initially predicted if more claims are developed. Fugitive dust from roads and mining activities would reduce the overall area available to local communities for subsistence harvesting of berries and other plants. While not harvested in the quantity that caribou and fish are, vegetation is a resource of high cultural and/or material importance in nearly all of the 27 primary subsistence study communities. If the road and/or future mining and infrastructure projects overlap with key berry harvesting areas for an individual community, then vegetation harvesting for that community could be reduced.

After reclamation of the road (assuming the road is not maintained for future public access or otherwise remains), the remaining cleared ROW would likely become a route for local and non-local hunters traveling by off-highway vehicles. If the reclaimed road alignment increases access into the region, state and federal regulators may respond by introducing stricter hunting and harvesting regulations, which would affect availability of resources to local communities. Impacts on resource availability due to increased competition and changes in hunting regulations would be most likely to occur for large land mammals such as caribou and moose.

The potential for increased access to the region resulting from a publicly accessible road is a primary concern that has been voiced residents during both scoping and traditional knowledge studies associated with the Ambler Road (Watson 2014; Allakaket Tribal Council 2022; BLM 2018). Many residents do not believe that the road will remain private and point to previous private access roads that eventually opened to the public (e.g., the Dalton Highway). While the BLM is not considering issuance of a ROW for a public road, it is reasonably foreseeable that there may be some public uses of the road, including local resident use of the Ambler Road for subsistence purposes, trespass, commercial use of the road by local communities, uses by individuals with existing land use rights, and, after the useful life of the road for mineral development, efforts to convert the road to a Public Road. If there is illegal trespass on the project road or these additional roads, it could result in higher levels of harvest, increased displacement from roads, and higher energetic expenditures from disturbance. If the road is eventually opened to the public, this could result in higher levels of human activity along the road, higher levels of recreational use of areas adjacent to the road, and higher levels of hunting and trapping. While regulation of hunting could partially mitigate the impacts of increased hunter access on caribou, increases in human activity would likely increase the energetic impacts to caribou along the road and decrease the use of the area by caribou. These activities would occur in addition to habitat loss and human activities in WAH summer range or elsewhere on their migratory range. Public access to the road for outsiders would likely have substantial negative impacts to subsistence users by increasing competition for subsistence resources, increasing disturbances to wildlife, and decreasing harvest success for local residents. According to Guettabi et al. (2016), increased outsider access resulting from the road and/or ROW would likely reduce harvest success for local hunters, particularly for moose (see Appendix L for more detailed discussion). The WAHWG cited the Dalton Highway as an example of how restricted access roads can easily be opened to the public due to political and public pressure, and how public roads can affect resource availability for local communities:

> The WACH declined for much of the last two decades. Reduced population levels during that time led to harvest restrictions. Although the most recent caribou count indicates a population that is stabilizing or possibly starting to increase, concerns remain that increased access due to roads could greatly compound user conflict and limited availability of caribou. We recognize that the proposed road is currently specified as being commercial-only. However, history (e.g., with the Dalton Highway) suggests that once roads are established they eventually become used by the public. We are greatly concerned that the Ambler Road will not remain closed to public use given this history and the multiple jurisdictions (State, Federal and Native) that the proposed road would cross. (Western Arctic Caribou Herd Working Group 2018)

The BLM is currently preparing an EIS regarding potential revocation of ANCSA 17(d)(1) withdrawals, including parcels in the Kobuk-Seward Planning Area, and associated changes in land management could affect subsistence resource availability. Revocation of withdrawals on certain parcels of land could result in changes in subsistence management, including the loss of Federal subsistence priority on those lands for local residents, or an increase in lands available for Federal subsistence priority. Such changes, in combination with increased hunting competition in the region, could affect subsistence uses and harvest success for certain study communities, either negatively or positively.

Overall, cumulative impacts of Alternative A and B related to resource abundance and availability would likely be greater than those under Alternative C, as they would be more likely to affect resource availability of migrating caribou to the subsistence study communities, particularly during the fall months, and are most likely to have population-level effects on sheefish and whitefish, all key subsistence species among the study communities. These alternatives would also be more likely to have larger indirect effects on caribou availability to the 42 caribou study communities, and downstream effects on the 32 fish study communities.

In addition to potential cumulative impacts on resource availability and abundance, the road, in combination with present and reasonably foreseeable actions, could also increase the potential for cumulative impacts to user access. Cumulative impacts to user access would likely be similar regardless of the alternative, as the different alternatives affect the same number (albeit a different set) of communities).

Mining development will result in the physical removal of traditional subsistence hunting and harvesting areas for the study communities in addition to decreased access to these areas through security/access restrictions. The overall area available for subsistence use will likely shrink over time due to the increasing presence of infrastructure and human activity within traditional use areas. Increased infrastructure across the region associated the road, mines, and other infrastructure projects, would increase the number of physical barriers to overland travel. Access impacts will most likely affect the 12 communities with subsistence use areas overlapping each of the proposed routes but could also affect additional communities as development and infrastructure expands. Under the proposed alternatives, the communities mostly likely to experience direct impacts to access include Shungnak, Evansville, Bettles, Kobuk, Ambler, Allakaket, Alatna, and Hughes. Further mineral development throughout the District, in addition to other reasonably foreseeable actions within the region could result in a larger area of development and more communities being affected.

The potential for increased access into the project area resulting from unauthorized use of the road and ROW may increase competition in the region for certain resources and decrease harvesting success for local hunters. Illegal trespass by unauthorized users along the Ambler Road will likely occur by both local/regional residents and non-local individuals, particularly during the hunting season. While these instances may be sporadic, they may also increase disturbances to resources and competition for local hunters, particularly in areas where existing trails and roads intersect with the road alignment.

> *Would it ever become public in the future? That's always the scary thing about roads once they become publicly accessible anybody from anywhere has access to that road. Whether it be from within the State of Alaska or outside.* (Noatak Government-to-Government Meeting with BLM, April 2023)

Secondary access roads developed by communities would likely be used, at least by local residents, for subsistence harvesting activities. If the Ambler Road also becomes open to local use for subsistence purposes, then such a road could have positive and negative impacts on subsistence. Some residents would likely use the road to access subsistence hunting and harvesting areas. The use of industrial roads for subsistence purposes has been documented on the North Slope of Alaska. Roads provide easy access to hunting areas, particularly for individuals who do not have access to snowmachines and ATVs, who have limited time to engage in subsistence activities, or who have health or other issues that make overland travel difficult. Access to the road may also help to mitigate some of the effects of the road on resource migration and distribution, as residents may be able to travel farther to access areas with heavier concentrations of the resource.

It is unclear whether the road would allow access to small mining claims; while large mines would likely have policies regarding hunting and fishing by workers, smaller mining outfits or individuals may allow these activities. According to the Western Arctic Herd Working Group (WAHWG 2017), communities within the region have already experienced increased competition in traditional hunting areas, with greater numbers of hunters concentrated within smaller areas. Sport hunting is a key issue within the region for subsistence harvesters, and public access to the area via a road or ROW would contribute to these impacts.

Ultimately, the cumulative impacts to subsistence resulting from the AMDIAR, other reasonably foreseeable developments, and climate change could result in reduced harvesting opportunities for local residents and alterations in subsistence harvesting and land use patterns, particularly if the road eventually becomes open to public use. A recent analysis comparing road-connected communities to non-road-connected communities showed that road-connected communities have substantially lower subsistence harvests than non-road-connected communities (Guettabi et al. 2016). Other research (e.g., Kofinas et al. 2016) has shown an estimated decline of one-third of subsistence harvests for communities along a publicly accessible road, with the potential for a relatively modest increase in income; thus, the loss to subsistence would likely not be offset by an increase in income, nor would increase income address the social or cultural losses to communities.

B.5.2 Evaluation of the Availability of Other Lands

See Section B.2.2 of this evaluation.

B.5.3 Evaluation of Other Alternatives That Would Reduce or Eliminate the Use, Occupancy or Disposition of Public Lands Needed for Subsistence Purposes

See Section B.2.3 of this evaluation.

B.5.4 Findings

The cumulative case would not result in a significant restriction to subsistence uses for the communities of Alakanuk, Anvik, Atqasuk, Beaver, Brevig Mission, Emmonak, Galena, Grayling, Holy Cross, Kaltag, Kotlik, Koyukuk, Livengood, Manley Hot Springs, Marshall, Minto, Mountain Village, Nenana, Nulato, Nunam Iqua, Pilot Station, Pitka's Point, Rampart, Ruby, Russian Mission, St. Mary's St. Michael, Stebbins, Tanana, Teller, and Wales.

The cumulative case may result in a significant restriction to subsistence uses for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Coldfoot, Deering, Elim, Evansville, Golovin, Hughes, Huslia, Kiana, Kivalina, Kobuk, Kotzebue, Koyuk, Noatak, Nome, Noorvik, Nuiqsut, Point Hope, Point Lay, Selawik, Shaktoolik, Shishmaref, Shungnak, Stevens Village, Unalakleet, Utqiagvik, Wainwright, White Mountain, and Wiseman.

This is based on the following findings:

- The construction and operation of the Ambler Road could cause population level impacts to the WAH and a reduction in the abundance of caribou available for residents of Alatna, Evansville, Anaktuvuk Pass, Buckland, Noatak, Selawik, Wiseman, Allakaket, Ambler, Bettles, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Nuiqsut, Shungnak, Deering, Elim, Golovin, Kivalina, Koyuk, Nome, Point Hope, Point Lay, Shaktoolik, Shishmaref, Unalakleet, Utqiagvik, Wainwright, and White Mountain. The Alternative A analysis of impacts to caribou abundance would apply similarly to the Cumulative Case. See Section B.2.4 of this evaluation for discussion. Development of mines and secondary access roads within the District would contribute to habitat loss, alternation, and fragmentation of the WAH migratory and winter range. Oil and gas development on the North Slope would continue and impact the range and movements of not only the WAH, but also the TCH and CAH as well. Communities that rely jointly on these herds for their subsistence needs would likely be impacted under the cumulative case. Additionally, future public use of the road could result in major increases in non-rural resident hunting, contributing to a decrease in the abundance of the herd. Climate change would reduce caribou forage and limit animals' ability to reliably access winter forage. Changing weather and vegetation patterns could affect winter survival rates for the WAH and other large migratory herds. This would likely exacerbate impacts described in B.2.4.

- The construction and operation of the Ambler Road could cause a reduction in the availability of caribou for residents of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Huslia, Kiana, Kobuk, Kotzebue, Noorvik, Selawik, Shungnak, and Wiseman. The Alternative A analysis of impacts to caribou availability would apply similarly to the cumulative case. See Section B.2.4 of this evaluation for discussion. In addition, future public use of the road by non-rural users hunting along or in the vicinity of the road could further deflect and/or delay the herd.
- The cumulative case could cause population level impacts to fish and a reduction in the abundance of harvestable fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, Stevens Village, and Wiseman. Much of the analysis of Alternative A would apply similarly to the cumulative case. See Section B.2.4 of this evaluation for discussion. Additionally, advance mining development and secondary road access could release mining related pollution, acid mine drainage, and toxic materials which could significantly impact aquatic life health and the survival of fish populations. Large mine dewatering could reduce groundwater flows into important spawning, egg incubating, and wintering habitats relied upon by salmon, sheefish, whitefish, and other important subsistence species which could have potential population level impacts. Given the proximity of the four most advanced mine projects to the Kobuk River sheefish spawning grounds and the large numbers of sheefish that spawn in this habitat, sheefish could be especially vulnerable to population-level effects. These impacts in conjunction with climate driven changes in fish productivity due to loss of habitat and warmer temperatures and recent declines in salmon abundance could lead to reductions in harvestable resources.
- The cumulative case could cause a reduction in the availability of fish for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Buckland, Evansville, Hughes, Huslia, Kiana, Kobuk, Kotzebue, Noatak, Noorvik, Selawik, Shungnak, Stevens Village, and Wiseman. Much of the analysis of Alternative A would apply similarly to the cumulative case. See Section B.2.4 of this evaluation for discussion. Additionally, advance mining development could release mining related pollution, fugitive dust, acid mine drainage, and toxic materials and contaminate fish downstream of the mine sites. This potential contamination from spills or perceived contamination could have indirect effects on subsistence, as subsistence users may reduce their consumption of a resource if they fear contamination; therefore, resources perceived as unhealthy or contaminated are considered unavailable to local residents.
- The construction and operation of the Ambler Road could cause a reduction in access for the communities of Alatna, Allakaket, Ambler, Anaktuvuk Pass, Bettles, Evansville, Hughes, Huslia,

Kiana, Kobuk, Selawik, Shungnak, and Stevens Village. Mining development will result in the physical removal of traditional subsistence hunting and harvesting areas for the study communities in addition to decreased access to these areas through security/access restrictions. Increased infrastructure across the region associated the road, mines, and other infrastructure projects, would increase the number of physical barriers to overland travel. Climate change would affect seasonal access to traditional hunting and fishing areas, and may make access to these areas unpredictable or unreliable. Access impacts will most likely affect the 12 communities with subsistence use areas overlapping each of the proposed routes but could also affect additional communities as development and infrastructure expands.

C. Notice and Hearings

ANILCA Section 810(a) provides that no “withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the public lands which would significantly restrict subsistence uses shall be effected” until the federal agency gives the required notice and holds a hearing in accordance with ANILCA Section 810(a) (1) and (2). The BLM provided notice in the Federal Register that it made positive findings pursuant to ANILCA Section 810 that Alternatives A, B, and C and the cumulative case presented in the Ambler Road Draft Supplemental EIS, met the “may significantly restrict” threshold. Therefore, the BLM will hold public hearings on subsistence resources and activities in conjunction with the public meeting on the Draft EIS in the vicinity of potentially affected communities. Information about public meetings and subsistence hearings will be available on the BLM’s website at eplanning.blm.gov, and will be announced through additional public notices, news releases, and mailings.

D. Subsistence Determinations under ANILCA Section 810(a)(3)

ANILCA Section 810(a) provides that no “withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the public lands which would significantly restrict subsistence uses shall be effected” until the federal agency gives the required notice and holds a hearing in accordance with ANILCA Section 810(a)(1) and (2), and makes the three determinations required by ANILCA Section 810(a)(3). The three determinations that must be made are: 1) that such a significant restriction of subsistence use is necessary, consistent with sound management principles for the utilization of the public lands; 2) that the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other such disposition; and, 3) that reasonable steps will be taken to minimize adverse impacts to subsistence uses and resources resulting from such actions [16 U.S.C. 3120(a)(3)(A), (B), and (C)].

The BLM has found in this preliminary subsistence evaluation that Alternatives A, B, C and the cumulative case considered in this Draft Supplemental EIS may significantly restrict subsistence uses. Therefore, the BLM will undertake the notice and hearing procedures required by ANILCA Section 810 (a)(1) and (2) in conjunction with release of the Ambler Road Draft Supplemental EIS in order to solicit public comment from potentially affected communities.

The determination that the requirements of the ANILCA Section 810(a)(3)(A), (B), and (C) have been met will be analyzed in the Final ANILCA Section 810 Evaluation. The Final Evaluation will integrate input voiced during the hearings by residents of potentially affected communities.

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Name and Title | **Date**

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Appendix N. Potential Mitigation

Table of Contents

Attachment

Acronyms

AAC	Alaska Administrative Code
ACEC	Area of Critical Environmental Concern
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AGL	above ground level
AIDEA	Alaska Industrial Development and Export Authority
ARD	acid rock drainage
BLM	Bureau of Land Management
BMP	best management practice
CFR	Code of Federal Regulations
DOI	U.S. Department of the Interior
EIS	Environmental Impact Statement
GAAR	Gates of the Arctic National Park and Preserve
ISPMP	Invasive Species Prevention and Management Plan
MBTA	Migratory Bird Treaty Act
NAD83	North American Datum of 1983
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NNIS	Non-native Invasive Species
NOA	naturally occurring asbestos
NPS	National Park Service
NTP	Notice to Proceed
PA	Programmatic Agreement
POD	Plan of Development
POL	Petroleum, Oils and Lubricants
ROD	Record of Decision
ROW	right-of-way

SF299	Standard Form 299
SPCCP	Spill Prevention Control and Countermeasures Plan
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USC	U.S. Code

1 Introduction and General Provisions

This document is intended to identify and discuss potential measures to mitigate adverse impacts from the Ambler Road Project. Overall, this broad list of potential mitigation is provided to inform the various decision makers of available options for mitigating impacts from the Amber Road Project. The Bureau of Land Management's (BLM's) authority to require and enforce mitigation generally is limited to mitigating impacts to BLM-managed lands and resources on those lands. However, for purposes of the National Environmental Policy Act (NEPA), mitigation measures are also identified and discussed for the range of activities the Alaska Industrial Development and Export Authority (AIDEA) has proposed, regardless of whether the activity occurs on or off BLM-managed land. Overall, this broad list of potential mitigation is provided to inform the various decision makers of available options for mitigating impacts from the Amber Road Project and will be expanded upon based on comments to this draft. This appendix is generally organized in the same order as the Draft Supplemental Environmental Impact Statement (EIS), with Section 1 providing general background and overall measures, Section 2 providing general measures related to design and construction features of any alternative, and Section 3 providing measures applicable to specific resource categories addressed in the Draft Supplemental EIS.

The following potential mitigation measures were identified through consideration of law, regulation, and plan policy; identified through proposals from AIDEA, other agencies, and/or members of the public; or identified as the BLM has worked through the analysis in the Draft Supplemental EIS. Each agency may select measures such as these for inclusion in decisions related to their own jurisdictions. If the BLM selects one of the action alternatives in its Record of Decision (ROD), the ROD would identify the mitigation measures that the BLM would require. While this document presents conceptual mitigation measures, the road right-of-way (ROW) grant and other authorizations would provide further detail regarding specifics of the mitigation measures listed in this document.

Measures to mitigate adverse impacts that have already been committed to by AIDEA through its project application are considered design features and as such, are presented in Chapter 2, Alternatives (Section 2.4.4), and analyzed as part of the proposed project and alternatives in Chapter 3, Affected Environment and Environmental Consequences, of the Draft Supplemental EIS. To the extent these design features could be modified for clarity or increased effectiveness, the modification is included in this appendix as a mitigation measure.

In this document, the effectiveness of each potential mitigation measure is noted, and in each resource section or subsection below, the expected effectiveness of the mitigation measures if collectively applied is discussed. For this analysis, it is assumed that the measure would by implemented by AIDEA and enforced by the BLM. The discussion includes consideration of whether and how the effectiveness of mitigation on BLM-managed land would be affected if the same mitigation is not applied off BLM-managed land. The landowner discussion is necessary, because the BLM manages only part of the land along each alternative and its authority is limited to mitigating impacts to BLM-managed lands and resources. The BLM would have authority over approximately 3,000 to 3,500 acres of the project on federal lands for Alternatives A and B (out of approximately 15,000 acres for the total project footprint), and authority over approximately 19,000 acres of the project on federal lands along Alternative C (out of approximately 23,000 acres total), as shown in Appendix F, Social Systems Tables and Supplemental Information, Table 5.

Guidelines used for consideration of effectiveness are as follows:

- Highly effective: The impact(s) targeted by the mitigation measure would not occur or would be wholly mitigated in normal construction or operations.

- Mostly effective: The impact(s) targeted by the mitigation measure likely would occur at a low level or in minor areas but overall would be avoided in normal construction or operations.
- Partially effective: The impact(s) targeted by the mitigation measure would occur despite the measures but would be reduced in effect or spatial extent.
- Minimally effective: The impact(s) targeted by the mitigation measure would occur despite the measures, which may have a mitigating effect but not enough to be measurable or otherwise meaningful.

The analysis of effectiveness in some cases are tempered by consideration of atypical events that could occur outside of normal construction or operating conditions and that may cause impacts. An example of an atypical event is an accident, such as a truck rollover that causes a spill.

1.1 General Measures*

1. **Potential BLM Mitigation Measure:** AIDEA would conduct all activities associated with the initiation, construction, operation, and termination of the grant within the limits of the authorized project area.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at restricting all impact to the relatively narrow corridor defined by the authorization. Wildlife (including mammals, fish and birds), subsistence, fugitive dust, and water quality impacts would extend beyond the bounds of the authorized project area.

2. **Potential BLM Mitigation Measure:** Any activities on the Ambler Road project area beyond those analyzed in the Draft Supplemental EIS and specified in the authorizations must have prior written approval of the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective at preventing AIDEA from taking actions that are not approved under the authorizations without formal approval from the Authorized Officer.

3. **Potential BLM Mitigation Measure:** AIDEA would ensure that the facilities to be constructed, used, and operated would limit or prevent damage to scenic, esthetic, cultural, and environmental values (including damage to fish and wildlife habitat), damage to federal property, and hazards to public health and safety.

   Effectiveness: This mitigation measure, on its own, would be partially effective at limiting or preventing damage to the identified resources. AIDEA would need to plan for and implement specific measures to meet this requirement. This Draft Supplemental EIS identifies impacts to the resources addressed in this measure that are unavoidable.

4. **Potential BLM Mitigation Measure:** AIDEA must notify the Authorized Officer in writing 30 days prior to the beginning of any temporary closure and 90 days prior to initiation of permanent closure and reclamation activities.

   Effectiveness: This mitigation measure, on its own, would be highly effective at informing the BLM of temporary and permanent closure of the road. This would allow the BLM to prepared for closure activities and put staff in place for oversight and review of closure activities and documents.

5. **Potential BLM Mitigation Measure:** Except as specified in the authorizations, AIDEA would not disturb or destroy pipelines, fuel gas lines, roads, trails, work pads, survey monuments or ROW markers, cathodic protection devices, monitoring rods, drainage/erosion control structures,

or any other facilities or properties existing on public lands. Any disturbance of these facilities or properties by AIDEA in the conduct or operations under this authorized project would be reported to the Authorized Officer and would be restored to the satisfaction of the Authorized Officer.

Effectiveness: This mitigation measure, on its own, would be highly effective at preventing disruption to the listed facilities and their functions on BLM-managed land. The measure recognizes the potential for accidental disturbance to facilities, but clearly leaves responsibility for restoration with AIDEA.

6. **Potential BLM Mitigation Measure:** Except for authorized road/traffic signs, no signs or advertising devices would be placed on the road ROW or on adjacent public lands, except those posted by or at the direction of the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective at preventing impacts to visual resources from intrusive and unnecessary features that detract from the natural setting.

7. **Potential BLM Mitigation Measure:** AIDEA would not block or obstruct the ingress or egress along any permanent existing roads or trails, including perennial winter trails and subsistence trails identified by communities, unless explicitly approved by the Authorized Officer. See also Section 3.4.2, Transportation and Access.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at maintaining existing access in the project area. The limitations on crossings imposed for safety would not be avoided.

8. **Potential BLM Mitigation Measure:** To ensure monument preservation and aid in the management of federal lands, the points where the road enters, on which the road is located, and where it leaves federal interest lands would be documented. This would be accomplished by locating and measuring to the nearest monuments on either side of the as-built centerline of the road. When on federal lands, if the road centerline falls within 1,320 feet of an existing monument, its position would also be measured and its relationship shown relative to the centerline. These steps would ensure both objectives and would assist in the federal land manager's ability to identify where the road is on federal lands.

   Effectiveness: This mitigation measure, on its own, would be highly effective at documenting the road location with respect to federal land and assist the BLM in meeting its land management obligations.

9. **Potential BLM Mitigation Measure:** AIDEA would conduct an environmental briefing with all employees, contractors, and subcontractors so they are familiar with the stipulations. AIDEA would maintain records of participant names and dates for these briefings and would make such records available to BLM on demand. AIDEA would ensure that a copy of the stipulations would be readily available in either hard copy or electronic format to all employees, contractors/subcontractors, and agency staff at all crew quarters and offices associated with road operations (e.g., gatehouses, offices at maintenance camps).

   Effectiveness: This mitigation measure, on its own, would be mostly effective at meeting the requirements of environmental mitigation measures set forth in BLM's ROD that can be influenced by the actions of employees, contractors, and subcontractors. It is possible that, through human error, some stipulations at some times in some locations do not get implemented and lead to adverse impacts that could have been avoided. Instructing workers on the compliance requirements in the stipulations would significantly improve the level of compliance.

10. **Potential BLM Mitigation Measure:** AIDEA would develop and submit a monitoring plan for approval by the Authorized Officer. It would be designed to demonstrate compliance with the approved plan of operations and other federal and state environmental laws and regulations, provide early detection of potential problems, and supply information that would assist in directing corrective actions should they become necessary. Examples of monitoring programs that may be relevant include water quality, air quality (dust control), slope stability, revegetation progress (during reclamation), noise levels, and wildlife mortality. Specific programs required to be included would be itemized in the Grant. Monitoring plans may incorporate existing state and federal monitoring requirements to avoid duplication. However, the submitted monitoring plan needs to include copies of and clearly reference these other plans. Appropriate corrective measures would be undertaken should impacts be identified during monitoring.

    Effectiveness: This mitigation measure, on its own, would be mostly effective at recording AIDEA's compliance with the mitigation objectives and, if necessary, identifying corrective action to address unanticipated impacts and or ineffective mitigation.

11. **Potential BLM Mitigation Measure:** AIDEA would ensure that copies of all relevant monitoring plan records are available for BLM review at any project camp, office, or permanent facility at all times.

    Effectiveness: This mitigation measure, on its own, would provide the BLM with up-to-date information on monitoring activities. In addition, the measure would build awareness of the importance of compliance at all operational levels of the project.

12. **Potential BLM Mitigation Measure:** AIDEA would provide to the BLM copies of any permits required by any other Federal or State agencies with jurisdiction (including, but not limited to, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Alaska Department of Fish and Game, the Alaska Department of Natural Resources, the Alaska Department of Environmental Conservation, and the Alaska Department of Transportation and Public Facilities) prior to receiving a Notice to Proceed (NTP) with surface disturbing activities on BLM-managed lands. The terms and conditions of all other agency permits would be incorporated into the terms and conditions of AIDEA's BLM-issued Grant of Right of Way. When other agencies require submission of activity plans or monitoring reports, AIDEA would provide identical and concurrent copies to BLM.

    Effectiveness: This mitigation measure, on its own, would be highly effective at providing the BLM with information pertaining to all of AIDEA's environmental commitments for the project and potentially provide efficiencies in compliance monitoring.

13. **Potential BLM Mitigation Measure:** In accordance with regulation at 43 Code of Federal Regulations (CFR) 2805.11(c), AIDEA may only use the authorized area for the specific use the grant authorizes. AIDEA would ensure that the road, camps, and any other authorized facilities are used only in support of authorized activities. Other uses, including use by hunters, fishers, tourists, researchers, or employee's friends or family members, is not authorized. This does not preclude providing appropriate emergency assistance to anyone in distress, providing assistance and support to law enforcement or search and rescue personnel, or providing support to agency staff and contractors engaged in administration of the authorized project.

    Effectiveness: This mitigation measure, on its own, would be mostly effective in constraining use of the road to its intended purpose, allowing for exceptions in the event of emergencies. This measure would avoid impacts from unauthorized use and subsequent environmental degradation.

14. **Potential BLM Mitigation Measure:** Snow removal and road grading should occur from west to east, to the extent practicable, to minimize the potential for the spread of invasive plant species.

    Effectiveness: This mitigation measure would be mostly effective at ensuring that invasive species already present along the Dalton Highway corridor are not introduced or spread into the project area.

Summary of Effectiveness: Together, all measures in this section would be highly effective in meeting the objectives of securing the road for its intended use, minimizing the effects of the road on environmental resources, and establishing an ongoing program of compliance.

1.2 Reporting Requirements

1. **Potential BLM Mitigation Measure:** AIDEA would submit documentation of their consultation with affected subsistence communities to the BLM within 90 days of approving 90 percent road design at each phase of construction and annually by the end of the calendar year for 2 years following completion of construction of each phase, and at minimum every 5 years thereafter for the life of the project. Reporting would include a list of issues raised during consultation and results of road use monitoring.

   Effectiveness: This mitigation measure, on its own, would be highly effective in recording AIDEA's involvement with affected communities during design, construction, and operation. The BLM would be able to monitor issues and respond appropriately.

2. **Potential BLM Mitigation Measure:** AIDEA would monitor road use and keep records of numbers of vehicles by vehicle class and trip purpose. AIDEA would include in its monitoring and record keeping any unauthorized use of the road.

   Effectiveness: This mitigation measure, on its own, would be highly effective at allowing tracking of road use with respect to volume, frequency, vehicle types, and trip purpose to compare actual road traffic with AIDEA's application. The BLM would be able to determine whether AIDEA is operating the road as intended.

3. **Potential BLM Mitigation Measure:** AIDEA would provide the BLM with as-built drawings of the road within 90 days of completion of each construction phase. Data would be in the form of an ESRI shape file(s) referencing the North American Datum of 1983 (NAD83).

   Effectiveness: This mitigation measure, on its own, would be highly effective in documenting the road location and construction details for BLM records and would be used to compare the constructed project to the project as proposed in the application. The as-built drawings could also be used to monitor compliance with construction specifications and mitigation commitments.

4. **Potential BLM Mitigation Measure:** AIDEA would provide annual reports of incidents and accidents, including location, date, nature of incident or accident, whether any administrative or enforcement action was initiated, actions taken by AIDEA in response, and status of response completion. At a minimum, the types of incidents and accidents must include fuel, oil, or hazardous material spills; overturned vehicles or equipment; incidents that resulted in exceeding state water quality standards; incidents that altered stream banks, resulting in the stream leaving its normal channel (i.e., stream blowouts); wildlife injuries or fatalities; and fish kills. During construction, AIDEA would provide monthly reports of camp locations and dates utilized, fuel storage locations and dates utilized, routes used for off-highway fuel hauls and dates utilized, storage locations for any hazardous materials with dates utilized, and types of materials.

Effectiveness: This mitigation measure, on its own, would be highly effective in documenting accidents and out-of-compliance actions, their consequences, the remediation actions taken, and the residual effects. This information would allow the BLM to monitor and identify ongoing problems and take corrective action with AIDEA, if needed.

Summary of Effectiveness: Together, all measures in this section would be highly effective in documenting AIDEA's design, construction, and operations practices for compliance with environmental commitments included in the ROD.

1.3 General Responsibilities and Plan of Development

1. **Potential BLM Mitigation Measure:** AIDEA would refine, based on the NEPA analysis, the Plan of Development (POD) provided with the Standard Form 299 (SF299) ROW grant application, and the POD would be reviewed and approved by the BLM and made part of the authorization(s) to AIDEA. In accordance with regulations at 43 CFR 2805.12(a)(8)(vi), AIDEA would construct, operate, and maintain the Ambler Road and Related Facilities within the proposed project area in a manner consistent with the authorization, including the approved POD.

   Effectiveness: This mitigation measure, on its own, would be highly effective in providing consistency in documenting AIDEA's plan for the road, with the same current information included in the Plan of Development (POD) and Standard Form 299 (SF299). This would eliminate conflict and confusion that could result if the project's guiding documents relied on information obtained during 2 different phases of project development.

2. **Potential BLM Mitigation Measure:** ADIEA's proposed design features, industry best management practices (BMPs), and the BLM adopted mitigation measures listed in the BLM ROD for the Ambler Road Draft Supplemental EIS would be incorporated by reference into the AIDEA's POD and compliance program. Selected design features, BMPs, and mitigation measures would be refined and clarified in the subsequent authorization stipulations.

   Effectiveness: This mitigation measure, on its own, would be highly effective in identifying AIDEA's responsibilities for meeting the environmental commitments developed during the application, NEPA review, and permitting processes.

Summary of Effectiveness: Together, the measures in this section would be highly effective in creating a record of AIDEA's design, construction, and operations commitments for reducing environmental impact.

1.4 General Completion of Use (Restoration/Reclamation)

See also Section 3.3.1, Vegetation and Wetlands.

1. **Potential BLM Mitigation Measure:** Upon completion of use of all, or a very substantial part, of the authorized project area, AIDEA would promptly remove all improvements and equipment, except as otherwise approved by the Authorized Officer, and would restore the project area to a condition that is approved in writing by the Authorized Officer. Road closure would include barriers near either end and at other locations as needed to minimize continued use of the alignment as a transportation corridor by off-road vehicles including snowmobiles.

   Effectiveness: This mitigation measure, on its own, would be partially effective in restoring the authorized project area; however, complete restoration would not be possible given the irreversible and irretrievable commitment of resources. In addition, the environmental impacts that could result from removal of road materials could be greater than the effect of leaving some materials in place. The plan for what is being removed and how it would be removed would be important in ensuring the effectiveness of this stipulation.

2. **Potential BLM Mitigation Measure:** When the project improvements (infrastructure, roadbeds, and pads) are no longer needed, the end-of-project reclamation would include removing the fill placed in wetlands, and restoring the original contours of the landscape to return the land to its original condition for fish and wildlife.

   Effectiveness: This mitigation measure, on its own, would be partially effective in restoring former wetlands and fish and wildlife habitat. The 50-year life of the project could cause changes to wetlands that may make complete restoration impossible. Recovering the landscape to preconstruction conditions would require removal of massive quantities of road building materials. The removal and disposal of some materials may have more environmental impact than leaving them in place. The lack of resiliency of the arctic environment can make restoration difficult. It can take a considerable length of time for recovery.

3. **Potential BLM Mitigation Measure:** The location and method of disposal of used fill and other waste material removed from the road and associated facilities during closure and reclamation would be subject to pre-approval by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective in ensuring that potentially contaminated waste material is disposed of in accordance with relevant law, regulation, policy, and land use plan requirements.

4. **Potential BLM Mitigation Measure:** AIDEA would submit an initial closure and reclamation plan for approval prior to receiving a NTP for construction on BLM-managed land. AIDEA would submit an updated closure and reclamation plan with each submission of as-built designs, at each five year interval for the life of the project, and upon notification of intent to begin closure and reclamation activities.

   Effectiveness: This mitigation measure, on its own, would be highly effective in identifying AIDEA’s plans and responsibilities for reclamation. In this process, AIDEA would regularly revisit the plan and methods of closure and update the plan as technologies and conditions of the facilities change.

5. **Potential BLM Mitigation Measure:** Each closure and reclamation plan update would be required to include documentation that AIDEA has notified any local communities authorized to receive goods or services via AIDEA facilities of the plan and anticipated timelines.

   Effectiveness: This mitigation measure, on its own, would be highly effective in informing affected communities of AIDEA’s plan and schedule for removal of facilities and restoration of the corridor.

6. **Potential BLM Mitigation Measure:** AIDEA would submit a final summary report to the Authorized Officer within 30 days of completion or cessation of operations. This report would include:

   a. Written statement of program completion with completion date.
   b. Summary compilation of incident and accident reports required under mitigation measure #4 in section 1.2.
   c. A comprehensive map showing camp locations and dates utilized, fuel storage locations and dates utilized, routes used for off-highway fuel hauls and dates utilized, storage locations for any hazardous materials with dates utilized, and types of materials.

Effectiveness: This mitigation measure, on its own, would be highly effective in providing a record for the BLM to identify locations of known and potential contaminants on BLM-managed land. The BLM could use this information to confirm complete removal of contaminated materials during the restoration process.

Summary of Effectiveness: Together, all measures in this section would be highly effective in documenting AIDEA's restoration and reclamation plan, keeping the plan current with the conditions of the facilities to be removed, and keeping the affected communities informed of the reclamation plan. The effectiveness of the restoration and reclamation of the road corridor itself would depend on the value of the restoration work versus the environmental effects of the restoration and reclamation activities. It may be only partially effective to remove all materials from the corridor.

2 Alternatives*

This section presents general requirements related to construction of any alternative. Specific design and construction measures are also listed in Section 3, Affected Environment and Environmental Consequences, for protection of individual resources.

1. **Potential BLM Mitigation Measure:** Before BLM would issue a NTP for a construction segment or project, AIDEA would, in a manner acceptable to the Authorized Officer, locate and clearly mark on the ground the exterior boundaries of the road ROW and the location of all related facilities proposed to be constructed as part of that specific construction segment or project.

   Effectiveness: This mitigation measure, on its own, would be highly effective in providing the BLM the information needed to confirm the limits of the road ROW, location of all related facilities and footprint of construction, communicating to contractors building the construction segment or project, and allowing the BLM or other agencies to perform compliance inspections to make sure work is occurring in authorized locations.

2. **Potential BLM Mitigation Measure:** AIDEA would provide financial guarantees, such as a performance bond, maintenance bond, and reclamation bond, making funds accessible to BLM to cover the full cost of construction, operation, maintenance, and termination/reclamation in the event they are unable to do so. The financial guarantee mechanisms must meet the requirements of BLM regulation and policy and be approved by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective in securing funding for the construction, operation, maintenance, and termination/reclamation efforts and ensuring that these processes would move forward, whether or not AIDEA is still a financially solvent entity within the State of Alaska.

3. **Potential BLM Mitigation Measure:** AIDEA would submit a plan for approval for the use of explosives on federal land, including but not limited to blasting techniques, to the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective in providing the BLM information pertaining to the use of explosives on BLM-managed lands. The use, locations, schedule, and techniques for blasting would assist the BLM in controlling public access in blasting areas and support environmental and public safety.

4. **Potential BLM Mitigation Measure:** All construction and operations activities would be conducted with due regard for good resource management and in such a manner as not to block

any stream or drainage system; change the character or course of a stream; cause the pollution of any stream, lake, wetland, or land area; or cause pollution of the air.

Effectiveness: This mitigation measure, on its own, would be mostly effective in having AIDEA adopt sound practices for providing environmental protections while supporting resource extraction. Environmental impacts cannot be wholly avoided. Requiring "due regard" for the proper management of resources and the avoidance of impacts to water, land, and air would support a culture of avoiding environmental impacts among project participants and reduce overall impacts of the project.

Summary of Effectiveness: Together, all measures in this section would be highly effective in identifying the project limits and AIDEA's commitments to resource protection, restoration, and reclamation. It would be mostly effective in reducing environmental impacts, but would not result in complete avoidance of impacts.

3 Affected Environment and Environmental Consequences

3.1 Introduction

This section reflects the Affected Environment and Environmental Consequences chapter of the Draft Supplemental EIS and presents mitigation measures and design features in the same order the topics are addressed in the Draft Supplemental EIS. Note that there is substantial crossover between some sections, such as water, wetlands, and soils/erosion control. Cross references are provided where possible.

3.2 Physical Environment

3.2.1 Geology and Soils

1. **Potential BLM Mitigation Measure:** Each installation of artificial erosion control media would remain in place and be inspected and maintained weekly during the growing season until sufficient vegetation is established to achieve natural erosion control.

   Effectiveness: This mitigation measure is designed to stabilize soils and slopes, reducing sedimentation into wetlands and waterbodies, and reducing erosion. On its own, the measure would be mostly effective at reducing impacts under normal construction conditions associated with erosion and sediment control. Higher than expected precipitation events may result in sedimentation and erosion than exceeds the artificial erosion control media capacity. Extremely wet and dry conditions (or wildfire conditions occurring during construction seasons) may result in insufficient establishment of natural erosion control within the growing season. The Stormwater Pollution Prevention Plan (SWPPP) prepared for the project (see Chapter 2, Section 2.4.4 of the Draft Supplemental EIS) would identify methods, procedures, and remediation measures to reduce these occurrences and repair or replace damaged or insufficient control media. Other agencies and landowners would likely include this mitigation in their permits and authorizations for the project.

2. **Potential BLM Mitigation Measure:** The monitoring plan included as a potential mitigation measure in Section 1.1 would include a permafrost monitoring plan to detect and respond to issues resulting from permafrost disturbance at any location in the construction or operating right of way, including spur roads, landing strips, and building pads.

Effectiveness: This mitigation measure is intended to address impacts to the infrastructure and impacts to the surrounding area associated with permafrost degradation. This could include surface cracking, embankment settlements, blocked or perched culverts, or drainage changes. On its own, this mitigation measure would be partially effective at eliminating infrastructure impacts associated with the thawing of permafrost sections under and along the road and road facilities. This mitigation measure, on its own, would only be minimally effective at reducing the project's contribution to area permafrost degradation, as identification of issues would be after-the-fact.

3. **Potential BLM Mitigation Measure:** AIDEA would immediately construct the road to full depth embankment (Phase 2), without the prior construction actions to create a pioneer road, to reduce permafrost degradation and associated road quality deterioration.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the permafrost degradation impacts associated with the construction and operation of the pioneer road, for which removal of vegetation and reduced depth of embankment for approximately 2 years would likely accelerate or amplify the warming of the soil regime. The mitigation measure would be minimally effective at eliminating the permafrost degradation anticipated with or without road construction due to climate change during the project lifespan.

4. **Potential BLM Mitigation Measure:** If foam is used to insulate the permafrost from thermal degradation, it would be composed of closed-cell extruded polystyrene or other closed cell foams (e.g., blueboard) rather than non-extruded expanded polystyrene foam.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with permafrost thawing under the road bed. Alaska road applications have found that closed cell foams are more effective than other foams for thermal insulation.

5. **Potential BLM Mitigation Measure:** Geotechnical investigations would include acid-base accounting for samples collected from material sites, along the road alignment, and at locations of ancillary facilities to identify areas of potential acid rock drainage. Testing also would be done for non-acidic metals leaching. Cuts would be minimized in areas with high potential for acid rock drainage and non-acidic metals leaching. AIDEA would provide a protocol for determining when alternative locations would be needed to avoid such areas and, if avoidance is not possible, how cut material and drainage would be handled.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with acid rock drainage (ARD). Decision making associated with the geochemical testing data may result in the development of ARD or metal leaching despite reasonable measures to predict and avoid. In addition, changes to the drainages or presence of neutralizing minerals can change, resulting in ARD and leaching development over time. Management and mitigation of ARD and metal leaching once initiated is difficult and very expensive, resulting in unbudgeted reclamation costs.

6. **Potential BLM Mitigation Measure:** AIDEA would develop and implement a plan to educate workers, regional health care workers, and residents of all communities in the area potentially affected by the Ambler Road, on the health effects of exposure to Naturally Occurring Asbestos (NOA). The plan would include opportunities for routine risk-based health screening for non-cancerous and cancerous asbestos related diseases of workers, nearby communities, and regular subsistence users.

   Effectiveness: This mitigation measure is designed to educate, build awareness, and diagnose health problems early. As such, it would be highly effective at those aims. However, it would be minimally effective at reducing impacts associated with NOA. In combination with measures proposed to require AIDEA to provide testing, training, and safety gear for workers, it would be beneficial and educational for workers, drivers, and local communities. The health related impacts are not changed by routine screenings; however, the opportunities to receive local medical care and screenings within the area communities, enabling early medical diagnoses and interventions, are likely a reassurance to area residents. Asbestosis and lung diseases can take decades to develop, but within the project lifespan.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts associated with geologic and soil hazards, and are likely to be implemented along the full length of the proposed road corridor (including non-BLM-managed lands). Additional mitigation measures addressing NOA are identified in Section 3.2.7, Air Quality.

3.2.2 Sand and Gravel Resources

The majority of the proposed mitigation in this section applies to operation of mineral material sites (i.e., gravel pits). However, some apply to placement and management of mineral materials for road and ancillary facility construction and operation.

1. **Potential BLM Mitigation Measure:** Gravel and other construction materials would not be taken from streambeds, riverbeds, active floodplains, lakeshores, or outlet of lakes unless the taking is approved by the Authorized Officer as per further site-specific analysis.

   Effectiveness: This mitigation measure is designed to minimize impacts on waterbodies, including but not limited to bank erosion, channel migration, changes to surface or subsurface flows, changes to flow velocity, and other local hydraulic effects. It addresses impacts to water bodies, water quality, and aquatic habitat. This mitigation measure, where applied, would be highly effective at eliminating impacts that would be caused by such actions, and maintaining distance between the project actions and the waterbodies would reduce impacts to water quality and habitat. It is assumed that obtaining the approval by the Authorized Officer to engage in these actions would require additional design review and sufficient mitigation measures to avoid or reduce impacts.

   This mitigation measure would only apply to non-navigable waterways. Many of the rivers crossed within the proposed alternatives have been determined navigable and are State-owned submerged lands. It would be the decision of the State of Alaska whether gravel extraction permits for the beds of State-owned riverbed would be issued. The State has issued gravel extraction permits within active floodplains and riverbeds in the past to expedite rural construction projects, so it cannot be assumed that the State would adopt this mitigation measure on non-navigable or navigable waterways.

   Because the BLM manages only portions of the lands proposed within each alternative, if this mitigation measure is not adopted by all land owners, managers, or resource permitting agencies, it is anticipated that there would be impacts to downstream watersheds.

2. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would provide a detailed mineral materials (e.g., gravel) mining and reclamation plan to BLM for approval at least 90 days prior to beginning any mining operations. The mining and reclamation plan would address all applicable items in the attached Mineral Materials Mining and Reclamation Plan Proposal form (Attachment A). It would also address what would be done with asbestos-containing materials during reclamation.

   Effectiveness: This mitigation measure is designed to provide sufficient time and professional resources to review and identify that land management objectives and mitigation measures are properly applied to all construction activities related to mineral mining on public lands. On its own, it would be highly effective at eliminating and reducing impacts associated with incomplete or incorrect application of land management policies.

3. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would notify BLM at the beginning and end of active mining operations.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at eliminating impacts associated with or land use conflicts on BLM-managed lands. It would be partially effective at eliminating impacts resulting from lack of agency coordination; timely public notifications; and incomplete implementation of approved monitoring, regulatory permit compliance, or reclamation plans associated with the material sites.

4. **Potential BLM Mitigation Measure:** Excavated materials would not be stockpiled in rivers, streams, 100-year floodplains, or wetlands unless approved by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with placement of fill or materials within a floodplain; disruption of natural floodplain hydrology, floodplain, and wetland connectivity; and changes in fish habitat for temporary storage of gravel and other materials.

5. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that the site is developed sequentially in cells. A disturbed cell would be reclaimed prior to opening a new area. Exceptions to allow for thawing of permafrost may be granted at the discretion of the Authorized Officer

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with erosion and sedimentation of soils.

6. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that a 100-foot undisturbed buffer is maintained along any lakes or creeks that flow through upland material mining pits. Any approved access roads that bisect the buffer area would be rehabilitated at the close of mining by revegetating the crossing with plant species and densities similar to those in the undisturbed buffer for at least 100 feet from the bank-full elevation. Access roads in buffers originally void of vegetation would be scarified to a minimum depth of 8 inches during final reclamation.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating water quality impacts that would be caused by erosion and sedimentation of disturbed soils under high flow events. This mitigation measure also is highly effective at reducing impacts caused by accidental leaks or spills from vehicles and mining equipment.

7. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that buffer zones are not disturbed, except by designated crossings. Operation of equipment, placement of overburden or mined material, or storage/placement of any equipment and supplies would not be allowed in any buffer zones identified in the mining and reclamation plan, specified in the Decision Record for this authorization, or required in these stipulations.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with water quality.

8. **BLM Standard Stipulation for Mineral Material Mining:** Unless separately authorized, AIDEA would ensure that no material site is used for storage of materials and supplies not related to production of mineral from that site. Unless separately authorized, AIDEA would ensure that mineral materials sites are not used for secondary or value-added production processes not related to production of mineral materials.

Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with the stockpiling of non-native soils that could alter the pH of the area.

9. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that no minerals originating outside the permit area are imported to the permit area, except as may be authorized in approved project plans.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with the stockpiling of non-native materials.

10. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that overburden, topsoil, and vegetation are stockpiled separately in a manner that prevents loss through erosion, preserves them for use in reclamation, and does not impede access to usable mineral materials.

    Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts on water quality and improving potential for successful reclamation activities. It may require larger acreages to be used for material stockpiling.

11. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that work pit sides are sloped to prevent erosion and provide for the safety of humans and animals. Slopes along pit sides and inactive faces would be no greater than 3:1 (horizontal:vertical).

    Effectiveness: This mitigation measure, on its own, would be mostly effective at eliminating impacts associated with slope failure on the safety of humans and animals.

12. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that site stabilization measures and measures to control erosion, sedimentation, and stormwater are maintained in proper working order throughout the term of the authorization, including during periods of temporary closure or inactivity.

    Effectiveness: This mitigation measure, on its own, would be highly effective at reducing water quality impacts associated with improperly placed or maintained controls. The implementation of a SWPPP is standard construction practice and permitting requirement in Alaska. It is included in AIDEA’s design features (Chapter 2, Section 2.4.4 of the Draft Supplemental EIS)

13. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that BMPs for dust abatement (e.g., graveling, watering) are utilized when deemed necessary by AIDEA, their contractor, or subcontractor, or when directed by a BLM representative.

    Effectiveness: This mitigation measure, on its own, would be highly effective at reducing air and water quality impacts associated with dust control. AIDEA has committed in their design features outlined in Chapter 2, Section 2.4.4 of the Draft Supplemental EIS to develop and implement a Dust Control Plan.

14. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would meet with BLM staff at the end of the life cycle of the material site mine, prior to final reclamation, to define final configuration of the mine.

    Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with reclamation activities and potential future impacts to floodplains, vegetation, habitat, and water quality that could result by the final form and condition of the mine site.

15. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that reclamation is conducted in accordance with the approved reclamation plan. Deviations or

modifications to the approved reclamation plan must be approved in writing by the Authorized Officer prior to execution.

Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating impacts associated with water resources and habitat from not implementing the approved plans.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be highly effective at reducing air, water, wetland, floodplain, and habitat impacts associated with decisions and actions to mine sand and gravel resources on BLM-managed lands in the project area. If applied similarly along the project area, these standard stipulations would extend throughout the project area. Most of these measures are considered standard stipulations for BLM Mining Procedures, and standard construction practices employed within the State of Alaska and have proven effective.

3.2.3 Hazardous and Solid Waste*

1. **Potential BLM Mitigation Measure:** AIDEA or its designee would prepare and implement a comprehensive waste management plan. This plan would be drafted in consultation with federal, state, and borough agencies as appropriate, and would be submitted to the Authorized Officer for approval. Management decisions affecting waste generation would be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan would include:
   - Precautions taken to avoid attracting wildlife to food and garbage, including use of bear-resistant containers for all waste materials and classes.
   - Protocols for the incineration, backhaul, or composting of all putrescible waste in a manner approved by the Authorized Officer; burial of waste is not permitted. All solid waste, including incinerator ash, would be disposed of in an approved waste-disposal facility in accordance with U.S. Environmental Protection Agency and Alaska Department of Environmental Conservation (ADEC) regulations and procedures.
   - Procedures for the disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by an Alaska Pollutant Discharge Elimination System permit.
   - Protocols for reporting hazardous material spills according to 18 AAC 75.300.

   Effectiveness: This mitigation measure, on its own, if implemented as planned, would be mostly effective at preventing avoidable spills and also effective as a means for ensuring employees and contractors who are trained in the plan are able to efficiently and effectively clean up or contain any spills that may occur.

2. **Potential BLM Mitigation Measure:** Construction camps and permanent facilities for maintenance and operations would meet ADEC standards for handling and disposal of solid waste, human waste, gray water, and kitchen sanitation. AIDEA would provide waste disposal, gray water, and sanitation plans with sufficient detail to determine that they comply with ADEC guidelines.

   Effectiveness: This mitigation measure, on its own, if implemented as described by the approved plans, would be highly effective at reducing impacts associated with solid waste, human waste and gray water.

3. **Potential BLM Mitigation Measure:** AIDEA would remove all waste generated by road activities, and dispose of waste according to applicable local, state, and federal laws. Prompt removal of discarded or unneeded material, equipment, and debris is required.

Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating air and water quality impacts associated with the abandonment, improper storage, or disposal of construction wastes

4. **Potential BLM Mitigation Measure:** Temporary construction camps, permanent maintenance and operations stations, and all facilities would be maintained in a sanitary manner. Solid waste would be collected in bear-proof containers until hauled away for proper disposal.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to wildlife and human safety associated with the improper handling of wastes.

5. **Potential BLM Mitigation Measure:** AIDEA would transport, store, transfer, and dispose of hazardous waste, hazardous materials, and hazardous material containers in a way that meets legal requirements and prevents release to the environment.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at preventing avoidable impacts on soil, air, and water quality from improper or illegal procedures in hazardous waste and handling.

6. **Potential BLM Mitigation Measure:** Hazardous material containment liner material would be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing soil and water quality impacts associated with leaks and spills of stored chemicals.

7. **BLM Standard Stipulation for Mineral Material Mining:** AIDEA would ensure that all solid waste and garbage, including incinerated ash, is removed from public lands and disposed of in an ADEC-approved waste disposal facility. No solid waste is to remain on site for more than 90 days.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with construction and camp garbage and waste.

8. **Potential BLM Mitigation Measure:** AIDEA would ensure that portable toilets are used for human waste disposal, and are regularly maintained anywhere construction or maintenance activity is concentrated, such as at material sites. The disposal of human waste is not authorized on public land.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating impacts associated with water and soil contamination associated with the improper storage, handling, and disposal of human and biological wastes on public lands. It is AIDEA's intent to construct long-term maintenance facilities that would likely include septic systems.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be highly effective in ensuring sites remain reasonably clean and tidy, wildlife is not habituated to human food and garbage, and lands and waters are not polluted by normal operations. See also the following measures regarding unforeseen events such as spills. Effectiveness on BLM-managed land would be compromised if these measures were not in place across the full length of the road. However, laws and stipulations of land owners and permitting agencies, such as ADEC, are likely to result in similar stipulations throughout, although it is possible the State of Alaska or Native corporations could allow landfilling on their lands. The BLM would have much greater authority over regulation and handling of solid and hazardous wastes under Alternative C, because so much more of the route would be located on BLM-managed lands.

3.2.3.1 Spill Prevention and Response

1. **Potential BLM Mitigation Measure:** For construction phases, including material site operation, and for operations and maintenance of the road, AIDEA would prepare a Spill Prevention Control and Countermeasures Plan (SPCCP). The plan would be submitted to the Authorized Officer prior to the storage or transport of petroleum products greater than 1,320 gallons. AIDEA would follow the approved plan and update it as necessary throughout the term of Road Activities. One or more other plans would be prepared, submitted for approval, and followed to address special spill prevention and countermeasures associated with other hazardous material known to be transported on the Ambler Road, such as mining chemicals, liquefied natural gas, and mining ore concentrates.

   Effectiveness: This mitigation measure, on its own, would be highly effective at preventing impacts on soils, air, and water quality from avoidable spills and accidents. If successfully implemented, it would also ensure employees and contractors are appropriately educated in the plan, trained in the procedures, and sufficiently equipped to identify, clean up or contain any spills, and comply with notification procedures, which would reduce impacts when spills or accidents occur.

2. **Potential BLM Mitigation Measure:** All spills would be contained and cleaned up as soon as the release has been identified. Appropriate spill response equipment and supplies must be on hand when hazardous materials are used. Field crews must have access to these materials, and they must be available at each refueling point. All employees would be trained in general spill-response protocol and reporting requirements. Personnel with a higher level of spill-response training specific the hazardous materials known to be transported on the Ambler Road would always be present at each maintenance station and, if there is an associated airstrip, have oversight responsibility for the airstrip. The release of Petroleum, Oils, and Lubricants (POLs) or hazardous substances other than POLs to any water body is to be reported to ADEC as soon as the person has knowledge of the release. All other releases would be reported in accordance with ADEC spill reporting guidelines (in Fairbanks 907-457-2121, or 1-800-478-9300 outside normal business hours).

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with spills.

3. **Potential BLM Mitigation Measure:** Notice of any reportable spill (as required by 40 CFR 300.125 and 18 Alaska Administrative Code [AAC] 75.300) would be given to the Authorized Officer immediately, but no later than 48 hours after occurrence.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with petroleum spills that need additional response expertise and oversight to ensure timely cleanup and prevent additional exposures.

4. **Potential BLM Mitigation Measure:** AIDEA would be responsible for documenting and assessing any disturbance or damage caused by spill cleanup activities and may be required to implement rehabilitation actions and monitoring to assess the effectiveness of cleanup activities in preventing further resource damage.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing long term effects to resources associated with spills.

5. **Potential BLM Mitigation Measure:** ADEC-approved oil spill cleanup materials (absorbents) would be carried by trucks transporting fuel or hazardous fluids on the road and would be available at all fueling points. AIDEA would ensure that communities identified at risk in the

SPCCP were trained in emergency preparedness and, where prompt access to the road would be practical, provided spill cleanup materials. The absorbents would be appropriate to the hazardous substances that are used throughout the project.

Effectiveness: This mitigation measure, on its own, would be highly effective at reducing soil and water quality impacts associated with oil spills, and would be effective at educating local community leaders in emergency preparation and spill response.

6. **Potential BLM Mitigation Measure:** AIDEA agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S. Code [USC] 9601, et. seq. or the Resource Conservation and Recovery Act, 42 USC 6901, et. seq.) on the authorization (unless the release or threatened release is wholly unrelated to the authorization permittee/AIDEA/permittee’s activity on the authorization). This agreement applies without regard to whether a release is caused by AIDEA, its agent, or an unrelated third party.

   Effectiveness: This mitigation measure establishes upfront in clear terms the legal and financial responsibility of AIDEA for all cleanup actions. This should be highly effective at motivating AIDEA to develop detailed plans and procedures, complying with local, state and federal laws, and ensure they and any contractors are training to successfully implement all spill response plans and procedures.

7. **Potential BLM Mitigation Measure:** During construction and operation, “duck ponds” would be placed beneath all parked vehicles at all times. Fuel spill kits would be kept on site wherever equipment is working. An overpack drum would be kept on site wherever drums are used to store or transfer petroleum or other hazardous materials.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with oil leaks and spills.

8. **Potential BLM Mitigation Measure:** AIDEA would ensure that all spill containment devices, including “duck ponds,” liners, and vehicle drip pans, are maintained in good working condition at all times. Spill containment devices that are punctured, torn, or worn beyond serviceability would be replaced within 24 hours of discovery of the unserviceable condition.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating impacts associated with spills and leaks.

9. **Potential BLM Mitigation Measure:** Equipment that has been identified as having fluid leaks would have a drip basin under the leak area to ensure no release to the surrounding environment occurs.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with leaking fluids onto soils and vegetation.

10. **Potential BLM Mitigation Measure:** Prior to allowing any cyanide to be transported on the Right of Way, AIDEA would be a signatory in good standing to the International Cyanide Management Code. AIDEA would also require that any third party permitted to haul cyanide on the Right of Way be a signatory in good standing to the International Cyanide Management Code.

    Effectiveness: This mitigation measure, on its own, would be highly effective at preventing avoidable spills.

Summary of Effectiveness: The spill measures listed above, if implemented collectively, are expected to be mostly effective in preventing spills and checking spills that do occur with minimal environmental damage under most circumstances. For spills of large volumes of toxic material that escape into flowing waters before adequate response can be mobilized (e.g., tanker truck rollover), the measures are likely to be ineffective. The measures described above likely would be required by land managers/owners such as the National Park Service (NPS), State, and Native corporations and by permitting agencies such as the U.S. Army Corps of Engineers (USACE) and Alaska Department of Fish and Game (ADF&G). Therefore, effectiveness is anticipated to be relatively uniform across the entirety of the Proposed Action and Alternatives. Failure to implement these measures off BLM-managed land could result in adverse impacts to BLM-managed land if a spill occurs upstream from or in relatively close proximity to BLM-managed land. These measures would be enhanced by the Fuel Handling and Storage measures (see Section 3.2.3.2).

3.2.3.2 Fuel Handling and Storage

1. **Potential BLM Mitigation Measure:** Transportation and storage of hazardous materials would be handled in a manner to minimize the potential impacts to the environment and human health.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with fuel spills.

2. **Potential BLM Mitigation Measure:** AIDEA would ensure that all hazardous materials containers, including POL containers, are stored within secondary containment.

   - Double-walled tanks would meet secondary containment requirements.
   - When containment other than double-walled tanks is used, the containment area would be lined with an impermeable liner composed of material compatible with the substance(s) to be contained. The liner would be free of cracks or gaps and sufficiently impervious to contain leaks or spills.
   - If the containment is completely under cover of a roof, then the containment volume must be large enough to contain the capacity of the largest container stored within.
   - If the containment is not completely under cover of a roof, then the containment volume must be large enough to contain the capacity of the largest container stored, plus water from a 5-year, 24-hour storm event. The amount of precipitation from a 5-year, 24-hour storm event for a given location can be found at hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating and or reducing impacts associated with leaks or breaks of tanks and containers.

3. **Potential BLM Mitigation Measure:** Transfer of POLS to equipment would be completed in a secure manner to minimize the possibility of contamination of the surrounding environment. At a minimum, secondary containment would be placed under the transfer location to catch overflow and assist the operator in containing a spill, if one occurs.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating impacts associated with leaking and spills during fuel transfers.

4. **Potential BLM Mitigation Measure:** Any equipment needing repairs that have the potential to release fluids would be repaired at a designated maintenance station if the equipment can be moved. If such repairs must be conducted in the field, the repairs would be completed over an impermeable liner to ensure fluid migration to the environment does not occur.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating or reducing impacts associated with equipment repairs.

5. **BLM Land Use Plan requirement:** No fuel storage or refueling of equipment would be allowed within the 100-year floodplain of a river or lake, unless approved by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with leaks or spills from vehicles or containers within floodplains.

6. **BLM Land Use Plan requirement:** Fuel barrels and tanks, propane tanks, and all other hazardous substance storage containers must be labeled with the following information: Contractor or Road Operator name, contents of the container (name of the product put in the container, if not in the original container from the manufacturer), and date the product was purchased/put in the container (e.g., Smith [University of Alaska-Fairbanks], Gasoline, September 2008). Fuel handling would be in compliance with all state and federal regulations.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with spills and leaks from fuel and chemical storage containers. This mitigation measure would communicate important data that would inform handling specifications and response protocols to facilitate safe and efficient cleanup responses.

Summary of Effectiveness: The fuel measures listed above, if implemented collectively, are expected to be mostly effective in preventing spills and checking spills that do occur with minimal environmental damage under most circumstances. For spills of large volumes of toxic material that escape into unfrozen soils or flowing waters before adequate response can be mobilized (e.g., tanker truck rollover), the measures are likely to be ineffective. The measures likely would be required by the NPS, State, and Native corporations and by permitting agencies such as USACE and ADF&G. Therefore, effectiveness is anticipated to be relatively uniform across the entirety of the Proposed Action and Alternatives. Failure to implement these measures off BLM-managed land could result in adverse impacts to BLM-managed land if a spill occurs upstream from waters that flow through BLM-managed land. These measures would be enhanced by the Spill Prevention and Response measures (see Section 3.2.3.1).

3.2.4 Paleontological Resources

1. **Potential BLM Mitigation Measure:** AIDEA would develop a plan addressing inadvertent discovery of paleontological resources as part of its Plan of Development, to be submitted for approval.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at eliminating impacts associated with paleontological resources since the mitigation measure only addresses what happens after the resource is inadvertently discovered. Assuming the POD stipulates that if paleontological resources are found, AIDEA would contact the BLM and suspend all operations in the immediate area and that operations would not continue until the BLM issues a written authorization to proceed, it would be mostly effective at reducing impacts.

3.2.5 Water Resources*

See also related stipulations under Sections 3.2.1, Geology and Soils (permafrost); 3.2.2, Hazardous Waste; 3.3.1, Vegetation and Wetlands; and 3.3.2, Fish and Aquatics.

3.2.5.1 Water – General

1. **Potential BLM Mitigation Measure:** All stream crossings would be designed based on site-specific information, such as fish species presence, seasonal in-stream flows and peak discharge, and floodplain regime (50- to 100-year flood events). Bridges would be designed to pass the 100-year discharge and culverts to pass the 50- to 100-year flood events, depending on size and fish presence. In developing estimates of flows and discharge for crossing design, climate trends

would be used to improve the future discharge estimates and delineation of the floodplains. See also Section 3.3.2, Fish and Aquatics, regarding fish passage culverts.

Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with the roadway embankment blocking natural hydrology, changing flow paths, increasing pooling, changing erosion and sedimentation, or reducing connectivity of wetlands and floodplains. This is a typical practice for the design of roads in Alaska.

2. **Potential BLM Mitigation Measure:** Stream crossings would preserve floodplain connectivity to the greatest extent possible. Their design would include setting the invert for overflow culverts at the same grade level as the floodplain, and distributing the overflow culverts to match the flood-flow patterns in the floodplain. Culverts installed for sheet-flow connectivity would be marked so they can be easily inspected to ensure their intended functions.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with the roadway embankment on connectivity of wetlands and floodplains. These techniques would reduce flow quantity changes at individual culverts and changes to the distribution of flow within a floodplain or wetland area crossed by the roadway embankment. Typical practice for the design of roads in Alaska is to mark all culverts to assist in inspection.

3. **Potential BLM Mitigation Measure:** Mobile ground equipment would not be operated in or on lakes, streams, or rivers on BLM-managed land except when ice thickness is adequate to support the equipment without altering the stream bed or displacing water outside the stream channel, unless specifically approved by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with disturbance to river and lake beds and wetland areas. This is a typical winter construction and safety practice.

4. **Potential BLM Mitigation Measure:** Following completion of use of ice bridges or ice roads, and before breakup occurs, AIDEA would breach ice bridges or ice roads at primary flow locations.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the blockage of primary flow channels during spring breakup and associated flooding of upstream reaches. This is typical practice for larger streams/rivers on Alaska's North Slope prior to breakup. Impacts to non-primary flow channels would not be mitigated by this measure, however.

5. **Potential BLM Mitigation Measure:** AIDEA would ensure that the temperature of natural surface water or groundwater would not be changed, beyond those changes happening under background conditions, by the Ambler Road or by any Ambler Road activities to affect the natural surface water or groundwater, unless approved by the Authorized Officer. Potential mitigation measures include limiting changes to energy pathways to those waters, such as avoiding changes in surface albedo, vegetative cover, reflected solar energy, or areas of pooling.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with water temperature changes such as increased permafrost thaw, vegetation health, aufeis growth, or loss of fish habitat. This measure may be difficult or costly to achieve, monitor, and maintain as climate changes continue.

6. **Potential BLM Mitigation Measure:** To comply with Executive Order 11988, and Department Manual 520, disturbance in floodplains would be avoided where practicable. When avoidance is not practicable, floodplain disturbance would be minimized and floodplain function restored to the extent practicable.

- New road construction within 100-year floodplains would be avoided unless no practicable alternative exists. Where the authorized route intersects a stream, it is assumed that road construction in the floodplain is unavoidable. Where new road construction is otherwise undertaken in the 100-year floodplain (e.g., parallel to a stream, in proximity to a lake, or for access to ancillary facilities), AIDEA would provide written documentation to the BLM of the alternative locations considered and rationale for why the alternatives are not practicable.
- Roads through floodplains would cross riparian areas perpendicular to the main channel to the extent practicable.
- Throughout the authorized project area, structural and vegetative treatments in riparian areas would contribute to the maintenance or restoration of proper functioning condition.
- When riparian vegetation is cleared, riparian vegetation diversity and density would be re-established to the extent practicable.

Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with construction of the roadway embankment within a floodplain and disruption of natural floodplain hydrology, floodplain and wetland connectivity, and changes in fish habitat.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be mostly effective at reducing impacts associated with water resources. Most of these measures are common design and construction practices in Alaska and would be applicable and highly likely to be implemented on all sections of all alternatives. Measures 4 and 5, if only required for BLM-managed lands, would result in higher performing sections on BLM-managed lands but less robust sections if not imposed for other lands. Based on the difficulty and potential high cost of Measure 5, it is unlikely to be implemented on lands outside of BLM management. Measure 6 would result in more of Alternative C being better designed and constructed, but with much of the current alignment including floodplains, may be very costly to redesign or construct. However, it is recommended that these measures be required for all lands for all alternatives.

3.2.5.2 Water Quality

1. **Potential BLM Mitigation Measure:** The applicant would employ BMPs for stormwater, sediment, and erosion control per the Alaska Storm Water Guide (dec.alaska.gov/water/wnpspc/stormwater/Guidance.html), with particular attention to considerations for linear projects.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with sedimentation and erosion. These are typical and required stormwater pollution prevention practices in Alaska construction projects.

2. **Potential BLM Mitigation Measure:** Snow ramps or snow bridges and ice thickening used during construction at watercourse crossings would be substantially free of soil and/or debris. The ramps and/or bridges would be breached upon completion of the winter construction season before spring snowmelt begins.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with sediment and debris entering the water course during construction activities and avoiding flooding by channel blockage during breakup.

3. **Potential BLM Mitigation Measure:** Caissons, coffer dams, or other methods would be used for in-water drilling or pile driving to keep work areas separate from surface waters, to protect water quality. If any drilling muds were used for geotechnical drilling, bridge pile drilling, or other

drilling, muds would be kept separate from any surface water. Muds would be disposed of as solid waste in an approved lined pit or in an established landfill and would not be disposed of on the ground surface or in water. See also Hazardous Waste (Section 3.2.3).

Effectiveness: This mitigation measure, on its own, would be highly effective at reducing water quality impacts associated with construction in river channels and floodplains that could introduce foreign materials to watercourses. It is recommended that this measure be required for all lands for all alternatives, especially for major bridge construction entailing bridge piers within the river channel.

4. **Potential BLM Mitigation Measure:** A 100-foot undisturbed vegetation buffer would be maintained along any ponds, lakes, creeks, rivers or higher-value wetland (patterned fens, emergent wetlands, and moss-lichen wetlands). The buffer width would start from the edge of the riparian area associated with waterbodies or from the edge of higher value wetland.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing water quality impacts associated with construction and roadway operations that could introduce foreign materials to ponds, lakes, creeks, rivers, or high-value wetlands. This measure would also provide a buffer to any hydrologic changes experienced at the roadway or cross drainage culverts prior to entering natural drainage channels. It is recommended that this measure be required for all lands for all alternatives.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be highly effective at reducing impacts associated with construction and operation on water quality. If these measures are only required for BLM-managed lands, Alternative C would benefit the most as it has the most waterway crossings (and BLM managed lands) where water quality can be impacted. Many of these measures are standard construction BMPs and likely to be required by other land owners and managers. It is recommended that these measures be required for all lands for all alternatives.

3.2.6 Acoustical Environment (Noise)

1. **Potential BLM Mitigation Measure:** As part of the plan of development, AIDEA would provide a Noise Management Plan, subject to land manager approval, outlining noise reduction methods and features to be used during construction and operation of the right of way.

   Effectiveness: The Noise Management Plan would likely include measures to reduce noise from construction vehicles and haul trucks, such as good mufflers, directional backup alarm, and limiting use of air brakes; however, the noise from blasting, excavating, grading, vehicle movement, and other construction and maintenance activities would be unavoidable. If mitigation measures in the plan were to be implemented, they would be partially effective at reducing impacts associated with construction and operational noises. The cost of noise barriers would be prohibitive and would not likely be included in the plan.

3.2.7 Air Quality and Climate

1. **Potential BLM Mitigation Measure:** Prior to receiving an NTP for surface disturbing activities, AIDEA would submit a Dust Control Plan, subject to approval by the Authorized Officer and review by ADEC, that would apply to all road construction and maintenance activities and to construction and operation of all project facilities, including airstrips, construction camps, and material sites. At a minimum, the plan would include: a literature review of the effectiveness and environmental effects of different palliative options; documentation of consultation with the ADEC, ADF&G, USFWS, NPS, and EPA regarding palliative selection; rationale for selection of palliatives that includes consideration for minimizing effects on fish, wildlife, vegetation, and water quality; and a dust control prescription (BMPs, palliatives, policies, practices, and

methodologies, and general schedules) by activity, season, road segment, and construction phase. In developing the Dust Control Plan, the BLM expects AIDEA to achieve 75 percent dust control. Details on palliatives, frequency, and application method would be included in this plan.

Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to air quality from dust generated or mobilized during construction, operations, and maintenance activities. While AIDEA has committed to employing standard BMPs related to dust suppression to minimize emissions, a requirement to submit a Dust Control Plan subject to approval by the Authorized Officer may further reduce impacts of fugitive dust on air quality, water quality, fish and aquatic life, fish habitat, and vegetation. If the BLM were to require AIDEA to submit a Dust Control Plan only within BLM-managed portions of the routes, this measure would be ineffective at reducing potential impacts for the majority of Alternatives A and B, since much of the land traversed by those routes are not managed by the BLM. Under Alternative C, this measure would be much more effective at reducing potential impacts given the large proportion of BLM-managed lands on that route.

2. **Potential BLM Mitigation Measure:** The Air Quality component of the monitoring plan required in Section 1.1 would include, at a minimum: methods for determining compliance with applicable State and Federal laws and regulations; methods for monitoring dust impacts at sensitive receptors in all potentially affected communities during construction, road maintenance activities, and during road use; and correlating those measurements with dust production by right of way activities; methods for monitoring dust production during all activities that involve disturbance of NOA materials; methods for determining the effectiveness of dust control policies, practices, and methodologies implemented; and actions to be taken in response to adverse monitoring results.

   Effectiveness: This mitigation measure would be mostly effective at reducing impacts to air quality from emissions and dust generated or mobilized during construction, operations, and maintenance activities. While AIDEA has committed to employing standard BMPs related to dust suppression to minimize emissions, the requirement to conduct air monitoring, document implementation of plans and practices, and identify corrective actions as necessary, would enforce the proposed mitigation and address unanticipated impacts or ineffective mitigation. If the BLM were to require AIDEA to submit a monitoring plan only within BLM-managed portions of the routes, or if corrective actions would only be enforced on BLM-managed portions of the routes, this measure would be ineffective at reducing potential impacts for the majority of Alternatives A and B, since much of the land traversed by those routes are not managed by the BLM. Under Alternative C, this measure would be more effective at reducing potential impacts given the large proportion of BLM-managed lands on that route.

3. **Potential BLM Mitigation Measure:** AIDEA would ensure that all construction camps would be located in areas that avoid potential exposure to asbestos, or have been constructed to avoid human exposure to asbestos. AIDEA would ensure that all personnel who work on construction or operation of the road or associated facilities are fully informed of hazardous areas and methods to prevent their exposure to asbestos.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at eliminating exposures to asbestos in the temporary construction camps. This mitigation measure also provides training to all personnel working within the project area of the NOA hazard, which would be partially effective at eliminating exposures. This mitigation measure, as expressed, would cover some of the design features that AIDEA has committed to regarding the avoidance of materials containing NOA, as well as conditions of use. This measure would be equally effective at addressing NOA exposure along any of the action alternatives.

4. **Potential BLM Mitigation Measure:** Naturally Occurring Asbestos: Prior to receiving a NTP with surface disturbing activities, AIDEA would submit for approval by the Authorized Officer a comprehensive plan for dealing with and minimizing human exposure to NOA. At a minimum, the plan would address specific details of implementing the relevant design features in their proposal, qualifications of staff providing oversight for NOA-related activities, testing methods, operating procedures and construction techniques specific to areas containing NOA, design criteria (such as capping depths) to be used where NOA materials must be used, documentation of locations where NOA materials are placed, and methods for informing road users and maintenance staff when they are working where NOA materials were used.

   Effectiveness: This measure would be mostly effective at eliminating impacts associated with NOA exposure, and reducing impacts where NOA materials are encountered, used, and handled in project construction and reclamation activities. It would be minimally effective at reducing public concern regarding the presence of NOA in visible road dust, since the asbestos fibers are too small to be seen and the health impacts typically too far removed in time.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be highly effective at reducing air quality impacts associated with particulates, including both fugitive road dust and asbestos fibers from NOA. These measures would reduce human exposures and reduce risk to human health. It is anticipated that these measures would be implemented for the entire length of any alternative.

3.3 Biological Resources

3.3.1 Vegetation and Wetlands

See also Section 3.2.1, Geology and Soils, for erosion control measures.

3.3.1.1 Vegetation – General

1. **Potential BLM Mitigation Measure:** AIDEA would conduct baseline surveys to identify rare plants, prior to conducting surface disturbing activities to avoid impacts to rare plants species.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating impacts associated with rare plants. However, other environmental and engineering considerations may prevent shifting the road alignment to avoid identified rare plants. If the rare plant surveys discovered large local populations of rare plant species that could be avoided, then mitigation would be beneficial. If applied to only BLM-managed lands, the effectiveness would be limited to those lands.

2. **Potential BLM Mitigation Measure:** All restoration and revegetation activities would be performed in accordance with AIDEA’s Revegetation Plan, as approved by the Authorized Officer. In order to minimize the risk of introducing invasive species, AIDEA’s revegetation plan would rely on use of topsoil with live native vegetation where practicable, and on planting and reseeding as secondary options.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the introduction of invasive species. However, invasive species would likely spread during the restoration and revegetation activities from equipment unless other industry BMPs, such as wheel washes or regular equipment inspections, were implemented. Without any mitigation, non-native invasive species (NNIS) would likely be introduced and spread along the road corridor. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

3. **Potential BLM Mitigation Measure:** AIDEA would ensure that all areas where vegetation is cleared or fill is placed, including road embankments, are revegetated as soon as practicable, unless operation of the authorized road and facilities necessitates the area remaining unvegetated.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with vegetation removal and subsequent erosion of topsoil. This is a typical BMP (SWPPP) used to control erosion on Alaska construction projects.

4. **Potential BLM Mitigation Measure:** AIDEA would employ mitigation measures to reduce contamination of roadside vegetation through industry BMPs that prevent and minimize fugitive dust, stormwater runoff, erosion, and spills and leaks. Contaminant monitoring would continue throughout the life of the project, and adaptive management would be employed to modify mitigation measures to reduce contamination.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the risk of contamination of vegetation. This is a standard industry mitigation measure that could minimize, but not entirely eliminate, the contamination of roadside vegetation during construction and operation.

5. **Potential BLM Mitigation Measure:** AIDEA would establish requirements that vehicles used on the road be in good working condition and would do a visual inspection for any signs of leaks.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the risk of contamination of vegetation. This is a standard industry mitigation measure that would minimize or eliminate the release of petroleum products associated with vehicle use.

6. **Potential BLM Mitigation Measure:** At temporary construction camps, permanent maintenance camps, turnouts, or other places of common intended or unintended pedestrian traffic, boardwalks would be built, used, and properly maintained in areas where repeated trampling would create visible trails or water tracks or would otherwise impede vegetation growth, or the route would be closed and closure enforced.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the risk of vegetation getting trampled and soils being compacted. The use and maintenance of boardwalks in areas of common pedestrian traffic would allow for unimpeded vegetation growth.

7. **Potential BLM Mitigation Measure:** Topsoil and vegetation would be stockpiled separately from overburden in a manner that prevents loss through erosion and allows for their use during the reclamation process.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the risk of erosion of topsoil and vegetation. This is a standard industry measure that would allow these materials to be used during the reclamation process. The use of live native vegetation during the revegetation process would minimize the spread of invasive species.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts associated with vegetation, including rare plants, invasive species, contamination, and trampling. These measures likely would be required by land managers/owners such as the BLM, NPS, State, and Native corporations and by permitters such as USACE and ADF&G. Effectiveness of these mitigation measures across the length of the road would depend on implementation across landownership boundaries. In other words, if implementation of these measures were not continuous along the road corridor, the effectiveness would be reduced.

3.3.1.2 Wetlands

See also Section 3.2.5, Water Resources.

1. **Potential BLM Mitigation Measure:** The following mitigation measures would be incorporated to reduce impacts to wetlands and wetland functions by helping to maintain hydrologic connectivity between bisected wetlands and waterbodies. Design measures would be based on geologic and hydrologic studies to freely convey surface water across the road surface.
    a. Bridges and culverts would be installed at all identified drainage crossings, including rills and ephemeral channels, to help maintain hydrologic connectivity, minimize changes to watershed basin areas, and reduce likelihood of water impoundment degrading permafrost. An adequate number of culverts and/or bridges would be used to maintain hydrologic continuity and existing drainage patterns within wetland complexes, ephemeral channels, and perennial streams.
    b. Roadside ditches would only be used in limited cut areas where permafrost presence is unlikely. These efforts could help to maintain hydrologic connectivity between bisected wetlands and reduce the effects of diverting surface water flow to minimize impacts.

    Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts of the project on the hydrologic connectivity of wetlands and waterbodies, and wetland functions. This is a standard industry measure. However, drainage pathways can be difficult to predict, and there is potential for some drainages to be missed or that culvert installation and/or maintenance would be inadequate.

2. **Potential BLM Mitigation Measure:** In wetlands, tundra mats or other appropriate types of ground protection would be used to minimize disturbance of ground vegetative cover outside the cut-fill footprint during non-winter construction, unless otherwise authorized by the Authorized Officer.

    Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with disturbance of the vegetative cover in wetlands. The use of ground protection is a standard industry measure to minimize vegetation disturbance.

3. **Potential BLM Mitigation Measure:** Permafrost stabilization measures would include features to minimize the disruption of groundwater flow though the active layer above the permafrost covered by the roadbed, to protect groundwater-fed wetlands such as fens.

    Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing risks to groundwater-fed wetlands. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

4. **Potential BLM Mitigation Measure:** Disturbance to uncommon wetlands such as patterned fens and moss-lichen wetlands would be avoided to the maximum extent practicable.

    Effectiveness: This mitigation measure, on its own, would be mostly effective at eliminating impacts to uncommon wetlands. Avoiding uncommon wetlands, if practicable, is a common industry standard. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be mostly effective at reducing impacts associated with the hydrologic connectivity of wetlands and waterbodies, wetland functions, and disturbance of the vegetative cover in wetlands. These measures likely would be required by land managers/owners such as the NPS, State, and Native corporations and by permitters such as USACE and ADF&G. Effectiveness of these mitigation measures across the length of the road would depend on implementation across landownership boundaries.

3.3.1.3 Non-native Invasive Species

1. **Potential BLM Mitigation Measure:** AIDEA would prepare an Invasive Species Prevention and Management Plan (ISPMP) to prevent the introduction and spread of NNIS, including terrestrial and aquatic plant and animals. The ISPMP would incorporate a landscape management approach across landowner boundaries, BMPs, Early Detection Rapid Response (www.doi.gov/sites/doi.gov/files/National%20EDRR%20Framework.pdf), and reporting requirements to land managers. The ISPMP must be approved by the jurisdictional land manager prior to authorization of road construction and operations.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the spread of non-native invasive species (NNIS). Without any mitigation, NNIS would likely be introduced and spread along the road corridor.

2. **Potential BLM Mitigation Measure:** At a minimum, the ISPMP would address the following items:

   - Compatibility with the BLM – Alaska Invasive Species Management 2010 Policy, available at:
   - eplanning.blm.gov/epl-front-office/projects/nepa/37008/44249/47684/AK_BLM_Invasive_Species_Management_Policy_2010.pdf.
   - Methods and timeframe for conducting a baseline NNIS survey prior to initiating surface disturbing activities, and periodic surveys throughout the duration of the authorization.
   - Methods of NNIS prevention and infestation management. The plan could include multiple methods of control and eradication depending on the size, density, location, and species present within the infestation. Methods of control and eradication could include manual, mechanical, or chemical treatment, or disposal of invasive plants, animals, and infested soil.
   - Clear procedures for documenting and reporting detections of species of highest concern (list to be provided by BLM) to the Authorized Officer within 30 days of detection.
   - Specific practices, procedures, and BMPs for preventing the spread of NNIS, addressing inspection and washing/brushing of vehicles (including tires and undercarriage), and cleaning of equipment, clothing, and shoes.
   - Specific procedures to ensure that aircraft, vehicles/equipment, or materials that have traveled to, parked in, or been staged in areas infested with invasive plants are inspected and certified weed-free prior to being allowed on the right of way.
   - A program (procedures, timeframes, and documentation) for training all employees engaged in road construction or maintenance and all drivers authorized to use the road in invasive species awareness and abatement.
   - An adaptive management and monitoring framework to mitigate the introduction and spread of NNIS (including terrestrial and aquatic plants and animals) throughout the duration of the authorization and for at least five growing seasons after completion of reclamation.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the spread of NNIS. Without any mitigation, NNIS would likely be introduced and spread along the road corridor. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

3. **Potential BLM Mitigation Measure:** Permitted activities, including road and snow maintenance activities, would commence from areas known to not be infested with invasive plants (e.g., western end of the road) and progress toward known infested areas.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the spread of NNIS. However, invasive species would likely spread during the permitted activities from equipment unless other industry standard BMPs to clean equipment prior to use were implemented. Without any mitigation, NNIS would likely be introduced and spread along the road corridor. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

4. **Potential BLM Mitigation Measure:** All mineral materials (sand and gravel) used on the project would be inspected and certified weed-free in accordance with the State of Alaska's Weed Free Gravel Certification Program (plants.alaska.gov/invasives/weed-free-gravel.htm).

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the spread of NNIS. However, invasive species would likely spread during the permitted activities from equipment unless other industry standard best management measures to clean equipment prior to use were implemented. Without any mitigation, NNIS would likely be introduced and spread along the road corridor. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be mostly effective at reducing impacts associated with the spread of NNIS. These measures likely would be required by land managers/owners such as the NPS, State, and Native corporations and by permitters such as USACE and ADF&G. Effectiveness NNIS management on BLM-managed land would be compromised if these measures were not in place throughout the length of the road. If these mitigation measures are consistently applied across landowner boundaries, NNIS infestations may remain localized and small enough to be eradicated during seasonal monitoring and removal efforts.

3.3.1.4 Forestry, Timber, and Fire

1. **Potential BLM Mitigation Measure:** Prior to initiating clearing operations on federal land, AIDEA would provide the Authorized Officer with an estimate of the amount of merchantable timber (tree species 5 inches in diameter at breast height or larger), if any, expected to be cut, removed, or destroyed, and would pay the BLM in advance of such construction or maintenance activity, such sum of money as the Authorized Officer determines to be the full stumpage value of the timber to be cut, removed, or destroyed. Prior to any operations AIDEA if required, would enter into a timber sale contract with the BLM for timber designated for cutting within the authorized project area.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with merchantable timber resources. If this mitigation measure is applied to only BLM-managed lands, the effectiveness would be limited to those lands.

2. **Potential BLM Mitigation Measure:** AIDEA would prepare and submit for approval by the Authorized Officer a Timber Clearing, Salvage, and Utilization Plan prior to any clearing activity addressing, at a minimum, clearing equipment and methods, minimizing risks to public safety, avoiding fire fuel hazards, minimizing forest health risks, skidding, yarding, and decking management to minimize environmental impacts, erosion and sediment control during timber handling operations, timeframes for removal of timber from public lands, and plans, if any, for making timber available for disposal to the public. All timber clearing would be performed in accordance with the approved plan.

Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with timber resources.

3. **Potential BLM Mitigation Measure:** AIDEA would ensure that removal of timber and other woody vegetation is limited to only that necessary to facilitate activities authorized in the Grant of Right of Way, and that trees that would not be removed are not damaged.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at eliminating impacts associated with forestry resources.

4. **Potential BLM Mitigation Measure:** Use of open fires in connection with Ambler Road activities is prohibited on BLM-managed land unless approved by the Authorized Officer and performed in accordance with federal law, except that incineration of solid waste combustibles may be conducted in accordance with the grant stipulations. AIDEA would require all employees, contractors, subcontractors, and authorized drivers to build no fires except in designated fire rings designed for the purpose.

   Effectiveness: This mitigation measure, on its own, would be highly effective at eliminating the risk of wildfire. Without this mitigation measure, the risk of wildfire would increase and wildfire impacts could occur across landowner boundaries.

5. **Potential BLM Mitigation Measure:** The federal government would not be held responsible for protection of the AIDEA's structures or their personal property from wildfire.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at reducing impacts associated with wildfire.

6. **Potential BLM Mitigation Measure:** AIDEA would employ measures from Firewise Alaska (forestry.alaska.gov/Assets/pdfs/home/firewise09.pdf) to prevent wildfires from overtaking maintenance stations and communication towers.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to maintenance stations and communication towers from wildfire.

7. **Potential BLM Mitigation Measure:** AIDEA would promptly notify the Authorized Officer of any fires that occur on or near lands subject to the terms of the project authorization. AIDEA would comply with the instructions and directions of the Authorized Officer concerning the use, prevention, and suppression of fires on BLM-managed land.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing the risk of wildfire, and the impacts of any wildfires that do occur. The prompt notification of any wildfires on or near lands subject to the terms of the project authorization. would lead to more effective wildfire management. Without this mitigation measure, the impacts associated with wildfire could increase across landowner boundaries.

8. **Potential BLM Mitigation Measure:** The BLM, through the Authorized Officer, reserves the right to impose restrictions on Ambler Road activities in any area to prevent the cause or spread of wildfire and ensure public safety during periods when fire danger is severe.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing wildfires and their impacts. Without this mitigation measure, the risk of wildfire would increase and wildfire impacts could occur across landowner boundaries.

9. **Potential BLM Mitigation Measure:** AIDEA would be held financially responsible for AIDEA's actions or activities that result in a wildfire. Costs associated with wildfires include, but

are not limited to, damage to natural resources and costs associated with any suppression action taken on the fire.

Effectiveness: This mitigation measure, on its own, would be minimally effective at reducing impacts associated with wildfire.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be mostly effective at ensuring responsible forestry and timber management procedures are followed, and mostly effective at reducing impacts associated with wildfire. The measures described above likely would be implemented by land managers/owners such as the NPS, State, and Native corporations and by permitters such as USACE and ADF&G. Effectiveness of these mitigation measures across the length of the road would depend on implementation across landownership boundaries.

3.3.2 Wildlife – General (applicable to Fish and Aquatics, Birds, and Mammals)*

1. **Potential BLM Mitigation Measure:** AIDEA would develop and implement a Comprehensive Wildlife Interaction and Avoidance Plan using the best available science and Indigenous Knowledge. The plan would be developed in consultation with the State, NPS, BLM, ANCSA village corporations owning lands in the ROW, and the Subsistence Advisory Committee (SAC), and would be approved by the Authorized Officer. The plan should include at a minimum animal crossing policies, animal avoidance on the road, potential for road closures, proper waste and attractant management, animal and human safety, and wildlife observation systems. The plan shall be reviewed at least every 5 years.

   Effectiveness: This mitigation measure would allow the management and mitigation measures associated with road impacts to wildlife to be updated in response to new information, changing conditions, and new data collection. The location, timing, and severity of potential impacts on the movement and distribution of wildlife are difficult to predict prior to road construction. This mitigation measure would use the best available information to develop mitigation measures but allow the plan to be updated periodically to ensure the plan is properly focused on the largest impacts based on the current science and Indigenous Knowledge. Properly implemented mitigation measures including animal crossing policies, animal avoidance on the road, potential for road closures, proper waste and attractant management, animal and human safety, and wildlife observation systems have the potential to decrease potential impacts significantly.

2. **Potential BLM Mitigation Measure:** AIDEA would develop and implement a Comprehensive Fish and Wildlife Monitoring Plan based on the best available science and Indigenous Knowledge. The plan would be developed in consultation with the State, NPS, BLM, ANCSA village corporations owning lands in the ROW, and the Subsistence Advisory Committee (SAC), and would be approved by the Authorized Officer. The plan should include at a minimum a process for documenting conditions of fish, birds, and key wildlife species prior to construction to establish a baseline; monitoring changes in habitat conditions and use during construction and operation of the road, including fish passage, to characterize impacts; and assessing the effectiveness of and refining mitigation measures as needed (subject to Authorized Officer approval). The plan would include a point of contact for communities and fish and wildlife managers seeking and sharing information on conditions of fish and wildlife in the area affected by the project. See also Measure 7, below, regarding the Fish and Wildlife Protection Plan.

   Effectiveness: This mitigation measure, on its own, would be highly effective at monitoring changes in the condition of fish and wildlife populations and would be a valuable tool in reducing impacts to fish and wildlife from the project if the program applied to the entire length of the Ambler Road. However, if the plan is only implemented within the BLM-managed portions of the routes, then this measure would be partially effective under Alternatives A and B. Under Alternative C, this measure still would be partially effective; however, given the larger proportion of BLM-managed lands on that route, the area of effectiveness would be larger. It is unlikely that other land management agencies would require a similar but separate commitment from AIDEA. If other land management agencies were interested in monitoring fish and wildlife along the route, it is likely that a collaborative program between the BLM, AIDEA, and other land management agencies would be adopted and this would add significantly to the effectiveness of the program overall.

3. **Potential BLM Mitigation Measure:** AIDEA would ensure that their employees, contractors, and subcontractors do not harass or feed wild animals (including fish, amphibians, birds, and mammals). The threshold for harassment is intentionally causing an animal to alter its behavior. This would be part of training for drivers authorized to use the Ambler Road. Operators would prohibit their employees and the employees of agents, contractors, and subcontractors, while on duty or living at any camp or mobile camp, from feeding wildlife or leaving garbage or other potentially edible items that would attract wildlife, including birds. Garbage would be kept in bear-proof containers while awaiting incineration or backhaul.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to wildlife as a result of harassment by AIDEA employees, contractors, and subcontractors. All best efforts to educate employees would not entirely avoid negative interactions between humans and wildlife. Because this measure would be easy to implement and it would be more difficult to educate employees and contractors where they can and cannot intentionally harass wildlife, it is likely that this mitigation measure would apply to the entire route, so the effectiveness would not vary by alternative. This mitigation measure is likely similar to an AIDEA proposed design feature that would implement a wildlife interaction protocol.

4. **Potential BLM Mitigation Measure:** AIDEA would notify the Authorized Officer within 30 days if an animal is killed during the course of construction or operation of the road or associated facilities, including in defense of life or property.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at reducing impacts associated with wildlife. Although easy to implement and likely to be implemented by other land managers than the BLM, the measure would do nothing to prevent mortality of wildlife and is a measure intended to convey information rather than reduce impacts.

5. **Potential BLM Mitigation Measure:** AIDEA would ensure that food, garbage, and other potential wildlife attractants are kept secured while awaiting their use, removal, or incineration.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with wildlife interactions. Proper containment and disposal of wildlife attractants such as food and garbage may prevent some wildlife from approaching humans and, therefore, may reduce the potential for injury or mortality of wildlife or humans. It is assumed that AIDEA's proposed design feature to implement a wildlife interaction protocol would include measures to properly contain food and waste. However, if the proposed design feature does not include such measures, this potential mitigation measure would apply only to BLM-managed lands, although it is likely to be implemented also by the State of Alaska and other agencies. If only implemented on BLM-managed lands, it would be minimally effective on Alternatives A and B, but largely effective on Alternative C.

6. **Potential BLM Mitigation Measure:** All field crews, construction workers, maintenance workers, and drivers on the road would follow a wildlife interaction plan prepared by AIDEA or a designee detailing how they are to manage wildlife attractants (food and non-food materials) and

respond to human-wildlife interactions. This would be included with the training for authorized drivers of the Ambler Road.

Effectiveness: This mitigation measure is related to an ADEA design feature. On its own, this measure would be mostly effective at reducing impacts to wildlife as a result of human-wildlife interactions. All best efforts to educate employees would not entirely avoid negative interactions between humans and wildlife. This mitigation measure would apply to the entire route, so the effectiveness would not vary by alternative. This mitigation measure is likely similar to an AIDEA proposed design feature that would implement a wildlife interaction protocol. Because it is related to an AIDEA design feature, it is expected to apply across all land managing agencies.

7. **Potential BLM Mitigation Measure:** AIDEA would work with land managers and wildlife agencies to identify construction timing windows to protect wildlife. Timing design features related to this mitigation would be determined during the design/permitting phase.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to wildlife associated with construction of the Ambler Road. If this measure were applied only to the BLM-managed portions of the route it would likely prove costly, burdensome, and minimally effective for Alternatives A and B overall. However, it is likely that the measure would be implemented on the entire route by all land managing agencies under any alternative, so the effectiveness would not vary by alternative or land management composition.

8. **Potential BLM Mitigation Measure:** During the design/permitting phase, AIDEA would develop a Fish and Wildlife Protection Plan that would include measures to maximize opportunities for unfettered wildlife movement and minimize habitat fragmentation during construction and operation (see also Measure 2, above, regarding the fish and wildlife monitoring program). Where practicable, this would include design features such as:

   - Burying infrastructure or facilities that may deter wildlife movement;
   - Creating wildlife escapement design features in excavations;
   - Siting and orienting infrastructure and facilities to allow maximum opportunities for unfettered wildlife movement;
   - Using vegetation to provide screened and unfragmented movement corridors around infrastructure and facilities; and
   - Following measures to minimize or eliminate visual or soundscape impacts that may deter wildlife movement.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts associated with wildlife movement and habitat fragmentation. Fragmentation is impossible to prevent. This measure would attempt to reduce the effects of fragmentation on wildlife through project design. If implemented only on BLM-managed lands, this measure would be minimally effective overall on Alternatives A and B, but moderately effective along the route as a whole on Alternative C. It is anticipated that land managers for non-BLM-managed lands would be supportive of implementing the plan.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts to wildlife as a result of construction and operation of the Ambler Road. It is not possible to fully avoid or mitigate the impacts of the road to wildlife. These measures would be relatively easy and inexpensive to implement that would have partial effectiveness at reducing some impacts. Except as noted above, it is likely that these wildlife measures would be adopted by other agencies or implemented by AIDEA over the length of the alternatives, heightening their effectiveness.

3.3.3 Fish and Aquatics*

See also Section 3.2.5, Water Resources, for related stipulations.

1. **Potential BLM Mitigation Measure:** AIDEA would submit culvert and bridge inspection and maintenance plans to the Authorized Officer for approval prior to construction and would adhere to the maintenance schedules and stipulations outlined in the plans.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with the potential for culverts and bridges to affect water quality or fish passage throughout the life of the project. If AIDEA were required to submit inspection and maintenance plans to the Approved Officer that included assessing fish passage conditions for culverts and bridges only within the BLM-managed portions of the routes, this measure would be ineffective at reducing potential impacts for most streams crossed by Alternatives A and B, since much of the land traversed by those routes are not managed by the BLM. Under Alternative C, this measure would be much more effective at reducing potential impacts given the large proportion of BLM-managed lands on that route.

2. **Potential BLM Mitigation Measure:** AIDEA would employ properly installed erosion and sedimentation measures during construction to minimize sedimentation impacts to fish habitat. AIDEA would also stabilize disturbed areas and employ BMPs at construction sites to direct stormwater away from fish-bearing waters.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing construction-related impacts associated with increased turbidity and sedimentation and the consequences of those impacts on fish and aquatic life. Employing measures to minimize erosion and sedimentation, stabilizing disturbed areas, and employing BMPs to direct storm-water away from fish habitat during construction is common practice for construction projects in Alaska. AIDEA is required to develop and adhere to SWPPPs during construction as well as maintenance activities along its entire route. If the BLM were to require AIDEA to employ additional measures beyond what is identified in their SWPPPs, such measures may further reduce impacts. If the BLM were to require this only on BLM-managed lands, this measure may be effective at further reducing impacts on streams crossed within a relatively small portion of the road. If limited to BLM-managed lands, this measure would be ineffective at reducing potential impacts beyond AIDEAs commitments for much of Alternatives A and B, but more effective for reducing impacts associated with Alternative C given the large proportion of BLM-managed lands on that route.

3. **Potential BLM Mitigation Measure:** Stream bed structures would be constructed such that the combination of structure height and subsequent water velocity allows all occurring fish species free movement within the water body. Any culvert that otherwise would be designed to convey less than the 100-year peak flood (1 percent exceedance probability) would be designed to convey at least the 100-year peak flood if it was a fish passage crossing.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with fish passage, assuming the mitigation measure would apply to all life stages for all species. If the BLM were to require AIDEA to employ such measures only on BLM-managed lands, this measure would be ineffective at reducing potential impacts for much of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route.

4. **Potential BLM Mitigation Measure:** All fish-bearing-stream crossings would be natural channel designs (e.g., U.S. Fish and Wildlife Service 2019), follow fish passage design guidelines, to facilitate fish passage for all life stages.

   Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts associated with crossing structures to affect water quality and passage for all life stages of fish. If the BLM were to require AIDEA to employ such measures only on BLM-managed lands, this measure would be ineffective at reducing potential impacts for much of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route. While AIDEA has committed to using stream simulation design principles to design culverts in fish-bearing streams, impacts would be further reduced if BLM implemented this measure.

5. **Potential BLM Mitigation Measure:** AIDEA would protect known or suspected Fish Spawning Beds, Fish Rearing Areas, and Overwintering Areas from sediment where soil material is expected to be suspended in water as a result of Ambler Road activities. Settling basins or other sediment control structures would be constructed and maintained to intercept sediment before it reaches rivers, streams, or lakes. Where disturbances cannot be avoided, proposed modifications and appropriate mitigation measures would be designed by AIDEA and approved by the Authorized Officer.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts associated with increased sedimentation on fish spawning, rearing, and overwintering habitats used by resident and anadromous fish during construction, throughout operations and maintenance, and during reclamation activities. If the BLM were to require AIDEA to employ such measures only on BLM-managed lands, this measure would be ineffective at reducing potential impacts for much of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route.

6. **Potential BLM Mitigation Measure:** AIDEA would notify the BLM within 48 hours of any observation of dead or injured fish on water source intake screens or in holes used for pumping water. AIDEA would temporarily cease pumping from that hole until additional preventative measures are taken to avoid further impacts to fish.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing fish mortality from water withdrawal activities. However, the measure would be mostly effective at reducing the potential for such activities to repeatedly cause fish mortality for prolonged periods. If the BLM were to require AIDEA to employ such measures only on BLM-managed lands, this measure would be ineffective at reducing potential impacts for much of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route.

7. **Potential BLM Mitigation Measure:** During periods of fish spawning, rearing, and migration, AIDEA's activities on federal land may be restricted by the Authorized Officer with written notice. As needed, the Authorized Officer may furnish AIDEA a list of areas where such actions may be required, together with anticipated dates of restriction. The Authorized Officer would coordinate with ADF&G for appropriate fish habitat protection measures.

   Effectiveness: This mitigation measure, on its own, would be partially to mostly effective at reducing impacts from specific activities that could otherwise affect resident or anadromous fish during periods of spawning, rearing, and migration. If the BLM were to require AIDEA to restrict activities that could otherwise affect fish during these periods only on BLM-managed lands, the measure would be ineffective at reducing potential impacts for most of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route.

If the activity would have lasting effects on habitats used by fish, but the activity would be restricted while fish are present, the measure would only be partially effective at reducing impacts.

8. **Potential BLM Mitigation Measure:** Dust suppressants or pesticides with ingredients potentially harmful to aquatic organisms would not be used within 328 feet of any fish-bearing stream and higher-value wetlands (e.g., emergent wetlands, moss-lichen wetlands, patterned fens and shallow ponds).

Effectiveness: This mitigation measure, on its own, would be highly effective at reducing the potential for dust control palliatives or pesticides to impact fish and aquatic life within 328 feet of fish-bearing streams and higher value wetlands. If the BLM were to require AIDEA to avoid using dust control suppressants with ingredients potentially harmful to aquatic organisms within this distance of fish streams and high value wetlands only on BLM-managed lands, this measure would be ineffective at reducing potential impacts to fish along the majority of Alternatives A and B, since much of the land traversed by those routes are not managed by the BLM. This measure would be much more effective at reducing potential impacts to fish under Alternative C, given the large proportion of BLM-managed lands on that route, than Alternatives or B. Further, this measure would be more effective if it were also to prohibit the use of dust control suppressants with potentially harmful ingredients to all fish-bearing waters, including lakes, ponds, and off-channel habitats.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be mostly effective, where employed, at reducing impacts associated with increased turbidity and sedimentation during construction and maintenance activities; ensuring fish passage is maintained throughout the life of the project for all life stages of fish and through regular inspections of culverts and bridges and that, where needed, corrective actions occur; ensuring all streambed structures allow for the free movement of all life stages of all fish species where fish occur; and minimizing potential impacts to fish during spawning, rearing, and overwintering by restricting activities. If AIDEA were to employ such measures only on BLM-managed lands, these measures would be ineffective at reducing potential impacts for much of Alternatives A and B, but more effective for Alternative C given the large proportion of BLM-managed lands on that route. These measures include design practices, some of which are likely to be required as part of State fish habitat and federal wetland permit conditions and therefore are likely to be implemented off BLM-managed lands. These measures do not remove the potential for aquatic impacts associated with contaminated soils or water from spills or leaks that would not be present under the No Action Alternative.

3.3.4 Birds*

1. **Potential BLM Mitigation Measure:** AIDEA would ensure that vegetation clearing during all phases of construction would be scheduled to minimize impacts on migratory birds and any other birds on the BLM special status species list or watch list (lists to be provided by BLM and updated periodically). The primary mechanism to avoid and minimize impacts is to conduct vegetation clearing outside of the nesting season (May 1–July 15 for this region). If AIDEA chose to clear vegetation during this timeframe, then AIDEA would have a qualified biologist survey any area where vegetation would be damaged or removed by the project or associated activities within 48 hours prior to vegetation disturbance. If an active nest is located, an appropriate avoidance area (as determined by the qualified biologist) would be marked and avoided until the biologist determines that the nest has been naturally vacated. This measure is similar to a measure proposed by AIDEA.

Effectiveness: This mitigation measure, on its own, would be highly effective at reducing impacts to nesting birds where implemented. Measures to avoid vegetation clearing during the breeding season and avoid bird nests would greatly reduce the likelihood of direct mortality of nesting birds during road construction.

AIDEA indicated in their application that “Construction on the pioneer road would likely take place year round, other than possible restrictions during spring break-up or bird nesting periods in compliance with the Migratory Bird Treaty Act (MBTA).” This would be consistent with the above Potential BLM Mitigation Measure. The MBTA is currently interpreted as prohibiting incidental take (DOI Solicitor Opinion M-37065) such as would occur during vegetation clearing associated with the Ambler Road construction. Therefore, to comply with the MBTA, AIDEA would be required to avoid construction during bird nesting periods. The BLM special status species policy and Alaska statewide land health standards afford protections to special status species and provide the framework for this Potential BLM Mitigation Measure. However, absent similar directives from other land management agencies, these measures would only be effective on BLM-managed lands, and incidental take of birds due to vegetation clearing could occur along the majority of the right of way for all alternatives.

2. **Potential BLM Mitigation Measure:** AIDEA would ensure that no vertical or near-vertical faces that may encourage bank swallow nesting are left on any slope, including on material stockpiles. If bank swallows establish nests, AIDEA would ensure that the face is not disturbed until after young are fledged or the nests are naturally vacated. If slope management is unfeasible, AIDEA would take steps to deter or exclude nesting bank swallows from the area without causing harm or harassment to bank swallows or other birds. Deterrents or exclusion measures must be installed prior to the breeding season and should remain present for the duration of the breeding season (Ontario Ministry of Natural Resources and Forestry 2017).

Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to nesting bank swallows, where implemented. This mitigation measure would discourage bank swallows from nesting in areas that may be affected by construction or operation activities, and if nesting were to occur, it prevents impacts to these nests. Because this mitigation measure is dependent on incidental observations of nesting activity, it would not be completely effective at preventing all impacts to nesting bank swallows.

This mitigation measure would only be implemented on BLM-managed lands and it is unlikely that other land management agencies would implement a similar requirement. Therefore, injury or mortality of bank swallows and loss of nesting habitat is possible along a majority of the authorized area under all alternatives.

3. **Potential BLM Mitigation Measure:** AIDEA would use best available technology to prevent facilities from providing nesting, denning, perching, or shelter sites for ravens, raptors, and foxes. AIDEA would provide annual reports on the use of facilities by ravens, raptors, and foxes for nesting, denning, perching, or shelter. Deterrents or exclusion measures meant to prevent the construction and use of nests by ravens or raptors should be installed prior to the breeding season and should remain present for the duration of the breeding season.

Effectiveness: This mitigation measure, on its own, would be partially to mostly effective at reducing nesting, denning, and shelter opportunities for predator species if implemented along the entire project route and minimally to partially effective if only implemented on BLM-managed land. For this mitigation measure to be effective, structures and features that are attractive to predator species would have to be monitored for use on a regular basis. Existing deterrents would have to be properly maintained and new deterrents would need to be placed if additional structures were identified as being used by nest predators. Development of mines and other projects along the Ambler Road could provide similar nesting, denning, and shelter opportunities for predator species if no mitigation is in place at these sites.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts to nesting birds along the entire length of the ROW. Identifying and avoiding nests prior to vegetation clearing is highly effective in reducing short-term mortality of or disturbance to individual birds, nests, eggs, and nestlings, but habitat loss and alteration would still impact local populations of birds using the area during various life stages. Because Measure 2 would only be effective on BLM-managed lands, bank swallows may be injured or killed along the majority of the project route for all alternatives.

3.3.5 Mammals*

1. **Potential BLM Mitigation Measure:** During periods of wildlife breeding, lambing, or calving activity, and during major migrations of wildlife, AIDEA's activities on BLM-managed land may be restricted by the Authorized Officer with written notice. From time to time, the Authorized Officer may furnish AIDEA a list of areas where such actions may be required, together with anticipated dates of restriction.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at reducing impacts to mammals during biologically important time periods. AIDEA's proposed design features (Chapter 2, Section 2.4.4 of the Draft Supplemental EIS) include similar and complimentary measures through the use of wildlife interaction and communication protocols. These measures provide opportunities for adaptive management of wildlife along the road.

2. **Potential BLM Mitigation Measure:** All wildlife would have the right of way on the Ambler Road. Vehicles must slow down or stop and wait to permit the free and unrestricted movement of wildlife across the road at any location. During known caribou migration, the Authorized Officer may require temporary cessation of traffic. All data on road closures due to caribou, including all recorded caribou observations and other relevant information, must be shared with the State, BLM, and the NPS.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing the potential for injury or mortality of mammals on the road. This measure is similar to a proposed design feature (Chapter 2, Section 2.4.4 of the Draft Supplemental EIS), but which is limited just to caribou. As such, measures to reduce impacts to caribou would occur along the entire length of the road; however, measures to reduce potential impacts to other wildlife would only occur on BLM-managed lands if this mitigation measure were implemented. It is possible that other land management agencies would implement similar measures designed to avoid impacts to special status species or wildlife that are socially or economically important. Despite this mitigation measure or the proposed design feature, mortality of caribou and other wildlife should be anticipated as a result of the road because no mitigation measure can be completely effective.

3. **Potential BLM Mitigation Measure:** Snow bank height would be minimized to allow caribou passage. AIDEA would take particular measures to ensure that snow bank height is reduced during spring migrations.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing delays, deflections, or displacement of caribou and other mammals attempting to cross the road during winter. Snow bank height is 1 of several factors that may influence caribou behavior at the road. Implementation of this mitigation measure only on BLM-managed lands would have almost no effect for Alternatives A or B because very few caribou occur on the east end of those routes.

Implementation of this mitigation measure on Alternative C would have a greater, but still limited, benefit to caribou because caribou use of BLM-managed lands along that route is substantially greater.

4. **Potential BLM Mitigation Measure:** Prior to starting activities, AIDEA would obtain the locations of known brown bear dens from current survey data for the purpose of avoiding both human/bear interactions and disturbance of bear dens.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at reducing potential impacts to denning brown bears. This mitigation measure would be highly effective along Alternative C, where much of the route is located on BLM-managed lands. Specifically, this could help to reduce impacts to denning brown bears in the Ray Mountains, where it is suspected that high quality denning habitat occurs in close proximity to the Alternative C route. In contrast, this mitigation measure would apply to a very small proportion of Alternatives A and B that does not include suitable brown bear denning habitat (i.e., alpine areas).

5. **Potential BLM Mitigation Measure:** During survey and construction, cross-country activity is prohibited within 1/2 mile of occupied grizzly bear dens identified by current survey unless alternative protective measures are approved by the Authorized Officer in consultation with the ADF&G. During maintenance and operations, cross-country activity originating from the Ambler Road is prohibited entirely.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at reducing potential impacts to denning brown bears. This mitigation measure would be highly effective along Alternative C, where much of the route is located on BLM-managed lands. Specifically, this could help to reduce impacts to denning brown bears in the Ray Mountains, where it is suspected that high quality denning habitat occurs in close proximity to the Alternative C route. In contrast, this mitigation measure would apply to a very small proportion of Alternatives A and B that does not include suitable brown bear denning habitat (i.e., alpine areas).

6. **Potential BLM Mitigation Measure:** Within the Tozitna North and Tozitna South Areas of Critical Environmental Concern (ACECs), aircraft associated with Ambler Road activities would be required to fly a minimum of 2,000 feet above ground level (AGL) from May 10 to June 30, unless doing so would endanger human life or be an unsafe flying practice. From July 1 to May 9, aircraft associated with Ambler Road activities would be required to fly a minimum of 1,000 feet AGL above these ACECs unless doing so would endanger human life or be an unsafe flying practice. Normal landings and takeoffs would be allowed.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts to wildlife within the ACECs as a result of aircraft activity associated with the Amber Road. Impacts to wildlife from aircraft would still be possible, but this measure would slightly decrease the magnitude and likelihood of impacts. Aircraft use as a result of the road would be limited; other aircraft not associated with the Ambler Road would not be required to adhere to this stipulation and could affect wildlife in the ACECs. This measure would be limited to Alternative C because Alternatives A and B do not cross ACECs. It is probable that the NPS would implement a similar measure (if Alternatives A or B are selected), but unlikely that other land management agencies would implement similar measures.

7. **Potential BLM Mitigation Measure:** To minimize wildlife entanglement and plastic debris pollution, erosion and sediment control products would be plastic-free, such as netting manufactured from 100 percent biodegradable, nonplastic materials like jute, sisal, or coir fiber.

   Effectiveness: This mitigation measure, on its own, would be minimally effective at eliminating impacts associated with wildlife entanglement and plastic debris pollution. The potential for wildlife entanglement in plastic erosion control products is not high. However, this is a measure that would be easily implemented and is not likely to be cost-prohibitive. This measure would do little to reduce impacts under Alternatives A and B, because BLM-managed lands constitute a small proportion of those routes. Under Alternative C, the effect would be greater as a larger proportion of those routes cross BLM-managed land. It is possible that, if the BLM were to adopt this mitigation measure, AIDEA would implement it across the entire route for consistency and ease of implementation. However, if the costs are prohibitive, it would not likely be implemented across the entire route. Other land management agencies, except potentially the NPS, are unlikely to implement a similar measure.

8. **Potential BLM Mitigation Measure:** AIDEA would prohibit all authorized users from hunting, fishing, shooting, or trapping from within the authorized ROW. This includes AIDEA's agents, employees, and contractors, and their respective employees, as well as the agents or employees of any entity allowed commercial use of the road (see also mitigation measures 1 and 2 under Section 3.4.3, Recreation and Tourism).

Effectiveness: This mitigation measure is intended to protect wildlife from increased access and associated hunting pressure on wildlife populations. On its own, this measure would be partially effective in maintaining the status quo in terms of existing hunting effects on wildlife.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts to mammals. Because BLM-managed land constitutes a small proportion of Alternatives A and B, if these mitigation measures are not adopted by AIDEA for other land management agencies, then their implementation would do little to reduce impacts across the entire project. Under Alternative C, these mitigation measures would have a greater affect as a result of the greater proportion of BLM-managed lands under Alternative C. No combination of mitigation measures can fully reduce the potential for behavioral disturbance, displacement, injury, or mortality of wildlife as a result of the Ambler Road. Impacts to wildlife would occur regardless, but these mitigation measures would be successfully in at least partially reducing these impacts.

3.4 Social Systems

3.4.1 Land Ownership, Use, Management, and Special Designations*

For wild and scenic river crossings, see Sections 3.2.5, Water Resources, and 3.4.2, Transportation and Access.

1. **Potential BLM Mitigation Measure:** AIDEA, in final design, would work with private landowners to ensure that surface use on Native allotments and other private parcels is prohibited unless authorized by allottee. AIDEA would minimize impacts of the road project (including materials sites, access roads, etc.) on nearby Native allotments and private parcels and on any existing development by means such as providing buffer space or using topography or existing vegetation as a screen.

Effectiveness: This mitigation measure is expected to be mostly effective at avoiding overlap of the road and facilities with private property. For properties close to the project area, this measure would be minimally effective at protecting private property from proximity impacts such as noise. It is likely that other agencies would adopt this measure in an effort to protect the private property of allotments.

2. **Potential BLM Mitigation Measure:** AIDEA would minimize impacts within the Gates of the Arctic National Park and Preserve (GAAR) by moving material sites and maintenance stations

outside of the Park Boundaries and by reducing the number of communications towers within GAAR boundaries as much as practicable.

Effectiveness: Allowing only the road in GAAR, with necessary bridges and culverts, and not allowing material sites, maintenance stations, and airstrips, and reducing the number of communications towers in GAAR, would be mostly effective in reducing the project footprint, disturbance, and industrial activity within the GAAR setting. If moving the road support facilities outside of GAAR would result in the facilities being located elsewhere along the route (as opposed to reducing the overall number of such facilities), the impacts associated with those facilities would still be incurred, but in locations outside a National Park System unit.

Summary of Effectiveness: The measures above would be mostly effective at minimizing impact to different land ownership and management issues. They could be implemented separately or together. The GAAR measure applies only to Alternatives A and B and is likely outside the jurisdiction of the BLM but could apply to other federal agency decisions. BLM and other landowning and permitting agencies likely also would be interested in avoiding use of Native allotments, so it is likely the allotment measure would be adopted by others, increasing its effectiveness.

3.4.2 Transportation and Access*

1. **Potential BLM Mitigation Measure:** AIDEA would prepare and submit a comprehensive Access Plan inclusive of construction and operational periods. The plan would be developed in consultation with the State, NPS, BLM, ANCSA village corporations owning lands in the ROW, and the Subsistence Advisory Committee (SAC), and would be approved by the Authorized Officer. The plan would, at a minimum, identify the commercial use(s) of the road and airstrips and would include guidelines for that use; guidelines for authorized and unauthorized monitoring and enforcement; and the controlled access process. The plan would also include types and locations of ramps and other suitable methods for allowing public access across the road ROW for subsistence and local over-snow travel purposes, and for preventing the potential for trespass along the road from crossing sites, road and trail intersections, and other locations (see mitigation measure 2 and 4, Section 3.4.2).

   Effectiveness: AIDEA has identified most of these as design commitments for the project. This mitigation measure is adding the preparation of a plan to be approved by the Authorized Officer to ensure continued use across the road ROW to preserve freedom of movement across the landscape, particularly in winter and generally by snowmobile for local residents. On its own, execution of the plan would be highly effective at providing safe road crossings. It would be partially effective at preserving today's freedom of movement, because it is highly unlikely that sufficient crossings would be identified, marked, and known to address all possible travel routes. Inevitably, travelers would feel less "free," and some likely would cross at unauthorized locations. It is likely that other land management agencies would adopt this or a similar measure to retain common routes and general freedom of movement.

2. **Potential BLM Mitigation Measure:** AIDEA's program to allow drivers to use the road would include education/training about the project stipulations that apply to drivers. AIDEA would maintain documentation of such education/training and make the records available to BLM or other jurisdictional agencies on request. No drivers would be allowed to use the road without such education/training.

   Effectiveness: This mitigation measure is designed to ensure those authorized to use the road had the same base of information about use of the road and protection of resources along the road. On its own, this measure would be mostly effective at educating users about relevant project stipulations. This would support limited vehicle access and enhance drivers' awareness of their obligations to mitigate environmental impacts. The program's success would depend on AIDEA ensuring availability of clearly stated information for drivers and ensuring drivers were trained before allowing drivers on the road. It is not clear whether other land managing and permitting agencies would adopt this measure, but it appears it would be effective if any one agency adopted it.

3. **Potential BLM Mitigation Measure:** In keeping with operation of the Ambler Road as an industrial access road not generally open to the public, AIDEA would operate project airstrips for Ambler Road activities only, except for emergency landings. Public access to airstrips for recreation, hunting, or other general uses would not be allowed and would be monitored by construction camp/maintenance camp crews and Ambler Road security. Details regarding methods of restricting access to project airstrips would be included in the Access Plan (see mitigation measure 1, Section 3.4.2).

   Effectiveness: This mitigation measure is designed to prevent impacts that could be associated with opening project airstrips to the general public. On its own, this measure would be highly effective at eliminating impacts associated with public access via airstrips. However, several airstrips do not occur on BLM-managed land and enforcement may require other land management agencies to adopt this measure. It is likely the NPS would adopt the measure if airstrips were on NPS-managed lands. The State and Native corporations could have reasons to want airstrips open to non-project uses, but given the overall concern expressed by local communities about public use of the road, impacts to subsistence resources, and potential trespass, along with the desire of AIDEA to limit the airstrips to Ambler Road activities only, it is more likely than not that all landowners would agree to prevent recreational/hunting use of the airstrips.

4. **Potential BLM Mitigation Measure:** AIDEA would make provisions for suitable permanent crossings of the road ROW for the public where the road ROW crosses or runs along existing roads, active trails or routes, easements (including Alaska Native Claims Settlement Act 17b public easements), or other ROWs or known routes identified through AIDEA coordination with subsistence communities in the region and land managers. Provisions for crossings would be in place during Phase 1 or combined phasing construction. To ensure continued subsistence access, AIDEA would maintain any current trail in its current location or replace that access as a parallel trail or provide a crossing in a suitable location as determined by the Authorized Officer. This information would be included in the Access Plan (see mitigation measure 1, Section 3.4.2).

   Effectiveness: AIDEA has identified most of these as design commitments for the project. This mitigation measure is adding the preparation of a plan to be approved by the Authorized Officer to ensure continued use across the road ROW to preserve freedom of movement across the landscape, particularly in winter and generally by snowmobile for local residents. On its own, execution of the plan would be highly effective at providing safe road crossings. It would be partially effective at preserving today's freedom of movement, because it is highly unlikely that sufficient crossings would be identified, marked, and known to address all possible travel routes. Inevitably, travelers would feel less "free," and some likely would cross at unauthorized locations. It is likely that other land management agencies would adopt this or a similar measure to retain common routes and general freedom of movement.

5. **Potential BLM Mitigation Measure:** In accordance with regulations at 43 CFR 2805.15(a), BLM would retain the right to access the lands covered by the grant at any time and to enter any facility AIDEA constructs on the right of way. BLM drivers would be allowed entry in authorized

driver training and would be authorized to drive the road for grant administration, inspection, and other public land management purposes at no charge. Other agencies or landowners that have permit-compliance responsibilities for the road or mines or that need access for land management and other functions similarly would be authorized to drive the road, after training, at no charge. Requirements to have commercial driver's license that may apply to other classes of drivers on the road would not apply to agency personnel except where they were otherwise required to have such a license.

Effectiveness: This mitigation measure is designed to allow for management and oversight of the public lands and would be highly effective at allowing the BLM and other agencies to meet their agencies' obligations. It is likely that all land management and permitting agencies would adopt this measure.

6. **Potential BLM Mitigation Measure:** Areas of approved restricted public access would be easily identifiable on the ground. AIDEA would provide appropriate signs, flagging, barricades, and other safety measures when regulating or prohibiting public access.

   Effectiveness: This mitigation measure is designed to prevent public trespass on the industrial use project area and in construction work zones. On its own, this measure would be minimally effective at retaining public safety during construction and at gateways to the road (guard stations).

7. **Potential BLM Mitigation Measure:** Where the proposed alignment interferes longitudinally with active trails or routes AIDEA would maintain such trails or routes in their current location by altering or refining the Ambler Road design or replacing those facilities with parallel facilities of equal or better condition. Location of security gates would be adjusted to ensure no unauthorized access.

   Effectiveness: This measure, on its own, would be highly effective in maintaining access to and use of the trail associated with the first 5.4 miles of Alternatives A and B. The additional cost associated with the design change would be offset by the benefit of allowing continued access to current users in this part of the corridor. Adverse impacts could result from this measure if the trail needed to be replaced or moved, which would require a larger construction footprint and lead to increased impacts to vegetation, habitat, and water resources. In addition, use of the trail could increase, which would have adverse effects on natural resources from increased off-road vehicle use and foot traffic. In general, other agencies likely would adopt similar measures for existing trails on their lands. Regarding the first 5.4 miles of Alternatives A and B, the measure is specific only to the BLM.

Summary of Effectiveness: The measures listed above, if implemented collectively, would be mostly effective at limiting uses of the road to those intended and allowing for both safe use of the road and reasonable crossings of the road. Considering the entrance to the road is on BLM-managed land, measures related to the control of access at the entry point would be effective along the entire length of the road. Residual impacts are likely to include minor trespass issues where the road is encountered between established crossing locations (e.g., by snowmobile). Maintaining the active trails or routes could have adverse impacts from construction and may increase public access in some segments of the Ambler Road. Most of these measures are likely to be adopted by other agencies to help protect existing access along and across the road and prohibit non-project access. The measures are mostly not interdependent and would be reasonably effective on their own if some agencies declined to adopt some specific measure.

3.4.3 Recreation and Tourism

1. **Potential BLM Mitigation Measure:** AIDEA would prohibit its agents, employees, and contractors, and their respective employees, from hunting, fishing, shooting, trapping, using vehicles off-road, or camping, while on duty or living at a camp.

   Effectiveness: This mitigation measure is intended to protect wildlife and local subsistence practices from new recreation activity. On its own, this measure would be mostly effective in maintaining the status quo and not increasing competition for resources in the area.

2. **Potential BLM Mitigation Measure:** AIDEA's agents, employees, and contractors, and their respective employees, would not use project equipment or personal vehicles, including those used for transportation to and from the job site, for the purpose of scouting for, or participating in, hunting, fishing, shooting, and trapping activities.

   Effectiveness: This mitigation measure is intended to protect wildlife and local subsistence practices from new recreation activity. On its own, this measure would be mostly effective in reducing the ease of access for new hunting and fishing activity.

Summary of Effectiveness: The two measures listed above are expected to be mostly effective in limiting change to existing use of the land for recreational purposes based on road-related workers inhabiting the area. The measures would be effective at forestalling competition between road-related workers (as new recreational hunters, trappers, and anglers in the area) and existing subsistence and recreational users. These measures would be relatively inexpensive to establish and are in character with other resource development project restrictions on workers, but these restrictions apply to individual liberties of employees outside while they are not working but still in the area. To achieve full effectiveness, it would be necessary for these measures to be in place throughout the length of the road and not just on BLM-managed land. It is likely the NPS and Native corporations would include similar measures on their lands, but it is not clear the State of Alaska would do so. Without State of Alaska participation, the effectiveness would be substantially reduced, particularly for Alternatives A and B where a larger percentage of the road and more of the camps would be on State lands.

3.4.4 Visual Resources

1. **Potential BLM Mitigation Measure:** AIDEA would submit to the BLM for review and approval a plan to minimize impacts from light fixtures and the appearance of facilities, and paint colors to be used during construction and operations phases of road activities.

   Effectiveness: This mitigation measure is designed to minimize the establishment of visually contrasting facilities and of light emission associated with the project in an environment otherwise influenced almost exclusively by relatively dim natural light (e.g., moon) after sundown in the winter months. The use of approved facility colors would further reduce visual impacts throughout the year, and in particular the summer season, with 24 hours of daylight in the project area. This measure on its own is likely to be partially effective, particularly in influencing the base design of facilities by selection of forms, textures, and colors with low contrast. However, camps and gatehouses would be expected to be new, engineered structure and to be lit and evident whenever the sky was dark, and headlights are assumed to be in use throughout the night on the road. These impacts could not be reduced to near zero without restricting all construction to underground and all activity to daylight hours.

2. **Potential BLM Mitigation Measure:** For temporary and long-term facilities, designs would use the minimum lighting intensity necessary to ensure safety; use localized task lighting; and incorporate measures such as diffusers, lenses, and shielding to reduce nighttime glare, light radiation, and backscatter into the sky.

Effectiveness: This mitigation measure is designed to minimize light emission associated with the project in an environment otherwise influenced almost exclusively by relatively dim natural light (e.g., moon) after sundown in the winter months. The use of approved facility colors would further reduce visual impacts throughout the year, and in particular the summer season, with 24 hours of daylight in the project area. This measure, on its own, is likely to be partially effective, particularly in influencing the base lighting design and minimizing large or glaring lights. However, camps and gatehouses would be expected to be lit and evident whenever the sky was dark, and headlights are assumed to be in use throughout the night on the road. These impacts cannot be reduced to near zero without restricting all activity to daylight hours.

3. **Potential BLM Mitigation Measure:** Structure designs and equipment at temporary construction camps and permanent maintenance and operations facilities would use color, form, line, and texture to reduce contrast with background features. Reflectivity would be minimized.

   Effectiveness: This mitigation measure is designed to minimize contrast of built facilities with the natural environment. This measure on its own is likely to be partially effective, particularly in influencing the base design of camps and facilities. However, camps and gatehouses would be expected to have engineered structures, including contrasting towers and boxy buildings that would contrast in line and form regardless. These impacts could not effectively eliminated.

4. **Potential BLM Mitigation Measure:** The exterior of structures associated with temporary construction camps and long-term maintenance and operations facilities would be colored covert green, shadow gray, or a similar color unless another color is specified in the project-specific stipulations as depicted on the BLM’s Visual Resource Management Standard Environmental Colors Chart. For more information visit: www.blm.gov/programs/recreation/recreation-programs/visual-resource-management.

   Effectiveness: This mitigation measure is designed to minimize contrast of built facilities with the natural environment based on color. This measure, on its own, is likely to be mostly effective. However, structures would be expected to be utilitarian, probably with metal siding and roofs, and to be reflective at certain sun angles, regardless of color.

5. **Potential BLM Mitigation Measure:** Non-enclosed steel structures (e.g., poles, fences, towers) would be powder coated and have a dull galvanized metal finish. Tall structures would be minimized and constructed in locations not conspicuous on the horizon, to the greatest extent possible.

   Effectiveness: This mitigation measure is designed to minimize contrast of built facilities with the natural environment based on line and color. This measure, on its own, is likely to be partially effective by reducing glare and ensuring tall structures were placed consciously. However, tall structures with visually contrasting vertical lines and some reflectivity would be installed, and communications towers would likely need to be placed in relatively conspicuous locations to achieve best communication between towers. Visual impact would occur despite mitigation.

6. **Potential BLM Mitigation Measure:** Other visual impact mitigation measures, subject to consistency with vegetation BMPs, would include:

   - Restore the construction zone in a manner that facilitates reestablishment of the adjacent natural vegetation.
   - Use root balls, salvaged native plant materials, and the surface layer removed from the construction footprint for redistribution on disturbed areas where feasible.
   - Maintain a screening of existing natural vegetation between the Ambler Road and its facilities and the Dalton Highway, to the extent possible.

- Minimize locating Ambler Road facilities, new material sites, and construction or maintenance material stockpiles in areas that would be visible to the public in places with special visual resource values.
- Blend the Ambler Road facilities into the natural setting to the extent practicable when crossing or passing near places with high visual resource value, including GAAR, ACECs, the Dalton Highway corridor, existing communities, and streams used for recreation and transportation.
- Use revegetation species that are appropriate for the general area. See also Section 3.3.1, Vegetation and Wetlands.
- Re-grade construction disturbances to a condition that blends with the surrounding terrain and surface drainage patterns.
- Monitor reclaimed, disturbed construction areas and take remedial action where expected revegetation success is not achieved.

Effectiveness: This mitigation measure is designed to minimize contrast by requiring use of natural vegetation and natural contours to help the road and associated facilities blend in or be hidden, particularly in areas where people (viewers) are more likely to be present or highly sensitive. This measure, on its own, is likely to be partially effective. However, the road and associated facilities, including bridges on river corridors and lights near the Dalton Highway and certain communities, would be visible and contrasting.

Summary of Effectiveness: The measures above, if implemented collectively, would be partially effective in reducing the visibility of the project, but overall, a new road across a natural environment would be readily visible at a distance from higher elevations and from the air and in foreground views when approached regardless of these measures. Similarly, lighting measures are expected to protect viewers from piercing glare but would not be expected to eliminate the visual effect of new lights in what is currently a natural night sky environment. To best achieve effectiveness, it would be necessary for these measures to be in place throughout the length of the road and not just on BLM-managed land. It is likely the NPS would require similar measures on GAAR lands. It is likely that the State of Alaska and NANA Corporation would require similar vegetation measures, mostly in the interest of minimizing erosion, but may not have the same requirements for line-form-texture-color of facilities. Nonetheless, these measures are not unusual for resource development and road projects and likely would not be unduly expensive to implement if implemented during design. Particularly with Alternatives A and B, the BLM would have authority over a relatively small portion of the road corridor. Therefore, the overall effectiveness of the BLM proposed mitigation measures could be quite low if not also adopted also by other landowners.

3.4.5 Socioeconomics and Communities*

1. **Potential BLM Mitigation Measure:** AIDEA would develop and implement a plan acceptable to the BLM and NPS that provides the following mitigation measures to address effects on socioeconomics:

    - Time construction activities to minimize impact to high-use tourist and recreation seasons (e.g., river floating, wildlife viewing, hunting, snow machining, dog mushing) (see also Section 3.4.7, Potential BLM Mitigation Measure #4).
    - Time construction activities to minimize impacts to local lodges and other businesses (i.e., minimize summer and fall construction in recreational and tourist areas).
    - Identify and promote work opportunities for local residents.

- Develop training programs for local residents so that they could be employed during construction and operations.

Effectiveness: The plan would address community and tourist economic activities affected by the project and prepare area residents for road-related jobs. This mitigation measure, on its own, would be partially effective at reducing economic impacts and enhancing economic benefit. However, impacts to tourist activities and lodges would occur. It is highly unlikely that it would be practical to avoid construction in all areas and at all times that they might be used for tourism. Training programs could be mostly effective in promoting new jobs and preparing residents to apply, where implemented, but it is unlikely to be practical to implement trainings in all communities that might want them or might benefit.

2. **Potential BLM Mitigation Measure:** Avoid locating construction support and operations/ maintenance facilities (e.g., construction camps) in places with special visual resource values that would be observable to the general public or that would reduce the visual values of private properties.

   Effectiveness: This mitigation measure, on its own, would be partially effective at reducing the impact of the project to private properties and tourism. By shielding project facilities from areas valued for their scenic quality, this measure would reduce impacts to property values. By protecting wilderness views, effects on visitors seeking wilderness experiences would be slightly reduced and the effect on the tourism economy would also be slightly reduced. The road construction and operational activities, however, would remain. If this measure is applied only to BLM-managed land, the effectiveness would be limited only to that portion of the alternative.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be partially effective at reducing impacts associated with socioeconomic conditions and communities. Reduced impacts would be beneficial to communities and tourists at the expense of project schedule delays and added design costs; however, the changes to the wilderness features of the area cannot be avoided. The presence of project construction equipment, constructed facilities, cleared areas, and large haul trucks cannot be reduced to a level of being imperceptible. It is likely that other agencies would adopt similar measures to protect existing businesses.

3.4.5.1 Public Health

1. **Potential BLM Mitigation Measure:** AIDEA would use only non-persistent and immobile types of pesticides, herbicides, preservatives, and other chemicals. Each chemical to be used and its application constraint would be approved by the BLM prior to use. AIDEA would avoid and minimize construction and operations activities related to chemical applications during sensitive periods in life cycles such as calving, denning, nesting, and migration. The use of pesticides and herbicides is regulated by ADEC’s Environmental Health Division through 18 AAC 90 and may require a permit.

   Effectiveness: This mitigation measure is intended to avoid accumulation of chemicals within the ecological system and, by extension, to avoid health risks to humans. This measure, on its own, would be highly effective at eliminating impacts from persistent chemicals. It would not, however, eliminate chemical environmental and health risk from accidental spills and leaks or risks associated with other types of chemicals that may be approved by the BLM and used for the project.

2. **Potential BLM Mitigation Measure:** AIDEA would develop and implement a plan to educate workers, regional health care workers, and residents of all communities in the area potentially affected by the Ambler Road on the health effects of exposure to NOA, pesticides, herbicides,

preservatives, and other chemicals. The plan would include opportunities for routine risk-based health screening of workers, nearby communities, and regular subsistence users for non-cancerous and cancerous diseases that could result from exposure to these compounds.

Effectiveness: This mitigation measure is designed both to educate people about risks, so they might avoid the risks, and to screen people for health impacts related to the road. This measure, on its own, would be partially effective at reducing impacts to health. Extending screenings and even education to a broad area because of the construction of a road is outside the norm for road projects and would be potentially expensive to implement. The State of Alaska may be unlikely to implement this measure on a similar level. Screenings may be most effective at providing psychological comfort that diseases have not manifested for those who are concerned about ingesting tainted wild food, for example. However, regular screening may also raise anxiety because people may assume screening means an expectation of health problems.

3. **Potential BLM Mitigation Measure:** AIDEA would prohibit its employees, contractors, subcontractors, and their employees from visiting local communities while on-duty or while staying at project facilities except for the conduct of official business. When communities are visited for conduct of official business, AIDEA would keep records of purpose, date, location, and participants, and would make such records available to BLM or law enforcement agencies on demand.

   Effectiveness: This mitigation measure is designed to protect local communities from undue outside public health influences such as exposure to disease, sexual exploitation, or distribution of alcohol or drugs. This measure, on its own, would be mostly effective at eliminating these risks on BLM-managed lands. However, it is not clear that all land managing agencies would adopt the measure, and the BLM may not have sufficient authority to enforce it outside BLM-managed lands, hence it may not be effective on other lands that are not managed by the BLM.

Summary of Effectiveness: The measures listed above, if implemented collectively, would be partially to mostly effective at reducing the targeted health impacts but would not eliminate health risks. It is likely that all land managing and permitting agencies would share concerns about public health, but as noted above it is not clear that all would implement these or similar measures at the same level.

3.4.6 Environmental Justice

Effects of the project on environmental justice populations would be addressed through implementation of mitigation measures related to subsistence resources (Section 3.4.7), socioeconomics (Section 3.4.5), and public health (Section 3.4.5). Any residual impacts to local communities noted in these areas would disproportionately affect low-income and minority populations.

3.4.7 Subsistence Uses and Resources*

1. **Potential BLM Mitigation Measure:** AIDEA's road construction, operations, and closure/reclamation would not impede qualified rural residents from pursuing subsistence activities (Alaska National Interest Lands Conservation Act, Public Law 96-487).

   Effectiveness: This mitigation measure is federal law. The other measures below would help ensure effectiveness.

2. **Potential BLM Mitigation Measure:** AIDEA would consult directly and regularly with affected subsistence communities, and ensure that affected communities are represented on the subsistence working group proposed by AIDEA (see Chapter 2, Section 2.4.4 of the Draft Supplemental EIS).

Formation of the subsistence working group and the ongoing consultation would adhere to the following guidelines:

- In order to ensure that representatives to the working group are recognized for their expertise and have the ability to speak for the community, all representatives would be nominated and approved by the Tribal Council for the community that they represent.
- AIDEA would consult with directly affected subsistence communities to discuss the siting, timing, and methods of road construction and operations to help discover local traditional and scientific knowledge, including locations needed to cross the Ambler Road, resulting in measures that minimize impacts to subsistence uses, potentially to include ramps for road crossing locations (see also Section 3.4.2, Transportation and Access).
- During this consultation, AIDEA would share the results of road use monitoring (both permitted and unpermitted uses).
- AIDEA would make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that road construction activities and operations and maintenance activities do not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the Authorized Officer would determine which road activities would occur, including the timeframes.
- AIDEA would designate a project liaison dedicated to receiving feedback from potentially affected communities.
- AIDEA would hire subsistence monitoring representatives in communities closest to the road corridor. These subsistence monitors would communicate with AIDEA or AIDEA's designated project liaison regarding subsistence impacts, community concerns, and subsistence activities occurring in the vicinity of the road.
- AIDEA would consult with affected communities in the development of monitoring plans for subsistence resources.

Effectiveness: This mitigation measure is designed to maintain a discussion about the road and subsistence use patterns in the area. The measures, on their own, would be mostly effective in providing road operators and the working group each with information about what the other is thinking or doing. It may be minimally or partially effective at disseminating information to the broader communities but would be a forum to encourage such dissemination.

3. **Potential BLM Mitigation Measure:** AIDEA would notify workers and road users when subsistence activities are ongoing in the area and direct them to refrain from actions that may affect the activities (e.g., not removing trapline markers).

   Effectiveness: This mitigation measure is designed to educate road users and workers about subsistence and, on its own, would be mostly effective at minimizing disturbance to subsistence activity near the road.

4. **Potential BLM Mitigation Measure:** Subsistence activity impact mitigation would also include:

- Identifying locations and times when subsistence activities occur, and minimizing work during these times and in these areas to the maximum extent practicable.
- Scheduling work (e.g., blasting) to avoid conflict with subsistence activities when possible.

- Managing project-related aviation activities (e.g., minimum altitude limits; reducing air traffic during the peak caribou hunting and migratory seasons) to avoid disturbance of hunters or prey species.
- Implementing ground traffic rules to reduce impacts to migrating caribou. These may include traveling in convoys when at all possible, and instructing drivers to stop when caribou are approaching the road (see Section 3.3.5, Potential BLM Mitigation Measure #2).

Effectiveness: This mitigation measure, on its own, would be partially effective at reducing impacts to subsistence activities. It is likely that project activities, particularly during the construction process, would affect subsistence activities despite these measures.

5. **Potential BLM Mitigation Measure:** AIDEA would establish a meat recovery plan for wildlife killed as a result of construction activities, truck traffic on the road, air traffic on airstrips, and other project related activity. The plan would be developed in consultation with the subsistence working group, allowing proximate rural residents an opportunity to remove and use the carcasses for subsistence.

   Effectiveness: This mitigation measure, on its own, would be mostly effective at ensuring that animals killed accidently supplemented traditional subsistence harvests and were not wasted.

Summary of Effectiveness: The measures listed above, if implemented collectively, would be partially effective at reducing impacts associated with subsistence. Actual reductions in average subsistence harvests because of the project may be effectively forestalled by these measures, particularly those regarding sharing of information and modifying project activities as a result, and those that promote freedom of movement across the road and across the landscape. Such effectiveness would be enhanced with implementation of wildlife measures. However, some impacts are unknown. If major changes to caribou wintering grounds or migration patterns resulted after the road had been in place for several years, the impacts to subsistence communities avoided by the caribou could be substantial despite the mitigation measures. While the risk may not be high that such a major change would occur, it is possible or likely that no mitigation would alter the new wildlife pattern or restore the subsistence use pattern. It is likely that AIDEA would voluntarily undertake measures to reduce conflict between subsistence activity and project activity, but it is not clear that the State would require AIDEA to undertake such measures on its lands.

3.4.8 Cultural Resources*

1. **Potential BLM Mitigation Measure:** Mitigation measures for historic properties are listed in a Programmatic Agreement (PA; Appendix J of the Ambler Road Draft Supplemental EIS). AIDEA would have to comply with the terms of the PA, which is an agreement with the BLM, USACE, NPS, Alaska Department of Natural Resources, Alaska State Historic Preservation Officer, Advisory Council on Historic Preservation, and AIDEA, related to implementation of Section 106 of the National Historic Preservation Act (NHPA; 16 USC 470 et seq.). A Cultural Resources Management Plan has been implemented and agreed to as part of the PA.

   Effectiveness: Per the NHPA regulations, the PA allows for a phased approach to compliance and addresses all project activities, regardless of land ownership, across all phases of the project. The measures outlined in the PA include identifying all cultural resources that may be present in the project area of potential effects, determining if those resources are eligible to the National Register of Historic Places, determining whether the project would adversely affect any eligible resources, and determining how those effects would be resolved through avoidance, minimization, or mitigation. This measure, on its own, would be mostly effective at ensuring that cultural resources were identified and considered; that consultation with PA Signatories and other interested parties occurred; and, for those resources that would be adversely affected, that the protocols and measures outlined in the PA were followed. Following the terms of the PA would satisfy the law. However, where sites or areas could not be avoided, the PA would not eliminate the impact. Instead, the PA would require mitigation measures to be developed through consultation and implemented prior to ground disturbance from the project. It is highly likely that other state and federal agencies would participate in implementing this measure, because all have an interest and mandate by law to protect historic resources and already have worked together to craft the PA.

2. **Potential BLM Mitigation Measure:** AIDEA would consult with the BLM, local communities, and Tribes to seek ways to avoid damaging or disturbing cultural landscapes, Traditional Cultural Properties, or other places of traditional cultural importance located along the project area route that are locally or regionally important but may not meet the criteria of a historic property. This consultation should include gathering information and data related to Tribes' origin stories and Tribal history of the project area; historic travel routes (e.g., winter trails and river routes); and their lifetime use areas and traditional use areas.

   Effectiveness: This mitigation measure is designed to ensure consideration of places of traditional cultural importance along the project route that may not be addressed in the Section 106 PA (Appendix J). The measure, on its own, would be mostly effective in ensuring information is shared that is relevant to the protection of culturally important places along the project route. It may be partially effective at avoiding disturbance to those places. Other state and federal agencies may participate in this measure related to the lands they manage, because it is closely related to the PA work the agencies have been working on, but it does not have the same force of law as the PA.

3. **Potential BLM Mitigation Measure:** AIDEA's road construction, operations, maintenance, and closure/reclamation would be coordinated with local communities and Tribes to help ensure these activities would not limit access to Native American religious sites, would not limit use and possession of sacred objects, would protect the indigenous people's freedom to worship through ceremonial and traditional rites (as defined in the American Indian Religious Freedom Act, 42 USC 1996); and would avoid adversely affecting the physical integrity of any Sacred Sites that may be located on federal lands, per EO 13007 (May 24, 1996; 61 FR 26771).

   Effectiveness: This mitigation measure, on its own, would be mostly effective at ensuring access to Native American religious beliefs, practices, and sites was not impeded. It is likely other federal agencies would participate in this measure, because the laws behind them apply to all federal lands. State agencies may participate as well for their lands but are not compelled by law.

Summary of Effectiveness: The measures listed above, if implemented collectively, would be partially to mostly effective at ensuring impacts to cultural resources are considered and/or avoided or mitigated. Certain cultural resources are only identifiable by the community sharing the values, traditions, beliefs, or social institutions associated with such places. Therefore, the effectiveness would be partially dependent on the extent of information sharing by Tribes, communities, or other parties about these types of places, if any exist along the project route. In addition, the effectiveness would be partially dependent on the types of cultural significance such places may have and whether impacts can be effectively mitigated.

3.5 Proposed Mitigation Adopted from USACE's 404 Clean Water Act and Section 10 Rivers and Harbors Act Permit Special Conditions*

The following proposed mitigation measures are adopted from the USACE's special conditions to the approved permit application (POA-2013-00396 in Appendix G of the joint JROD) to minimize impacts from the project.

3.5.1 Pre-Construction Meeting*

1. The permittee shall convene a pre-construction meeting with their contractor representatives present, a minimum of 15 days prior to the discharge of fill material into waters of the US authorized under this DA permit. The permittee shall invite the USACE, and appropriate federal, state and borough resource or regulatory agencies within 10 days of the meeting date. The permittee shall provide copies of the DA permit and all attachments to all contractor representatives who shall make the permit copies available at all times in the field during construction activities.

3.5.2 Fill Discharges*

2. The Permittee shall use only clean fill material for this project. The fill material shall be free from items such as trash, debris, automotive parts, asphalt, construction materials, concrete blocks with exposed reinforcement bars, and soils contaminated with any toxic substance, in toxic amounts in accordance with Section 307 of the Clean Water Act.
3. The Permittee shall install erosion control measures along the perimeter of all work areas to prevent the displacement of fill material outside the authorized work area. The erosion control measures shall remain in place and be maintained until all authorized work is completed and the work areas are stabilized. To the maximum extent practicable, plastic-free erosion and sediment control products such as netting manufactured from 100-percent biodegradable materials like jute, sisal or coir fiber shall be used for erosion control. Immediately after completion of the final grading of the land surface, all slopes, land surfaces, and filled areas shall be stabilized using sod, degradable mats, barriers, or a combination of similar stabilizing materials to prevent erosion.
4. Snow and ice clearing operations shall not result in the discharge of vegetation, soil or debris into waters of the U.S. outside of all authorized fill areas.

3.5.3 Mitigative measure to minimize impacts to streams, floodplains, and fish habitat*

5. Culvert widths shall be 1.2 times the bankfull width of the stream plus two feet as recommended in the Washington Department of Fish and Wildlife's Water Crossing Design Guidelines, 2013. Culverts in fish-bearing streams shall be designed to maintain a natural channel and substrates to maintain a natural stream bed character. This embedded stream simulation design shall maintain fish passage by retaining the natural steam slope, meander, and water velocity and depth patterns similar to the natural (undisturbed) stream reaches upstream and downstream of the culvert location.
6. Final cross-drainage culvert locations shall be determined in the field during breakup and locations staked. Existing (natural) drainage patterns shall be maintained throughout all construction and operation periods by the installation of culverts in all authorized fill areas in

sufficient number and size to prevent ponding, dewatering, water diversion between watersheds, or concentrating runoff flows and to ensure that hydrology is not altered.

7. The applicant shall implement the conservation measures outlined in NMFS February 21, 2020 letter to BLM.
8. Stream crossings shall preserve floodplain connectivity to the greatest extent possible.
9. Overflow culverts should be at the same grade level as the floodplain, and placed to match the flood-flow patterns in the floodplain.
10. Gravel and other construction materials shall not be taken from streambeds, riverbeds, active floodplains, lakeshore or outlets of lakes. Material sites shall be located outside of active channels and active floodplains. A 500’ buffer around all streams shall be maintained, within which no material site or access road to a material site shall be located.
11. Where it is practicable, a 100-foot undisturbed vegetation buffer shall be maintained along ponds, lakes, creeks, rivers or higher-value wetland (patterned fens, emergent wetlands and moss-lichen wetlands). The buffer width shall start from the edge of the riparian area associated with the waterbodies or from the edge of the higher value wetland.
12. An Adaptive Management Plan (AMP) for monitoring, maintaining, and repairing culverts over the life of the road shall be developed in consultation with ADF&G and the Corps. The AMP shall include documentation of culvert locations with GPS; regular monitoring during culvert installation and through the road operations; corrective measures which would be taken if concerns are identified; and timeframes for those measures to be implemented. Corrective measures may include installation of additional culverts, increasing culvert size, adding thaw lines, adding deadman anchors or other appropriate measures. AIDEA shall use its proposed AMDIAP subsistence Advisory Committee to help in oversight of the AMP. The permittee shall prepare and submit a culvert monitoring report to the Corps for three summer seasons following completion of the fill placement for the road construction as well as at years five, and every five years after that for the life of the road. The reports shall be submitted prior to July 30 of each year. The report shall include photographs of at least 20% of the crossings to demonstrate the hydrologic conditions at spring beak-up time and post break-up (summer conditions). In addition, the report shall include photographs (and locations photographs were taken) and an evaluation of all areas where additional culverts are necessary to retain existing drainage patterns and where culvert maintenance, repair, upgrade, setting adjustments or replacement are necessary.

3.5.4 Mitigation measures to protect thaw-sensitive permafrost soils*

13. The permittee shall construct the road to Phase II standard embankment depths in areas with thaw sensitive permafrost soils and in emergent wetlands, without first constructing the pioneer road.
14. The collection of upstream runoff in ditches shall be minimized to reduce the effects of diverting surface waters to adjacent drainage ways and to reduce the potential for permafrost degradation.
15. The permittee shall use insulation in the roadway where necessary to reduce impacts to permafrost soils (for example, in areas of thaw-sensitive permafrost soils). These areas shall be identified prior to construction and on-site changes made during construction as necessary to protect permafrost soils. These areas shall be identified in the final design and would be provided to the Corps for review 45 days prior to construction. If foam is used to insulate the permafrost from thermal degradation, it shall be composed of closed-cell extruded polystyrene or other closed cell foams (e.g., blueboard) rather than non-extruded expanded polystyrene foam.

3.5.5 Nutuvukti Fen and Nutuvukti Lake Protection*

16. AIDEA shall design the road where it crosses upstream of Nutuvukti Fen and Nutuvukti Lake to minimize the disruption of surface and shallow subsurface flow though the active layer to protect hydrologic inputs to the fen and lake. Evidence of soils or vegetation drying downstream of the road, or any changes to fen or lake hydrology would be considered noncompliance with this condition.
17. AIDEA shall locate the road alignment to minimize water quality impacts to Nutuvukti Fen and Nutuvukti Lake.

3.5.6 Floodplains*

18. To comply with Executive Order 11988, disturbance in floodplains would be avoided where practicable. When avoidance is not practicable, floodplain disturbance would be minimized and floodplain function maintained or restored to the extent practicable.
19. A 100-year flood standard (or larger) shall be used for conveyance of all stream simulation and other moderate and major culverts and bridges.

3.5.7 Activities Involving Trenching*

20. Trenches may not be constructed or backfilled in such a manner as to drain waters of the U.S. (e.g., backfilling with extensive gravel layers, creating a French drain effect). Ditch plugs or other methods shall be used to prevent this situation. Except for material placed as minor trench over-fill or surcharge necessary to offset subsidence or compaction, all excess materials shall be removed to a non-wetland location. Revegetation shall follow the process outlined in special condition 29. The backfilled trench shall achieve the pre-construction elevation, within a year of disturbance unless climatic conditions warrant additional time. The additional time must be approved by the Corps. Excavated material temporarily sidecast into wetlands shall be underlain with ice pads, geotextile or similar material, to allow for removal of the temporary material to the maximum extent practicable.

3.5.8 Site Restoration of Ground Disturbing Activities*

21. To prevent erosion, disturbed areas shall be stabilized immediately after construction. Revegetation of the site shall begin as soon as site conditions allow and in the same growing season as the disturbance unless climatic conditions warrant additional time. Additional time must be approved by the Corps. Native vegetation and topsoils removed for project construction shall be stockpiled separately and used for site rehabilitation. Except in areas of top soil excavation, excavated soils shall be sorted into mineral subsoils and topsoil, and stored separately. Topsoil is defined as the upper, outermost layer of soil, usually the top two (2) to eight (8) inches. The depth of topsoil can be measured as the depth from the surface to the first densely packed layer of soil. When backfilling, topsoil shall be placed as the uppermost layer to provide a seed bed for native species. If topsoil and/or organic materials are not available from the project site for rehabilitation, other locally-obtained native materials may be used. Species to be used for seeding and planting shall follow this order of preference: 1) species native to the site; 2) species native to the area; 3) species native to the state.

3.5.9 Airborne Dust*

22. The permittee shall ensure pollution to aquatic resources from road gravel spray and fine airborne dust discharges are minimized to the maximum extent practicable. Dust abatement practices,

during dust prone weather and/or seasonal conditions, must be performed for the life of the project (use of the road). Compliance with this condition shall be determined by the absence of visible dust and gravel on wetland vegetation adjacent to the authorized fill areas.

23. Dust suppressants with ingredients potential harmful to aquatic organisms shall not be used within 328 feet of any fish –bearing stream and higher –value wetlands (e.g., emergent wetlands, moss-lichen wetlands, patterned fens and shallow ponds).

3.5.10 Navigation: Section 10 Mandatory (33 CFR PART 320.4(o)(3), and HQ memorandum)*

24. Your use of the permitted activity must not interfere with the public’s right to free navigation on all navigable waters of the U.S.

25. You must install and maintain, at your expense, any safety lights and signals prescribed by the U.S. Coast Guard (USCG), through regulations or otherwise, on your authorized facilities. The USCG may be reached at the following address and telephone number: Commander (oan), 17th Coast Guard District, P.O. Box 25517, Juneau, Alaska 99802, (907) 463-2272.

26. The permittee understands and agrees that, if future operations by the U.S. require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee would be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the U.S. No claim shall be made against the U.S. on account of any such removal or alteration.

3.5.11 Historic Properties/Cultural Resources*

27. The permittee shall implement the attached Programmatic Agreement (PA), entitled Programmatic Agreement by and Among the Bureau of Land Management, Alaska State Historic Preservation Officer, and Advisory Council on Historic Preservation Regarding the Ambler Road Industrial Access Road Project, Alaska, dated April 23, 2020. If you fail to comply with the implementation and associated enforcement of the PA the Corps may determine that you are out of compliance with the conditions of the Department of the Army permit/verification and suspend the permit/verification. Suspension may result in modification or revocation of the authorized work.

28. If human remains, historic resources, or archeological resources are encountered during construction, all ground disturbing activities shall cease in the immediate area and the applicant shall immediately (within one business day of discovery) notify the U.S. Army Corps of Engineers (Corps), Alaska District, Regulatory Office at 2715 University Avenue, Suite #201E, Fairbanks, Alaska 99709, (907) 474-2166, or to Regpagemaster@usace.army.mil). Upon notification the Corps shall notify the State Historic Preservation Office (SHPO). Based on the circumstances of the discovery, equity to all parties and consideration of the public interest, the Corps may modify, suspend or revoke the permit in accordance with 33 CFR 325.7. After such notification, the project activities on federal lands shall not resume without written authorization from the Corps, SHPO, and federal manager. After such notification, project activities on tribal lands shall not resume without written authorization from the SHPO and the Corps.

3.5.12 Geotechnical Investigations*

29. AIDEA shall avoid the use of materials containing naturally occurring asbestos (NOA is defined as 0.1 percent asbestos by mass) to the greatest extent practicable. If use of NOA materials cannot be avoided, the fill material and road cuts shall be capped with non-NOA materials in order to not expose NOA to the air, AIDEA shall follow DOT&PF measures as allowed under 17 Alaska Administrative Code 97 and described in May 14, 2015 regulations regarding the use of materials containing NOA.
30. The applicant shall submit a final project plan to the Corps for review prior to beginning any permitted work. This plan shall be based on the geotechnical investigations conducted to identify areas to be avoided due to the presence of naturally occurring asbestos and sulfide minerals that can cause acid drainage in cut and fill areas. The final plan shall incorporate all mitigation measures.

3.5.13 Self-Certification*

31. Within 60 days of completion of the work authorized by this permit, the Permittee shall complete the attached "Self-Certification Statement of Compliance" form and submit it to the Corps (U.S. Army Corps of Engineers, Regulatory Division, 2715 University Avenue, Suite #201 E, Fairbanks, AK 99709). In the event that the completed work deviates in any manner from the authorized work, the Permittee shall describe the deviations between the work authorized by this permit and the work as constructed on the "Self-Certification Statement of Compliance" form. The description of any deviations on the "Self-Certification Statement of Compliance" form does not constitute approval of any deviations by the Corps.

3.5.14 Modifications*

32. Should any other agency require and/or approve changes to the work authorized or obligated by this permit, the Permittee is advised a modification to this permit may be required prior to initiation of those changes. It is the Permittee's responsibility to request a modification of this permit. The Corps reserves the right to fully evaluate, amend, and approve or deny the request for modification of this permit.

Summary of Effectiveness: The measures listed above, if implemented collectively, are expected to be highly effective at reducing impacts to resources associated with removal-fill activities in wetland and waters. Because these measures are adopted from the USACE's approved permit application (POA-2013-00396 in Appendix G of the joint JROD), these measures would be implemented along the entire corridor, regardless of land ownership.

4 References*

Ontario Ministry of Natural Resources and Forestry. 2017. *Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario*. Queen's Printer for Ontario, 2017. 37 pp.

USFWS (U.S. Fish and Wildlife Service). 2019. Fish Passage Engineering Design Criteria. USFWS, Northeast Region R5. Hadley, Massachusetts.

Attachment A. BLM Mineral Materials Mining and Reclamation Plan Proposal Form

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Attachment A:

BLM Mineral Materials Mining and Reclamation Plan Proposal Form

While there is no requirement to use this form to apply for a mineral material mining authorization, all of the relevant information identified here is required for a mining plan to be determined complete.

NOTE 1: Applicants should contact BLM to request separate authorization for the following activities, which are outside the scope of activities authorized under a mineral material mining plan:

Establishment and operation of camps on public lands for commercial purposes.

Storage of materials or supplies not related to the production of mineral materials, including culverts, bridge railings, calcium chloride, or other road maintenance supplies.

Secondary or value-added production processes, including operation of hot-batch plants, asphalt production, cement production, fabrication of components for off-site use, and similar activities not related to the production of mineral materials.

NOTE 2: Applicants would be required to provide a copy of the following documentation prior to beginning operations.

The relevant approved Storm Water Pollution Prevention Plan (SWPPP)

A certified Spill Prevention, Control, and Countermeasures Plan (SPCCP) if required by 40 CFR 112, or a Spill Contingency Plan (SPC) subject to BLM approval.

Providing those, even in draft form, as part of this mining plan would help expedite the analysis and approval.

Applicants would also be **required** to provide a copy of any other permits required by applicable State or Federal regulation (e.g., a Clean Water Act Section 404 permit, an Alaska Department of Fish and Game Fish Habitat Permit, etc.) **prior to** beginning operations. Thus, they are encouraged to pursue those with the relevant agency concurrently with this application.

MINING PLAN

Project Name
Prepared By
Date

Operator Information

Operator Name
Mailing Address
Phone Numbers (Office, Cell, and FAX)
Point of contact

Permittee Information (if different than operator information)

Permittee(s) Name
Mailing Address
Phone Numbers (Office, Cell, and FAX)
Point of contact

General Plan Information

Mineral Material type(s) to be mined
Quantity per Year to be mined (cubic yards)
Total quantity to be mined

General Schedule of Operations from Start through Closure

Proposed date for mobilization to site
Proposed date for start of mining
Estimated date for end of mining
Estimated date for beginning of reclamation
Estimated date for completion of reclamation
Estimated date(s) for period(s) of temporary or seasonal closure
Other relevant milestone date estimates (e.g., planned change of mining method, etc.)

DESCRIPTION OF OPERATIONS

Location

Legal Description: (Township, Range, section(s), quarter section(s))
Highway milepost
Site name (if known)
Are non-native invasive plant species present at the site? (if known).

Equipment and Devices

Provide a list or description of all equipment and devices that would be used in the operations and the purpose/use for each

Operating Practices

Type of action/operation proposed (open pit, quarry, etc.)
Mining methods or techniques proposed (dozer scraping, excavator, drag line, blasting, etc.)
Estimated dimensions of excavation/workings (length, width, depth)
Description of processing/washing/crushing/sorting to be conducted on site
If water-based processes are proposed (washing), a detailed description of the water management plan, including water source, flow control, settling, and discharge rates and locations.
Estimated average daily production (cubic yards)
Estimated depth of overburden above usable materials
Estimated maximum volume of material stockpiles
Estimated volume of material stockpiles at completion of mining
Estimated total surface disturbance (acres); include mining area, access, berms, stockpiles, fuel yards, sanitation facilities, etc.
Description of overburden stockpiling (location, methods to prevent loss from erosion)
Description of dust control practices
Proposed daily hours of operation

Reclamation Plan

Description of proposed reclamation practices and methods

Regrading and reshaping to conform with adjacent landforms
Placement of growth medium and establishment of self-sustaining revegetation
Measures to control erosion, landslides, and water runoff

General reclamation schedule, from start to finish
Description of final pit configuration (reference diagrams)
Reclamation practices for roads/access features
Post-reclamation disposition of access features (reclaimed, left for future access to the pit, etc.)

Monitoring Plan

A monitoring plan must be designed to demonstrate compliance with the approved plan of operations and other Federal and State environmental laws and regulations, provide early detection of potential problems, and supply information that would assist in directing corrective actions should they become necessary. Examples of monitoring programs which may be relevant to a given operation include water quality, air quality (dust control), slope stability, revegetation progress (during reclamation), noise levels (if near visitor services facilities), and wildlife mortality. Monitoring plans may incorporate existing State and/or other Federal monitoring requirements to avoid duplication. However, the submitted monitoring plan needs to include copies of and clearly reference these other plans.

Where applicable, the monitoring plan must include details on:

Type and location of monitoring devices
Sampling parameters and frequency
Analytical methods
Reporting procedures
Procedures to respond to adverse monitoring results

Interim Management Plan

The interim management plan describes management of the project area during periods of temporary and seasonal closures to prevent unnecessary or undue degradation.

The interim management plan must include, where applicable, the following:

Measures to stabilize excavations and workings
Measures to isolate or control toxic or deleterious materials (e.g., if hazardous materials, including POLs, are left on site)
Provisions for the secure storage or removal of equipment, supplies and structures
Measures to maintain the project area in a safe and clean condition
Plans for monitoring site conditions during periods of non-operation
Schedule of anticipated periods of temporary closure during which you would implement the interim management plan

Description of Support Facilities

Office and administrative facilities

Description of structures and locations (reference project maps)

Sanitation needs

Human waste management methods (port-a-john, etc.)
Cleaning and maintenance schedule

Public safety considerations

Proposed fencing, barriers, or barricades and the need/purpose for each
Proposed signage and the need/purpose for each
Description of any other proposed public safety features or devices

Trash and solid waste management

Methods for interim secure storage of garbage generated on site
Schedule for incineration of solid waste combustibles
Schedule for backhaul of non-combustible waste
Description of burning/incineration facilities

SWPPP or other water management plans

Proposed means of stormwater diversion around workings
Diversion ditches and discharge locations in case water is produced during mining operations
Sediment and erosion control methods and devices
Schedule for inspection and maintenance of sediment and erosion control devices
Location of any planned water discharge
Water needs and uses
Water sources, including and methods and rates of water extraction or transfer

Access

Location(s) of each proposed road (reference project maps)
Road type for each proposed road (haul, light vehicle, access, etc.)
Road maintenance methods and schedules
Proposed upgrades to existing roads
The location of reasonable public passage or access routes through or around the area to adjacent public lands

Hazardous materials, including, but not limited to, POLs and explosives

SPCCP or SCP, as applicable
Location of all hazardous materials storage (reference project maps)
Location of refueling areas
Blasting plan, if applicable

Project Maps and Diagrams

Maps must be at an appropriate scale and of sufficient detail for BLM to discern the locations of:

Excavation boundaries
Types and location of material stockpiles
Phasing plan (see attached example)
Processing facilities
Overburden areas
Administrative facilities (office structures, etc.)
Equipment storage areas
Maintenance facilities and/or location
Refueling areas
Fuel storage
All water bodies within the intended disturbance area
Access features
Public safety devices, including proposed fences, barricades, and signage

Diagrams

Pre-mining cross sections
Post mining cross sections
Post-reclamation cross sections

The BLM may require additional, site-specific information when resource status or conditions warrant.

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Appendix O. References

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Appendix P. Glossary

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Glossary

Active floodplain: The flat area along a waterbody where sediments are deposited by seasonal or annual flooding; generally demarcated by a visible high water mark.

Aerial: Consisting of, moving through, found in, or suspended in the air.

Affect: To bring about a change. As a verb, affect is most commonly used in the sense “to influence” or “impact.” The adjective “affected” means acted upon or influenced by.

Alluvial: Sedimentary material consisting mainly of coarse sand and gravel; made up of or found in the materials that are left by the water of rivers, floods, etc.

Alternatives: The different means by which objectives or goals can be attained. One of several policies, plans, or projects proposed for decision making. The BLM is directed by the National Environmental Policy Act (NEPA) to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.…” (40 Code of Federal Regulations [CFR] 1507.2, Section 102(2)(E))

Ambient: Used to describe the environment as it exists at the point of measurement and against which changes (impacts) are measured.

Ambient air quality standard: Air pollutant concentrations of the surrounding outside environment that cannot legally be exceeded during fixed time intervals and in a specific geographic area.

Anadromous: Fish that mature in the sea and swim up freshwater rivers and streams to spawn (e.g., salmon, Dolly Varden, Arctic cisco).

Aquatic: Growing, living in, frequenting, or taking place in water; used to indicate habitat, vegetation, and wildlife in freshwater.

Archaeological resource: Places where remnants, such as artifacts or features, of a past culture survive in a physical context that allows for their interpretation. Archaeological resources can be districts, sites, buildings, structures, or objects and can be prehistoric or historic.

Aufeis: Thick ice that builds up as a result of repeated overflow.

Biological Assessment (BA): A document prepared by or under the direction of a federal agency; addresses listed and proposed species and designated and proposed critical habitat that may be in the action area and evaluates the potential effects of the action on such species and habitat.

Bureau of Land Management (BLM): An agency of the U.S. government, under the U.S. Department of the Interior, responsible for administering certain public lands of the United States.

Calving area: A large area where large mammals, particularly ungulates such as caribou, congregate to give birth to their young.

Capital expenses: The money spent to purchase or upgrade physical assets (e.g., buildings, roads, machinery).

Caribou Study Community: Any community that is in game management subunits that overlap caribou herd ranges, and which have Federal Subsistence Board customary and traditional use determinations for those herds.

Cubic feet per second (cfs): 1 cfs equals 448.33 gallons per minute.

Class I air quality area: Areas such as national parks over 6,000 acres, wilderness areas over 5,000 acres, national memorial parks over 5,000 acres, and international parks that were in existence as of August 1977, where air quality should be given special protection. Federal Class I areas are subject to maximum limits on air quality degradation called air quality increments (often referred to as prevention of significant deterioration increments). All areas of the United States not designated as Class I are Class II areas. The air quality standards in Class I areas are more stringent than national ambient air quality standards.

Code of Federal Regulations (CFR): A codification of the general and permanent rules published in the *Federal Register* (FR) by the executive departments and agencies of the federal government.

Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA): Authorizes funds administered by the U.S. Environmental Protection Agency (EPA) to identify and clean up hazardous waste sites; also known as Superfund.

Connected action: Connected actions are: a) actions (other than unconnected single actions) that may be: (1) connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they (i) automatically trigger other actions that may require environmental impact statements; (ii) cannot or will not proceed unless other actions are taken previously or simultaneously; and (iii) are interdependent parts of a larger action and depend on the larger action for their justification (40 CFR 1508.25(a)(i-iii)).

Conservation system unit: Any unit in Alaska of the National Park System, National Wildlife Refuge System, National Wild and Scenic Rivers System, National Trails System, National Wilderness Preservation System, or a National Forest Monument, including additions and expansions to these systems in the future (Section 102(4) of the Alaska National Interest Lands Conservation Act.

Consultation: Exchange of information and interactive discussion; consultation can be mandated by statute or regulation that has prescribed parties, procedures, and timelines, such as under NEPA, Section 7 of the Endangered Species Act (ESA), or Section 106 of the National Historic Preservation Act (NHPA).

Cooperating agency: Assists the lead federal agency in developing an Environmental Impact Statement (EIS). A cooperating agency may be any agency that has special jurisdiction by law or special expertise for proposals covered by NEPA (40 CFR 1501.6). Any federal, state, tribal, or local government jurisdiction with such qualifications may become a cooperating agency by agreement with the lead agency.

Council on Environmental Quality (CEQ): An advisory council to the president, established by NEPA. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the president on environmental matters.

Criteria air pollutants: The 6 most common air pollutants in the United States: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (both PM_{10} and $PM_{2.5}$ inhalable and respirable particulates), and sulfur dioxide (SO_2). Congress has focused regulatory attention on these 6 pollutants because they endanger public health and the environment, are widespread throughout the

United States, and come from a variety of sources. Criteria air pollutants are typically emitted from many sources in industry, mining, transportation, electricity generation, energy production, and agriculture.

Cultural resources: The remains of sites, structures, or objects used by humans in the past, historic or prehistoric.

Cumulative action: Proposed actions, which, when viewed with the proposed action, potentially have cumulatively significant impacts related to 1 or more identified issues. Cumulative actions "should be discussed" in the same NEPA document (40 CFR 1508.25(a)(2)).

Cumulative effect/impact: The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions (40 CFR 1508.7, 1508.25). Cumulative impacts can result from individually minor but collectively significant actions taking place over time.

Decision maker: The BLM official (also termed authorized official, authorized officer, responsible official, and responsible manager) who has been delegated authority to approve an action and is responsible for issuing a decision to implement a proposed action.

Density: The number of individuals per a given unit area.

Deposit: A natural accumulation, including precious metals, minerals, coal, gas, and oil, that may be pursued for its intrinsic value, such as a gold deposit.

Design features: Measures or procedures incorporated into the proposed action or an alternative, including measures or procedures that could reduce or avoid adverse impacts. Because these features are built into the proposed action or an alternative, design features are not considered mitigation.

Development: The phase of mining operations that occurs after exploration has proven successful and before full-scale production.

Direct effect/impact: "those effects which are caused by the action and occur at the same time and place" (40 CFR 1508.8(a)).

Draft Environmental Impact Statement (Draft EIS): The draft statement of the environmental effects of a major federal action, which is required under Section 102 of NEPA and released to the public and other agencies for comment and review.

Effect: Environmental change resulting from a proposed action. Effects can be both beneficial and detrimental. Direct effects are caused by the action and occur at the same time and place, while indirect effects are caused by the action but are later in time or farther removed in distance, although still reasonably foreseeable. Indirect effects may include growth-inducing and other effects related to induced changes in the pattern of land use, population density, or growth rate and related effects on air and water and other natural systems, including ecosystems. Effect and impact are synonymous, and both are used in this document.

Employment: Labor input into a production process, measured in the number of person-years or jobs; the number of jobs required to produce the output of each sector. A person-year is approximately 2,000 working hours by 1 person working the whole year or by several persons working seasonally. A job may be 1 week, 1 month, or 1 year.

Endangered species: Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range; plant or animal species identified by the Secretary of the Interior as endangered in accordance with the ESA.

Environment: The physical conditions that exist in an area, such as the area that would be affected by a proposed project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance; the sum of all external conditions that affect an organism or community to influence its development or existence.

Environmental Impact Statement (EIS): An analytical document prepared under NEPA that portrays the potential impacts on the environment of a proposed action and its possible alternatives. An ElS is developed for use by decision makers to weigh the environmental consequences of a potential decision.

Environmental justice (EJ): The fair treatment and meaningful involvement of all people, regardless of natural origin or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Executive Order (EO) 12898 directs federal agencies to achieve environmental justice as part of their missions by identifying and addressing disproportionately high adverse effects of agency programs, policies, and activities, on minority and low-income populations.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geologic agents, including gravitation creep.

Essential fish habitat (EFH): As defined by the Magnuson-Stevens Fishery Conservation and Management Act, "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." In Alaska, there are 6 federal Fisheries Management Plans that identify EFH for fish species managed under a fishery management unit. For the purpose of interpreting the definition of EFH habitat, "waters" include aquatic areas and their associated physical, chemical, and biological properties; "substrate" includes sediment underlying the waters; "necessary" refers to the habitat required to support a sustainable fishery and the managed species contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" includes all habitat types that a species uses throughout its life cycle.

Ethnographic: Of or pertaining to the descriptive and analytical study of the culture of particular self-defined groups or communities.

Exception: A 1-time exemption to a lease stipulation, determined on a case-by-case basis.

Exploration: The search for economic deposits of minerals, gas, oil, or coal through the practices of geology, geochemistry, geophysics, drilling, shaft sinking, and mapping.

Exploratory unit: A prospective area delineated on the basis of geological or geophysical inference and permit the most efficient and cost-effective means of developing underlying resources.

Federal action: A BLM proposal is a federal action when (1) the proposal is at a stage in development where the BLM has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal (40 CFR 1508.23); (2) the proposed action and effects are subject to BLM control and responsibility (40 CFR 1508.18); (3) the action has effects that can be meaningfully evaluated

(40 CFR 1508.23); and (4) effects of the proposed action are related to the natural and physical environment, and the relationship of people with that environment (40 CFR 1508.8 and 1508.14).

***Federal Register* (FR):** The official daily publication for rules, proposed rules, and notices of federal agencies and organizations, as well as EOs and other presidential documents. The FR is published by the Office of the Federal Register, National Archives and Records Administration.

Final Environmental Impact Statement (Final EIS): A revision of the Draft EIS that addresses public and agency comments on the draft.

Fisheries habitat: Streams, lakes, and reservoirs that support fish populations.

Fishery: The act, process, occupation, or season of taking an aquatic species.

Floodplain: The lowland and relatively flat area adjoining inland waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Fossil: Evidence or remnant of a plant or animal preserved in the earth's crust, such as a skeleton, footprint, or leaf print.

Frequency: The number of samples in which a plant or animal species occurs, divided by the total number of samples.

Fugitive dust: Particles suspended randomly in the air, usually from road travel, excavation, or rock loading operations.

Game Management Unit (GMU): A geographic division made by the Alaska Department of Fish and Game for the management of fish and wildlife in the state. Different GMUs have different hunting and fishing seasons, bag limits, and other harvest rules.

Geology: The scientific study of the origin, history, and structure of the earth; the structure of a specific region of the earth's surface.

Geomorphic: Pertaining to the structure, origin, and development of the topographical features of the earth's crust.

Global warming: An increase over time of the average temperature of the earth's atmosphere and oceans. It is generally used to describe the temperature rise over the past century or so and the effects of humans on the temperature rise.

Greenhouse effect: A process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases (GHGs) and is reradiated in all directions. Since part of this reradiation is toward the earth's surface and the lower atmosphere, it elevates the average surface temperature above what it would be in the absence of the gases.

Greenhouse gas (GHG): A gas that absorbs and emits thermal radiation in the lowest layers of the atmosphere. This process is the fundamental cause of the greenhouse effect. The primary GHGs that are considered air pollutants are CO_2, methane (CH_4), nitrous oxide, and chlorofluorocarbons.

Groundwater: Water found beneath the land surface in the zone of saturation below the water table.

Habitat: The natural environment of a plant or animal, including all biotic, climatic, and soil conditions, or other environmental influences affecting living conditions. The place where an organism lives.

Hazardous air pollutants (HAPs): Also known as toxic air pollutants, those that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. The EPA is required to control 187 HAPs. Examples of HAPs are benzene (found in gasoline), perchloroethlyene (emitted from dry cleaning facilities), and methylene chloride (used as a solvent).

Hazardous waste: As defined by the EPA, a waste that exhibits 1 or more of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. Hazardous wastes are listed in 40 CFR 261.3 and 171.8.

Historic property: Historic properties are defined in the NHPA (54 United States Code [USC] 300308) as any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on, the National Register of Historic Places, including artifacts, records, and material remains related to such a property or resource."

Human environment: Includes the natural and physical environment and the relationship of people with that environment. When economic or social effects and natural or physical environmental effects are interrelated, then the analysis must discuss all of these effects on the human environment (40 CFR 1508.14).

Hydrocarbon: A naturally occurring organic compound composed of hydrogen and carbon. Hydrocarbons can occur in molecules as simple as methane (1 carbon atom with 4 hydrogen atoms), but also as highly complex molecules, and can occur as gases, liquids, or solids. The molecules can have the shape of chains, branching chains, rings, or other structures. Petroleum is a complex mixture of hydrocarbons.

Hydrologic system: The combination of all physical factors such as precipitation, stream flow, snowmelt, and groundwater that affect the hydrology of a specific area.

Hyporheic zone: Where surface and groundwater interact beneath and adjacent to streams; it is critical for salmon spawning and egg incubation and regulates biological activity that affects stream health (see Hancock 2002 for more information).

Impact: See Effect.

Impermeable: Not permitting passage of fluids through its mass.

Impoundment: The collection and confinement, usually of water (in the case of mining, tailings materials), in a reservoir or other storage area.

Indirect effect/impact: Impact caused by an action but later in time or farther removed in distance, although still reasonably foreseeable. Effects that "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on water and air and other natural systems, including ecosystems" (40 CFR 1508.8(b)).

Infrastructure: The underlying foundation or basic framework; substructure of a community's built environment, such as schools, police and fire stations, hospitals, roads, airports, and water and sewer systems.

Insect-relief area: An area with relatively low numbers of insects that caribou use for relief from insects.

Irretrievable: Applies to losses of production, harvest, or commitment of renewable natural resources. For example, some or all of the wildlife forage production from an area is irretrievably lost during the time an area is used as an oil or gas development site. If the use changes, forage production can be resumed. The production lost is irretrievable, but the act is not irreversible.

Irreversible: A term that applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Jurisdictional wetland: A wetland area delineated and identified by specific technical criteria, field indicators, and other information, for the purposes of public agency jurisdiction. The U.S. Army Corps of Engineers regulates "dredging and filling" activities associated with jurisdictional wetlands. Other federal agencies that can become involved with matters that concern jurisdictional wetlands include the U.S. Fish and Wildlife Service, EPA, and the Natural Resource Conservation Service.

Landform: Any physical, recognizable form or feature on the earth's surface having a characteristic shape that is produced by natural causes. Landforms provide an empirical description of similar portions of the earth's surface.

Land management: The intentional process of planning, organizing, programming, coordinating, directing, and controlling land use actions.

Landscape: The sum total of the characteristics that distinguish a certain area on the earth's surface from other areas; these characteristics are a result not only of natural forces, but also of human occupancy and use of the land. An area composed of interacting and interconnected patterns of habitats (ecosystems), which are repeated because of geology, landforms, soils, climate, biota, and human influences throughout the area.

Land status: The ownership or management status of lands.

Land use allocation: The assignment of a management emphasis to particular land areas with the purpose of achieving the goals and objectives of some specified use(s) such as campgrounds, wilderness, logging, and mining.

Land use plan: A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of the Federal Land Policy and Management Act (FLPMA); an assimilation of land-use-plan level decisions developed through the planning process outlined in 43 CFR 1600, regardless of the scale at which the decisions were developed. The term includes both Resource Management Plans and Management Framework Plans.

Listed species: Species that are listed as threatened or endangered under the ESA.

Long-term impacts: Impacts that normally result in permanent changes to the environment such as the loss of habitat due to development of a gravel pit. For each resource, the definition of long term may vary.

Management area: An area delineated on the basis of management objective prescriptions.

Marine: Of, found in, or produced by the sea.

Migratory: Moving from place to place, daily or seasonally.

Mining District: The term "Mining District" applies traditionally to geographic areas described by miners and are often governed under bylaws drawn up by miners. The Ambler Mining District is an informal descriptive term applied to the approximate area mapped in this Supplemental EIS and has no formal or legal standing. In contrast, the many individual mining claims and mining agreements that exist within the mapped area do have legal rights and responsibilities under state and federal law.

Mitigation: Steps taken to (1) avoid an impact altogether by not taking a certain action or parts of an action; (2) minimize an impact by limiting the degree or magnitude of the action and its implementation; (3) rectify an impact by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate an impact over time by preserving and maintaining operations during the life of the action; and (5) compensate for an impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

National Environmental Policy Act (NEPA): An act declaring a national policy to encourage productive and enjoyable harmony between humankind and the environment; promote efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity; enrich the understanding of the ecological systems and natural resources important to the nation; and establish a CEQ.

National Pollutant Discharge Elimination System (NPDES): A program authorized by Sections 318, 402, and 405 of the Clean Water Act, and implemented by 40 CFR 122. The NPDES program requires permits for the discharge of pollutants from any point source into waters of the United States.

Notice of Availability (NOA): The FR notice that an EIS (draft or final) or Record of Decision is available. Publication of a notice of filing of an EIS by the EPA formally begins the public comment period.

Notice of Intent (NOI): This FR notice announces that an EIS will be prepared. Publication of this notice formally starts the scoping process.

Particulates: Small particles suspended in the air, generally considered pollutants.

Per capita income: Total income divided by the total population.

Permafrost: Permanently frozen ground.

Plant community: A vegetation complex, unique in its combination of plants, that occurs in particular locations under particular influences. A plant community is a reflection of integrated environmental influences on the site (e.g., soils, temperature, elevation, solar radiation, slope aspect, precipitation).

Pollution: Human-caused or natural alteration of the physical, biological, and radiological integrity of water, air, or other aspects of the environment that produce undesired effects.

Preferred alternative: The alternative the BLM believes would reasonably accomplish the purpose and need for the proposed action while fulfilling its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors. This alternative may or may not be the same as the BLM or proponent’s proposed action.

Proposed action: A proposal for the BLM to authorize, recommend, or implement an action to address a clear purpose and need. A proposal may be generated internally or externally.

Public scoping: A process whereby the public is given the opportunity to provide oral or written comments about the influence of a project on an individual, the community, and/or the environment.

Raptor: Bird of prey such as eagles, hawks, falcons, and owls.

Reasonably foreseeable action: Actions for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends.

Record of Decision (ROD): A document separate from, but associated with, an EIS that states the decision, identifies alternatives (specifying which were environmentally preferable), and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and, if not, why (40 CFR 1505.2).

Regulated air pollutants: Pollutants first set forth in the Clean Air Act of 1970 and are the basis upon which the federal government and state regulatory agencies have established emission thresholds and regulations. Regulated air pollutants include criteria air pollutants, HAPs, volatile organic compounds (VOCs), and GHGs. The same pollutant may be regulated under more than 1 regulatory standard.

Regulation: An official rule. Within the federal government, certain administrative agencies (such as the BLM) have a narrow authority to control conduct within their areas of responsibility. A rule (also called a regulation or rulemaking) is a statement published in the FR to implement or interpret law or policy (see Administrative Procedure Act, 5 USC 551(4) [“‘rule’ means the whole or a part of an agency statement of general or particular applicability and future effect designed to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of an agency”]). A rule is generally published as a proposed rule and then as a final rule. Once a rule is published in final, it is codified in the CFR and remains in effect until it is modified by publication of another rule.

Resident: A species that is found in a particular habitat for a particular time period, such as winter or summer resident, as opposed to a species found only when passing through during migration.

Resource Management Plan (also known as Land Use Plan or Management Framework Plan): A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of FLPMA, Public Law 94-579, 90 Statute 2743; an assimilation of land use plan-level decisions developed through the planning process outlined in 43 CFR 1600, regardless of the scale at which the decisions were developed.

Right-of-way: Public lands that the BLM authorizes a holder to use or occupy under a grant (e.g., roads, pipelines, power lines, fiber-optic lines).

Riparian: Occurring adjacent to streams and rivers and directly influenced by water. A riparian community is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

Scenic River: River designation, under the Federal Wild and Scenic Rivers Program, on the basis of undisturbed and scenic character. Scenic rivers are given special management criteria by federal agencies.

Scoping (internal and external): The process by which the BLM solicits internal and external input on the issues and effects that will be addressed, as well as the degree to which those issues and effects will be analyzed in the NEPA document. Scoping is a form of public involvement in the NEPA process. Scoping occurs early in the NEPA process and generally extends through the development of alternatives (the public comment periods for EIS review are not scoping). Internal scoping is simply the use of BLM staff to decide what needs to be analyzed in a NEPA document. External scoping, also known as formal scoping, involves notification and opportunities for feedback from other agencies, organizations, and the public.

Scoping process: A part of the NEPA process; early and open activities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an EIS (40 CFR 1501.7).

Sediments: Unweathered geologic materials generally laid down by or within waterbodies; the rocks, sand, mud, silt, and clay at the bottom and along the edge of lakes, streams, and oceans.

Sensitive species: Plant or animal species that are susceptible or vulnerable to activity impacts or habitat alterations; species that have appeared in the FR as proposed for classification or are under consideration for official listing as endangered or threatened species.

Short-term impacts: Impacts occurring during project construction and operation, and normally ceasing upon project closure and reclamation. For each resource, the definition of short term may vary.

Significant: The description of an impact that exceeds a certain threshold level. Requires consideration of both context and intensity. The significance of an action must be analyzed in several contexts, such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts, which should be weighted along with the likelihood of its occurrence. The CEQ regulations at 40 CFR 1508.27(b) include 10 considerations for evaluating intensity.

Sociocultural: Of, relating to, or involving a combination of social and cultural factors.

Socioeconomic: Pertaining to or signifying the combination or interaction of social and economic factors.

Soil horizon: A layer of soil material approximately parallel to the land surface that differs from adjacent genetically related layers in physical, chemical, and biological properties.

Solid waste: Includes garbage and/or refuse.

Spawning: Production, deposition, and fertilization of eggs by fish.

Subsistence: Harvesting of plants and wildlife for food, clothing, and shelter. The attainment of most of one’s material needs, such as food and clothing materials, from wild animals and plants.

Substantive comment: A comment that does 1 or more of the following: questions, with reasonable basis, the accuracy of information in the EIS; questions, with reasonable basis or facts, the adequacy of, methodology for, or assumptions used for the environmental analysis; presents reasonable alternatives other than those presented in the EIS; or prompts the BLM to consider changes or revisions in 1 or more of the alternatives.

Terrestrial: Of or relating to the earth, soil, or land; inhabiting the earth or land.

Thermokarst: Depressions and uneven ground settlements resulting from the thawing and melting of permafrost.

Third-party contracting: Contracting for the preparation of NEPA documents that is funded by the non-BLM proponent of an action. The BLM must still approve this analysis.

Threatened species: A plant or animal species likely to become an endangered species throughout all or a significant portion of its range within the foreseeable future.

Traditional knowledge: An intimate understanding by indigenous peoples of their environment, which is grounded in a long-term relationship with the surrounding land, ocean, rivers, ice, and resources. This understanding includes knowledge of the anatomy, biology, and distribution of resources; animal behavior; seasons, weather, and climate; hydrology, sea ice, and currents; ecosystem function; and relationship between the environment and the local culture.

Waterbody: A jurisdictional water of the United States (see 33 CFR 328.4). Examples of waterbodies include streams, rivers, lakes, ponds, and wetlands.

Water quality: The interaction between various parameters that determines the usability or non-usability of water for onsite and downstream uses. Major parameters that affect water quality include temperature, turbidity, suspended sediment, conductivity, dissolved oxygen, pH, specific ions, discharge, and fecal coliform.

Wetlands (biological wetlands): Those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstance support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include habitats such as swamps, marshes, and bogs (see jurisdictional wetlands).

Wild and Scenic Rivers: Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Wilderness: A wilderness, in contrast with those areas where humans and their works dominate the landscape, is recognized as an area where the earth and its community of life are untrammeled by humans, where humans are visitors who do not remain. An area of wilderness also means an area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of human's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

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