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

Willow Master Development Plan

Supplemental Environmental Impact Statement

FINAL

Volume 15: Appendix E.15 to H

January 2023

Prepared by:
U.S. Department of the Interior
Bureau of Land Management
Anchorage, Alaska

In Cooperation with:
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Native Village of Nuiqsut
Iñupiat Community of the Arctic Slope
City of Nuiqsut
North Slope Borough
State of Alaska

Estimated Total Costs Associated with Developing and Producing this SEIS: $3,350,000

Mission

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

Cover Photo Illustration: North Slope Alaska oil rig during winter drilling.
Photo by: Judy Patrick, courtesy of ConocoPhillips.

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Willow Master Development Plan

Appendix E.15
Economics Technical Appendix

January 2023

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Memorandum

Date: April 20, 2022

To: Kristen Hansen, DOWL

From: Patrick Burden and Leah Cuyno

Re: Updated Economic Analysis of Proposed Alternatives for the Willow Master Development Plan Supplemental EIS

DOWL requested Northern Economics to quantify the potential economic impacts of the proposed alternatives being considered for the Supplement to the Willow Master Development Plan (MDP) EIS. The supplemental analysis addresses deficiencies identified in the August 2021 U.S. District Court of Alaska decision to vacate the earlier Record of Decision and Final EIS by including an additional alternative that would provide 'maximum protection' to surface values in the Teshekpuk Lake Special Area (TLSA). This new action alternative would result in less infrastructure in the TLSA. The results of this updated economic impact analysis will be used to inform the environmental consequences section of the Supplemental EIS (SEIS).

This memorandum transmits the results of the updated economic impact analysis and describes the approach, assumptions, and data used in the analysis.

Scope of Analysis

Project Alternatives

For the purpose of this quantitative analysis, the following action alternatives are analyzed-- Alternatives B, C, D, and E. Note that Alternative A, is the No Project alternative; no development will occur under this alternative and the existing or baseline economic conditions will continue.

Alternative B is the *Proponent's Project* alternative. The alternative provides the shortest road access from the GMT Unit to the proposed Willow facilities.

Alternative C is described as the '*disconnected infield roads*' alternative.

Alternative D is described as the '*disconnected access*' alternative.

Alternative E is described as the '*Three-Pad Alternative'*.

The proposed development scenarios for Alternatives B, C, and D include 5 drill sites, and construction of processing facilities at the Willow Central Processing Facility (WCF), a Willow Operations Center (WOC), access roads, pipelines, an airstrip, and a gravel mine.

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However, certain features, particularly with respect to location and access vary depending on the alternative. For example, Alternative C would not include a gravel road connection between the WCF and the three northern drill sites, BT1, BT2, and BT4. There would be no road bridge across Judy Creek. Instead, an annually- constructed ice road would provide seasonal ground access to these drill sites. Alternative C would require two WOCs and airstrips: a South WOC and airstrip near the WCF, and a North WOC and airstrip, near BT2.

Alternative D, on the other hand, considers a development in which the Plan Area does not have year-round gravel road access to GMTU and Alpine. Instead, the Plan Area would be accessible only by air, ice road, and limited low ground-pressure vehicle. Alternative D includes construction of an annual ice road from GMTU to the Plan Area. Alternative D retains gravel roads between Plan Area facilities for safety and spill response. Alternative D would require a new diesel pipeline to the WOC from the Kuparuk CPF2 and approximately 25 acres of additional gravel pad footprint at the WCF. The lack of flexibility to use existing North Slope infrastructure and associated constraints on construction and logistics would extend the construction phase, delay the first oil date, and affect operational efficiency and emergency response for the life of the development.

Alternative E is the additional alternative identified by the BLM and cooperating agencies to address the Alaska District Court's remand. Under this alternative, drill site BT4 will be eliminated, resulting in only 4 drill sites and a WCF to support the Willow Project. Additional features of this alternative include moving drill site BT2 to a location north of Fish Creek (BT2 North), expanding drill sites BT1 and BT2 to accommodate more wells, relocating drill site BT5 to the northeast location just outside of yellow-billed loon setback buffer, and eliminating the constructed freshwater reservoir.

More details on these different alternatives are provided in Chapter 2 of the SEIS document.

Economic Indicators

This analysis quantifies the potential economic effects or consequences of the Project alternatives with respect to the following economic indicators:

1. **Potential Revenues.** This analysis provides estimates of the following potential government revenue streams:
    - State of Alaska: Royalty Revenue, Property Tax, Production Tax, Oil Surcharge, Corporate Income Tax.
    - Federal Government: Royalty Revenue, Corporate Income Tax, Gravel sales
    - North Slope Borough: Property Tax

2. **Potential Employment.** This analysis provides estimates of the direct, indirect, and induced employment effects associated with the construction phase and operations phase of the proposed Project alternatives. Employment effects reflect the total number of average part-time and full-time jobs resulting from the proposed construction and production (operations) activities.
3. **Potential Labor Income.** This analysis provides estimates of the potential labor income effects associated with the construction phase and operations phase of the proposed Project alternatives.

Approach, Assumptions, and Data

Estimating Potential Revenues

To quantify the potential streams of government revenues, the cash-flow model originally developed by the Alaska Department of Natural Resources (DNR) for evaluation of oil and gas projects in the Alaska North Slope was adapted and modified to reflect the Willow MDP SEIS project alternatives. The DNR model is based on the current fiscal regime and contains input cells that are fixed due to statutes or regulations; the major fiscal model parameters are shown in the table below.

Table 1. Alaska Fiscal Model Parameters

Category	Definition (Alaska Statute)	Value
Conservation Surcharges ($/barrel)	*43.55.201, 43.55.300*	$0.05
North Slope Oil Tax	–	–
Production Tax Rate on PTV	*43.55.011 (e)*	35%
$/BOE QCE exclusion ($/barrel)	*43.55.165 (e)(18)*	$0.30
Overhead allowance for lease expenditures	*43.55.165 (a)(2), 15 AAC 55.271*	4.5%
Minimum tax	–	–
Minimum Gross Tax (applied on GVPP)	*43.55.011 (f)*	4.0%
Oil and Gas Property Tax	–	–
Property Tax Rate	*43.56.010*	2.0%
Gross Value Reduction on "New Oil"	–	–
GVR %	43.55.160 (f)	20.0%
Additional GVR % (New field, ROY>12.5%)	43.55.160 (f &g)	30.0%
GVR Year Limit	*43.55.160 (f)*	7
GVR Oil Price limit: 3 years with ANS price above	*43.55.160 (f)*	$70.00
State and Federal Income Tax	–	–
State Income Tax	–	9.40%
Federal Income Tax	–	21.00%

The major inputs and assumptions used in the model to reflect the proposed project include:

1. Capital Expenditures (CAPEX)

Over the last 10 years Northern Economics, Inc. (NEI) has been working on various development projects in the North Slope, to estimate the effects of oil and gas development on local communities, regional entities, and the State of Alaska. As part of

these projects, NEI has obtained cost information from company specific projects as well as from surveys of operating companies and businesses in the oil and gas support services sector.

The facility CAPEX estimates presented in this memorandum are based on data from five proprietary project CAPEX estimates that had central processing facilities. The CAPEX estimates were adjusted to fit the specification required by the DNR cash-flow model, and a linear regression equation for CAPEX was developed based on total volume of oil and natural gas liquids (NGLs) produced over the life of the field, and whether the project had seasonal access. The regression equation has the form of Seasonal Access (1 if seasonal access, 0 if year-round access) * 1015.96 + million barrels of oil and NGLs produced (MMBO) * 0.656946 + 4306.702. The equation has a coefficient of determination (r^2) of 0.60.

Drilling CAPEX was estimated using the same variables as the facility CAPEX. The drilling regression equation has the form of Seasonal Access (0,1) * 152.8 + MMBO * 1.30049 + 2875.411. The equation has a coefficient of determination (r^2) of 0.72.

The estimated drilling and facilities capital expenditures are shown in the table below.

Table 2. Estimated Capital Expenditures by Alternative, in millions of 2021 $

Capital Expenditure Item:	Alternatives B	Alternative C	Alternative D	Alternative E
Drilling	$3,914	$4,270	$4,331	$3,893
Facilities	$4,832	$5,847	$5,935	$4,821
Total:	$8,746	$10,118	$10,267	$8,714

Source: Northern Economics estimates.

2. Operating Expenditures (OPEX)

The OPEX regression equation has the form of MMBO * 0.039407392 + 4515.887379. Alternatives C and D have higher operating costs than Alternative B and E due to the additional costs of providing seasonal access and operating additional facilities.

The estimated total cumulative operating expenditures amount to $4.547 billion for Alternative B, $4.774 billion for Alternative C, $4.843 billion for Alternative D, and $4.546 billion for Alternative E.

3. Crude Oil Price Forecasts

Two oil price projections were used in this analysis to provide a range of estimates for the potential revenue effects— 1) the latest U.S. Energy Information Administration (EIA) oil price projections published in the *Annual Energy Outlook 2021* on February 3, 2021, and 2) the latest Alaska Department of Revenue (ADOR) oil price projections published in the *Revenue Sources Book Fall 2021* on December 24, 2021.

The ADOR oil price forecast (for ANS West Coast) reflects a more conservative price forecast (at $60.66 per barrel in real 2021$, average over 2022 to 2031 period) while the

EIA price forecast reflects a higher oil price scenario (at $80.33 per barrel in real 2021$, average over 2022 to 2050). The ADOR forecast is a 10-year forecast through 2029 and the EIA forecast is through year 2050. Prices beyond the timeframe published were extrapolated using the cumulative annual growth rate provided in the 10-year forecast.

4. Netback Costs: Tariffs/Transportation Costs

For royalty calculations, oil is valued at the wellhead, hence, netback costs which include marine transportation cost, quality adjustment, TAPS tariff, and pipeline and feeder line tariffs, are deducted from the projected market price. Estimates of netback costs used in this analysis are from the Alaska Department of Revenue's *Revenue Sources Book Fall 2021*; except for the feeder line tariff data which was obtained from the Alaska Department of Natural Resources, Division of Oil and Gas.

5. Projected Annual Production Volumes

The table below shows the total projected oil production under each alternative. All Alternatives have a 25-year production life. Oil production for Alternatives B, C, and E begin in Year 6 of the project life, while first oil production for Alternative D starts in Year 7.

Table 3. Annual Production Volumes in millions of barrels of oil (MMBO)

Year	Alternative B	Alternative C	Alternative D	Alternative E
6	60.39	60.39	0.00	60.31
7	66.48	66.48	60.39	66.88
8	59.30	59.30	66.48	60.18
9	52.58	52.58	59.30	51.74
10	46.40	46.40	52.58	45.67
11	41.10	41.10	46.40	39.43
12	36.92	36.92	41.10	35.38
13	33.28	33.28	36.92	31.20
14	29.85	29.85	33.28	27.83
15	26.74	26.74	29.85	25.24
16	24.21	24.21	26.74	23.06
17	21.50	21.50	24.21	20.93
18	19.07	19.07	21.50	18.62
19	16.23	16.23	19.07	15.96
20	14.19	14.19	16.23	13.93
21	12.32	12.32	14.19	11.98
22	10.93	10.93	12.32	10.47
23	9.68	9.68	10.93	9.27
24	8.77	8.77	9.68	8.31
25	8.07	8.07	8.77	7.57
26	7.46	7.46	8.07	6.94
27	6.32	6.32	7.46	5.87
28	6.19	6.19	6.32	5.82
29	5.66	5.66	6.19	5.22
30	5.23	5.23	5.66	4.84
31	0.0	0.0	5.23	0.0

Source: CPAI, 2022.

Estimating Employment and Income Effects

Direct manpower requirements for the Willow MDP were estimated by CPAI and presented in the results section below. The potential indirect and induced employment and income effects for this analysis were estimated using the IMPLAN model of the Alaska economy. The IMPLAN model is an input-output model that is commonly used in economic impact studies to measure the multiplier effects/stimulus effects of an economic development project.

The estimates of industry spending on capital expenditures (CAPEX; construction costs) and on operating expenditures (OPEX) for each of the project alternatives, as described above, were used as inputs for the model. The IMPLAN model provides estimates of the number of part-time and full-time indirect and induced jobs required to meet the increase in demand for goods, materials, and services during the construction and the operations phases of the proposed project. These indirect and induced jobs (and associated income) are considered the multiplier effects or stimulus effects that result from the increase in demand in various industries/sectors in the Alaska economy, particularly those that support the construction sector, and the oil and gas extraction/production sector (indirect effects), as well as all the other sectors that provide goods and services to the industry workers (induced effects).

The IMPLAN model provides estimates of indirect and induced labor income based on information on average Alaska wages and salaries in the various sectors of the economy. Prevailing annual average wages for oil and gas jobs are presented below.

Results

Projected Government Revenues

The Willow MDP is projected to generate revenues to the federal government, the State of Alaska, and the North Slope Borough from royalties, taxes, and other fees. The projected revenues by revenue stream and by Alternative are presented in the table below. The values shown in the table reflect the estimated total cumulative revenues through the end of the production life of the field.

Table 4. Estimated Potential Revenues of the Willow MDP SEIS Alternatives

Revenue Category	Alternative B		Alternative C		Alternative D		Alternative E	
	DOR Price	EIA Price	DOR Price	EIA Price	DOR Price	EIA Price	DOR Price	EIA Price
State of Alaska								
Royalty Revenue	$2,329.9	$3,662.3	$2,329.9	$3,662.3	$2,301.5	$3,701.2	$2,270.0	$3,560.1
Property Tax	$103.7	$103.7	$124.3	$124.3	$133.7	$133.7	$101.4	$101.4
Production Tax	$393.0	$3,622.9	$404.1	$3,273.5	$385.4	$3,593.2	$374.3	$3,399.1
Oil Surcharge	$26.2	$26.2	$26.2	$26.2	$26.2	$26.2	$25.5	$25.5
Corporate Income Tax	$833.2	$1,781.8	$677.3	$1,659.7	$630.1	$1,644.0	$783.0	$1,711.1
Total:	**$3,686.0**	**$9,196.9**	**$3,561.8**	**$8,746.1**	**$3,477.0**	**$9,098.4**	**$3,554.2**	**$8,797.3**
Federal Government								
Royalty Revenue	$2,329.9	$3,662.3	$2,329.9	$3,662.3	$2,301.5	$3,701.2	$2,270.0	$3,560.1
Corporate Income Tax	$1,726.9	$3,646.8	$1,411.3	$3,399.8	$1,315.8	$3,368.0	$1,625.3	$3,503.8
Gravel sales	$9.9	$9.9	$9.9	$9.9	$9.9	$9.9	$9.9	$9.9
Total:	**$4,066.7**	**$7,319.0**	**$3,751.1**	**$7,072.0**	**$3,627.2**	**$7,079.1**	**$3,905.2**	**$7,073.8**
North Slope Borough								
Property Tax	$1,278.6	$1,278.6	$1,533.2	$1,533.2	$1,649.3	$1,649.3	$1,250.1	$1,250.1

Source: Northern Economics estimates.

At the State level, there are several potential sources of revenues that would be generated from the proposed development. Production from the Willow development would result in royalties paid to the federal government, and State of Alaska would receive 50 percent of those royalties. The federal royalty rate is 16.67 percent of the wellhead value. Total estimated cumulative state royalties range from $2.27 billion to $3.70 billion.

The state would receive property tax payments on onsite facilities and these revenues would start accruing during the construction phase. Total State property tax revenues are projected to range between $101 million and $134 million, depending on the Alternative.

Oil produced and sold from lands within Alaska are subject to a severance tax as the resources leave the land. This severance tax is commonly referred to as the "production tax." The production tax applies to oil produced from any area within the boundaries of

the state, including lands that are owned by the state, the federal government (like NPR-A), or private parties, such as Native corporations. Severance tax or production tax payments are based on the current tax rate of 35 percent of the production value, which is the value at the point of production, less all qualified lease expenditures (net value). Qualified lease expenditures include certain qualified capital and operating expenditures. Total production taxes are estimated to range from $374 million to over $3.6 billion, depending on the oil price assumption and the Alternative.

An oil and gas corporation's Alaska income tax liability depends on the relative size of its Alaska and worldwide activities and the corporation's total worldwide net earnings. State corporate income tax is calculated as 9.4 percent of the Alaska share of worldwide income for each corporation. The ADNR model, however, does not take into consideration corporate worldwide income (which is unknown at this time) but simply evaluates all the costs and revenues and the resulting state income tax given the 9.4 percent income tax rate. Total estimated state corporate income tax payments could range between $630 million and $1.78 billion, depending on the Alternative and oil price assumption. In addition, the state would also receive oil surcharge revenues estimated to amount to about $26 million. Conservation surcharges apply to all oil production in Alaska and are in addition to oil and gas production taxes. Revenues derived from these surcharges are intended to be used for oil and hazardous substance release prevention and response

At the Federal level, projected federal royalty revenue, corporate income taxes, and gravel royalties could amount to between $3.63 billion and $7.3 billion (total through the entire economic life of the field).

At the regional level, the NSB government is anticipated to benefit from property tax revenues. The property tax would be based on the assessed valuation of the facilities developed onsite. The annual levy is based on the full and true value of property taxable under AS 43.56. For production property, the full and true value is based on the replacement cost of a new facility, less depreciation. The depreciation rate is based on the economic life of proven reserves. Pipeline property is treated differently; it is valued on the economic value of the property over the life of the proven reserves. The State property tax rate is 20 mills. A local tax is levied on the state's assessed valued for oil and gas property within a city or borough and is subject to local property tax limitations. The current tax rate for the NSB is 18.5 mills (hence, the state portion of the property tax is 1.5 mills). Property tax payments would start to accrue during the construction phase. Total cumulative NSB property tax revenues are estimated to amount to between $1.25 billion and $1.65 billion, depending on the Alternative.

The City of Nuiqsut could also potentially benefit from higher bed tax revenues from higher hotel occupancy during the initial construction years while mobilization of construction equipment is occurring and even during operations. The City of Nuiqsut

currently has a 12 percent bed tax. The change in the level of hotel occupancy however is difficult to quantify at this point because the timing and level of activities are uncertain and may vary. The City also has a tobacco tax that could generate additional revenues for the City. Furthermore, the City of Nuiqsut would be eligible to receive funds through the NPR-A Impact Mitigation Grant Program, which is funded by royalty and other revenues from leases in the NPR-A. As noted above, production from the Willow development is anticipated to generate royalties that would significantly increase funds for the NPR-A Impact Mitigation Grant Program.

Projected Employment and Income Effects

Table 5 presents the estimated direct manpower requirements during the construction phase for both the Proponent's Proposed Alternative (Alternative B) and Alternative E (the additional alternative being considered in the SEIS). These jobs will be required on the project site in the North Slope. Peak construction employment for both Alternatives is anticipated to occur in Year 4 of the project schedule with about 1,650 jobs (seasonal peak) jobs under Alternative B and about 1,700 jobs (seasonal peak) under Alternative E. The jobs created during the construction phase would be temporary, with some activities only occurring over several months (i.e., ice road construction). Given Alternative E's reduced infrastructure, the construction phase is expected to be shorter, lasting 8 years compared to 10 years under Alternative B.

Drilling activities are planned to occur over a period of 7 years starting in Year 5. Under Alternative E, drilling activities would require 390 annual average jobs in the North Slope from Year 5 through Year 8, and reduced to 195 jobs for the remaining 3 years of drilling (Year 9 to 11). Under Alternative B, 390 annual average jobs would be required from Year 5 through Year 10, then reduced to 99 jobs on the last year of drilling (Year 11). North-Slope based workers would be on a 2-week rotation so the number of workers on-site would be half of the numbers noted above. Drilling activities would also require 10 year-round jobs based in Anchorage.

Direct construction and drilling activities would also support on average about 3,000 indirect and induced part-time and full-time jobs per year in other sectors of the state's economy over the construction phase (under Alternatives B). Alternatives C and D would result in slightly higher indirect and induced jobs (about 3,500 and 3,900, respectively), mainly due to the higher estimated construction spending on additional facilities and logistics, while Alternative E is projected to result in about 2,900 indirect and induced jobs.

Table 5. Estimated Number of Direct Construction Jobs

Year	Proponent's Proposed Alternative		Alternative E	
	Seasonal Peak	Annual Average	Seasonal Peak	Annual Average
1	40	26	40	26
2	200	130	200	130

Year	Proponent's Proposed Alternative		Alternative E	
	Seasonal Peak	Annual Average	Seasonal Peak	Annual Average
3	750	488	750	488
4	1,650	1,073	1,733	1,127
5	1,500	975	1,650	1,073
6	950	618	950	618
7	350	228	350	228
8	100	65	100	65
9	100	65	–	–
10	100	65	–	–

Source: CPAI, 2022.

During the operations phase, Alternative E is projected to generate the same number of direct O&M jobs as the Project Proponent's Alternative as shown in Table 6. The project is estimated to support 25 year-round jobs based in Anchorage during the operations phase of the project. The North Slope based job numbers shown in the table are the estimated number of workers required for O&M activities assuming a 2-week rotation. The number of workers onsite at any given time would be half of the number shown in each year in the table above (CPAI, 2022). These operations and maintenance jobs would mostly be year-round but there will be some jobs associated with production activities that will also be seasonal in nature.

Table 6. Estimated Number of Direct O&M Jobs: Proponent's Project Alternative and Alternative E

Year	Slope Based	Anchorage Based
6	100	25
7	275	25
8	400	25
9+	425	25

Source: CPAI, 2022.

In addition to the direct jobs, annual operations and maintenance activities are estimated to create an additional 360 to 400 indirect and induced jobs per year.

These estimated jobs are available for workers residing in the North Slope, other areas of Alaska, and outside Alaska. It is unknown at this time how many workers from North Slope communities and other Alaska communities would participate in the direct oil and gas activities. According to the Alaska Department of Labor and Workforce Development, over the past decade, the share of oil industry workers who are not Alaska residents has grown, ranging from 31 percent nonresident in 2010 to 35 percent in 2020. This percentage of non-resident workers could change in the future, depending on availability of training programs and labor supply.

Oil field development projects in the North Slope typically require specialty tradesmen and construction workers with the skills and experience in ice roads, pipeline construction, facilities construction, and drilling; and these jobs are typically held by non-local workers. However, opportunities do exist for North Slope residents that live

near existing oil developments. Local residents have participated in oil and gas jobs such as ice road monitors, camp security and facilities operators, and subsistence representatives. The Alaska Department of Labor and Workforce Development and the oil and gas industry have training programs geared towards developing special skills required in oilfield services. This is expected to create more employment opportunities for local residents.

Table 7 shows the prevailing average yearly earnings of workers in various industries in Alaska that are associated with the direct construction and operations jobs described above. The table shows that direct oil and gas industry jobs currently pay about $170,000 per year; and the oil and gas extraction sector paying even more at approximately $242,000 per year.

Note that a direct oil and gas industry worker either works for an oil producer or an oilfield service company. Thousands of other jobs that directly serve the oil and gas industry but are not categorized under this sector are generally included in the Support Activities for Mining sector; some of these jobs are in security, catering, accommodations, transportation, and logistics services.

Indirect and induced jobs, on the other hand, would be jobs in a variety of other sectors of the Alaska economy that provide goods and services to the oil and gas industry and its direct workers. The projected annual average earnings associated with these indirect and induced jobs are estimated to be about $60,500.

Table 7. Prevailing Statewide Average Annual Earnings by Selected Industries associated with the Direct Construction and Operations Jobs

Industry	Average Annual Earnings
Oil and Gas Industry	$169,632
Oil and Gas Extraction	$242,160
Support Activities for Mining	$119,268
Construction (industry-wide average)	$82,356
Construction of Buildings	$76,428
Heavy Construction	$110,748
Specialty Trade Contractors	$71,052

Source: QCEW 2020 data, ADOLWD,2022.

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Willow Master Development Plan

Appendix E.16
Subsistence and Sociocultural Systems Technical Appendix

January 2023

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List of Acronyms

ATV	all-terrain vehicle
CRD	Colville River Delta
MDP	Master Development Plan
NSB	North Slope Borough
Project	Willow Master Development Plan Project
SRB&A	Stephen R. Braund and Associates

Glossary Terms

Direct effects analysis area – All subsistence use areas within 2.5 miles of Willow Master Development Plan Project infrastructure.

Household – One or more individuals living in one housing unit, whether or not they are related.

Subsistence – A traditional way of life in which wild renewable resources are obtained, processed, and distributed for household and community consumption according to prescribed social and cultural systems and values.

Subsistence use areas – The geographic extent of a resident's or community's use of the environment to conduct traditional subsistence activities.

1.0 SUBSISTENCE USES AND PRACTICES, NUIQSUT AND UTQIAĠVIK

This appendix provides detailed data tables, figures, and discussion related to Nuiqsut and Utqiaġvik (Barrow) **subsistence** uses. The Willow Master Development Plan (MDP) Final Environmental Impact Statement defines the analysis area for subsistence and sociocultural systems as all areas used for subsistence activities by the communities of Nuiqsut and Utqiaġvik. These study communities were selected because they both have documented use near the Willow MDP Project (Project) and would be most likely to experience direct and indirect effects to subsistence uses. The following sections provide a brief introduction to Iñupiat subsistence harvesting patterns followed by a description of each community's **subsistence use areas**, harvest and use data, timing of subsistence activities, travel methods, and resource importance.

1.1 Introduction

The Iñupiat are an Alaska Native people whose territory extends throughout northwest and northern Alaska. Archaeological research indicates that humans have occupied northern Alaska for roughly 14,000 years (Kunz and Reanier 1996). At the time of European contact, the North Slope was inhabited by two indigenous Iñupiat populations: the Tagiugmiut and the Nunamiut. The Tagiugmiut ("people of the sea") inhabited coastal areas of the Arctic Coastal Plain and relied primarily on harvests of marine mammals, terrestrial mammals (mainly caribou), and fish. The Nunamiut ("people of the land") inhabited the interior, including the Brooks Range and Arctic foothills areas, and relied mostly on terrestrial mammals and fish, with caribou comprising the majority of their subsistence harvests. Being located on or near the coast, the study communities of Nuiqsut and Utqiaġvik were traditionally inhabited by the Tagiugmiut. The Iñupiat remain the primary occupants of the North Slope today and continue the traditions of their ancestors, including hunting, harvesting, and sharing wild resources. Subsistence activities tend to occur near communities, along rivers and coastlines, or at particularly productive sites where resources are known to occur seasonally. Residents often conduct subsistence activities from camps located in areas that provide access to multiple resources throughout the year. Harvesters apply traditional knowledge, which is passed down through generations and learned through experience on the land, to determine the locations, timing, and methods for their subsistence activities. Relevant traditional knowledge includes knowledge about the distribution, migration, and seasonal variation of animal populations and other environmental factors such as tides, currents, ice, and snow conditions.

Prior to the 1950s, when mandatory school attendance and economic factors such as a decline in fur prices compelled families to permanently settle in centralized communities, the Iñupiat were seminomadic and ranged over large geographic areas for trapping, fishing, gathering, and hunting activities. Contemporary subsistence use areas include many of these traditional use areas. Certain harvest locations are used infrequently or by a small number of harvesters; however, these places may still be important to a community if they are particularly productive areas or if they have cultural, historical, or familial significance to the user. As an example, while the Prudhoe Bay development area is no longer part of the contemporary use area of the Nuiqsut people, residents continue to identify with the area as part of their traditional territory due to its historical use by their ancestors. Like other communities on the North Slope, Nuiqsut and Utqiaġvik have a "mixed, subsistence-market" economy (Walker and Wolfe 1987), where families invest money into small-scale, efficient technologies to harvest wild foods. In recent years, the advent of snow machines and all-terrain vehicles (ATVs), including four-wheelers, has reduced the time required to travel to traditional hunting and harvesting areas but has also increased the need for cash employment to purchase, maintain, and procure supplies for the new equipment, a hallmark of the mixed cash economy (Ahtuangaruak 1997; Impact Assessment Inc. 1990a, 1990b; SRB&A and ISER 1993; Worl and Smythe 1986).

While the use of camps and cabins continues, residents of the North Slope today more commonly use their communities as a base from which they conduct same-day subsistence activities (Impact Assessment Inc. 1990a; SRB&A 2010b, 2017a).

1.2 Subsistence Overview

1.2.1 Nuiqsut

Nuiqsut is located on the Nigliq Channel of the Colville River, in an area that provides abundant opportunities for the subsistence harvesting of terrestrial mammals, marine mammals, fish, and waterfowl. Although the location is

less advantageous for marine mammal harvests than some other North Slope communities that are located directly on the coast, the Beaufort Sea is easily accessible via the Nigliq Channel. The Colville River is the largest river system on the North Slope and supports the largest overwintering areas for whitefish, which local residents harvest in substantial quantities (Craig 1987; Seigle, Gutierrez et al. 2016).

The Nuiqsut area was traditionally a gathering place where Iñupiat and Athabascan people gathered to trade and fish, maintaining connections between the Nunamiut and the Tagiugmiut (Brown 1979). After the 1971 passage of the Alaska Native Claims Settlement Act, 27 Iñupiat families from Barrow (since renamed Utqiaġvik) resettled at Nuiqsut to live a more traditional lifestyle and to reclaim their ancestral ties to the area (Impact Assessment Inc. 1990b). The site was selected primarily for its easy access to the main channel of the Colville River for fishing and hunting and for the ease of movement between upriver hunting sites and downriver whaling and sealing sites (Brown 1979).

Today, according to the most recent U.S. Census in 2020, Nuiqsut has a population of 512 residents living in 130 occupied **households** (USCB 2021). Primary sources of employment in the community include the village corporation (Kuukpik Corporation), the North Slope Borough (NSB), and the NSB school district (NSB 2018). Nuiqsut is one of 11 Alaska Eskimo bowhead whaling communities. It is the closest community to the major oil-producing fields of the North Slope, which have resulted in impacts to subsistence and sociocultural systems (SRB&A 2009, 2017a, 2018) but also provide jobs, corporate dividends, and local revenue. During winter, Nuiqsut residents have seasonal access to the Dalton Highway via Alpine, Kuparuk, and Prudhoe Bay development roads. This access allows residents to travel to Fairbanks and Anchorage to purchase subsistence equipment and supplies, including boats, snow machines, firearms, and ammunition at reduced cost.

1.2.1.1 Subsistence Use Areas

Figure E.16.1 depicts Nuiqsut subsistence use areas for all resources over multiple historic and contemporary time periods (BLM 2004; Brown, Braem et al. 2016; Pedersen 1979, 1986; SRB&A 2010b). Use areas from all these studies overlap with portions of the Project area. Lifetime (pre-1979) use areas show Nuiqsut residents using a large area centered on the community to harvest subsistence resources; reported use areas extended offshore approximately 15 miles, as far east as Camden Bay, south along the Itkillik River, and west as far as Teshekpuk Lake. Subsequent use area data show Nuiqsut residents traveling across a progressively larger area to harvest subsistence resources. Use areas for the 1995–2006 time period document Nuiqsut residents traveling beyond Atqasuk in the west, offshore more than 50 miles northeast of Cross Island, overland to Cape Halkett and Utqiaġvik in the north, to Camden Bay in the east, and beyond the Colville River in the south. The majority of these use areas are concentrated around the Colville River, in areas to the southwest of the community, offshore areas north of the Colville River Delta (CRD), and northeast of Cross Island. Use areas for other time periods (1973–1986; 2014) are generally within the extent of the Pedersen (1979) and Stephen R. Braund and Associates (SRB&A) (2010b) use areas described above. SRB&A (2010b) notes that for the 1995–2006 time period, wolf and wolverine use areas continued farther south toward Anaktuvuk Pass but were not documented due to the extent of the map used during interviews.

Nuiqsut subsistence use areas for individual resources are shown on Figures E.16.2 through E.16.9 for the time periods listed above, in addition to the 2008–2019 time period (SRB&A 2021) for caribou only. Nuiqsut subsistence use areas for large land mammals are shown on Figures E.16.2 through E.16.4. Nuiqsut caribou use areas are shown on Figure E.16.2. As indicated on the figure, areas consistently used by Nuiqsut residents for caribou hunting are in an overland area between the Ikpikpuk and Kuparuk rivers, north to the coast, and south along the Colville River. The maximum extent of the use areas documented among all the studies extends from Atqasuk in the west toward Point Thomson in the east and south along the Colville and Anaktuvuk rivers to Anaktuvuk Pass. SRB&A's (2010b) overlapping use areas show that the greatest number of caribou use areas are concentrated along the Colville River and CRD, along the Itkillik River, and overland to the west and south of the community; these areas generally correspond to the caribou hunting areas reported during the 2008–2019 study years (SRB&A 2021).

Nuiqsut moose use areas (Figure E.16.3) show residents' consistent use of areas adjacent to the Colville River for moose harvests. While lifetime (pre-1979) use areas were completely confined to the Colville River, more recent moose use areas have expanded to include other tributaries such as the Chandler and Anaktuvuk rivers and Fish Creek. Moose use areas for the 1995–2006 time period show the highest amount of overlapping use along the Colville River south of Nuiqsut as far as Umiat. Figure E.16.4 depicts Nuiqsut grizzly bear use areas for the

lifetime and 1973–1986 time periods, including areas along the Colville River watershed from Fish (Iqalliqpik) Creek to Umiat.

Nuiqsut furbearer and small land mammal use areas are shown on Figure E.16.5. Lifetime (pre-1979) use areas show residents using overland areas near the community, as well as the more southern Colville, Chandler, Anaktuvuk, Itkillik, and Kuparuk rivers, to harvest small land mammals. Subsequent studies, including those for the 1973–1986 and 1995–2006 time periods, depict an expansion from previously recorded use areas. SRB&A's (2010b) wolf and wolverine use areas for the 1995–2006 time period extend to the Meade River in the west and beyond the Dalton Highway in the east, including a single-use area that extends east to just south of Kaktovik. Small land mammal use areas for the most recent available use area study show less use to the east and west of the community and more use south into the Brooks Range.

Nuiqsut fishing areas from multiple time periods (Figure E.16.6) indicate consistent use of the Colville River and smaller tributaries, including the Itkillik, Chandler, and Anaktuvuk rivers as well as Fish and Judy (Kayyaaq) creeks. Contemporary use areas extend somewhat father along the Colville and Itkillik rivers as well as along Fish Creek.

Nuiqsut use areas for birds (Figure E.16.7) are mostly concentrated along the Colville River and nearby overland areas for various time periods, although they also include offshore eider hunting areas extending from Cape Halkett to Camden Bay. Lifetime (pre-1979) wildfowl use areas are generally located near the Colville River and in nearshore locations extending east to Prudhoe Bay. More recent goose and eider use areas (1994–2003 and 1995–2006 time periods) occur in a somewhat larger area and include areas offshore and east of Prudhoe Bay to Camden Bay. The most recent documentation of bird use areas for the 2014 time period shows them to be north of the community and offshore into Harrison Bay.

Figure E.16.8 displays Nuiqsut use areas for vegetation for several time periods and shows use of the Colville River as far south as Umiat and areas near Fish Creek for harvests of vegetation and berries. In addition, berry gathering areas were documented along the Itkillik, Chandler, and Anaktuvuk rivers during a study for the 1994–2003 time period.

Nuiqsut marine mammal use areas (Figure E.16.9) show use of the Beaufort Sea and CRD at varying extents, depending on the time period. Lifetime Nuiqsut use areas for marine mammals included offshore areas from Atigaru Point to Kaktovik at distances of less than 20 miles; subsequent studies documented use areas extending to Cape Halkett in the west and varying distances to the east. SRB&A's (2010b) use areas showed Nuiqsut residents harvesting marine mammals up to 40 miles offshore to the north of the community and even farther offshore (approximately 60 miles) in an area near Cross Island, a sandy barrier island used traditionally and currently as a base of operations for Nuiqsut whaling crews. Nuiqsut 2001–2016 bowhead whale hunting global positioning system tracks extend as far east as Flaxman Island and over 30 miles offshore from Cross Island.

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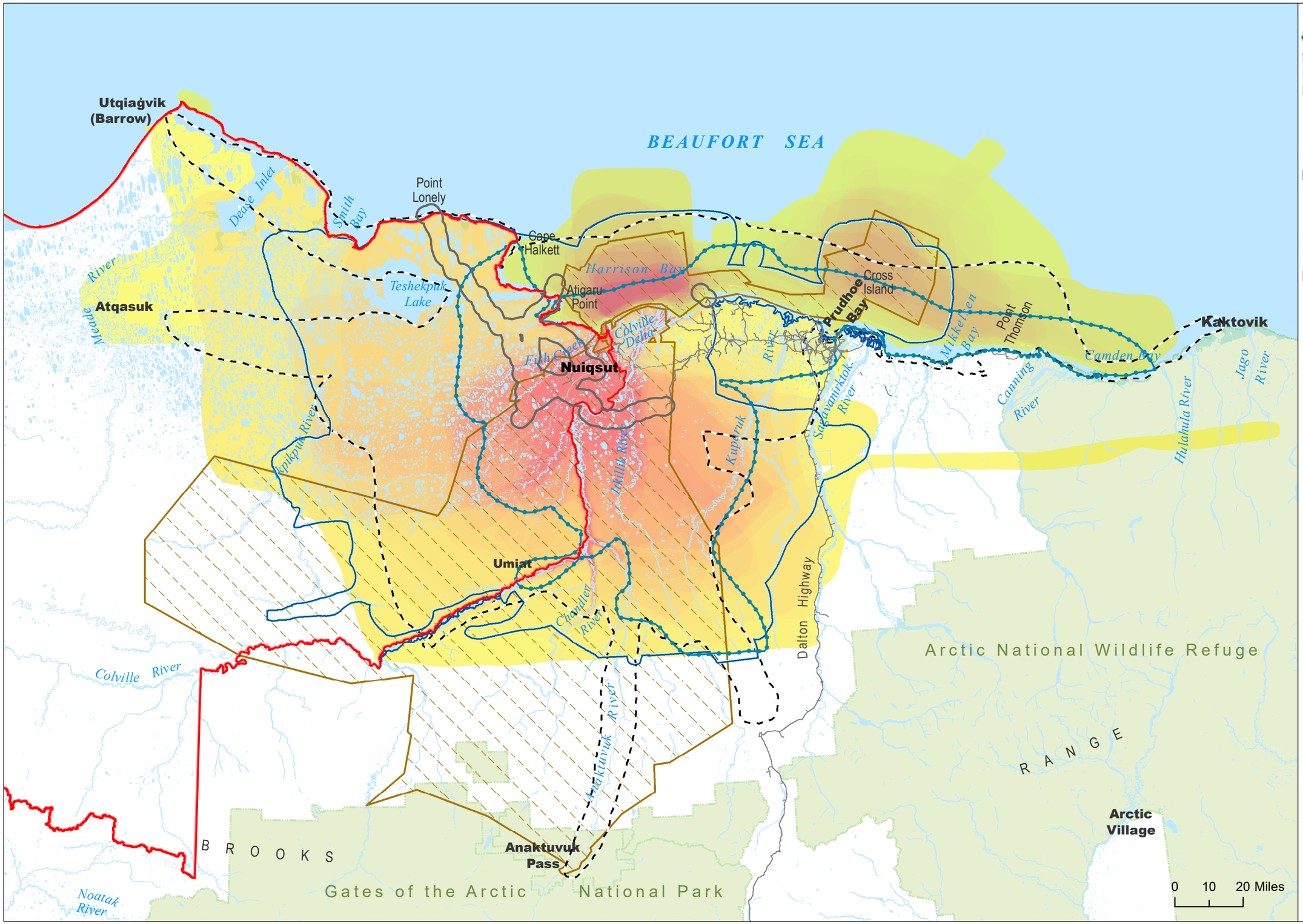


Subsistence Data

- All Resources, Lifetime Previous to 1979 [a]
- All Resources, 1973-1986 [b]
- All Resources, 1994-2003 [c]
- All Resources, 2014 [d]
- Overlapping Subsistence Use Areas All Resources, 1995-2006 [e] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

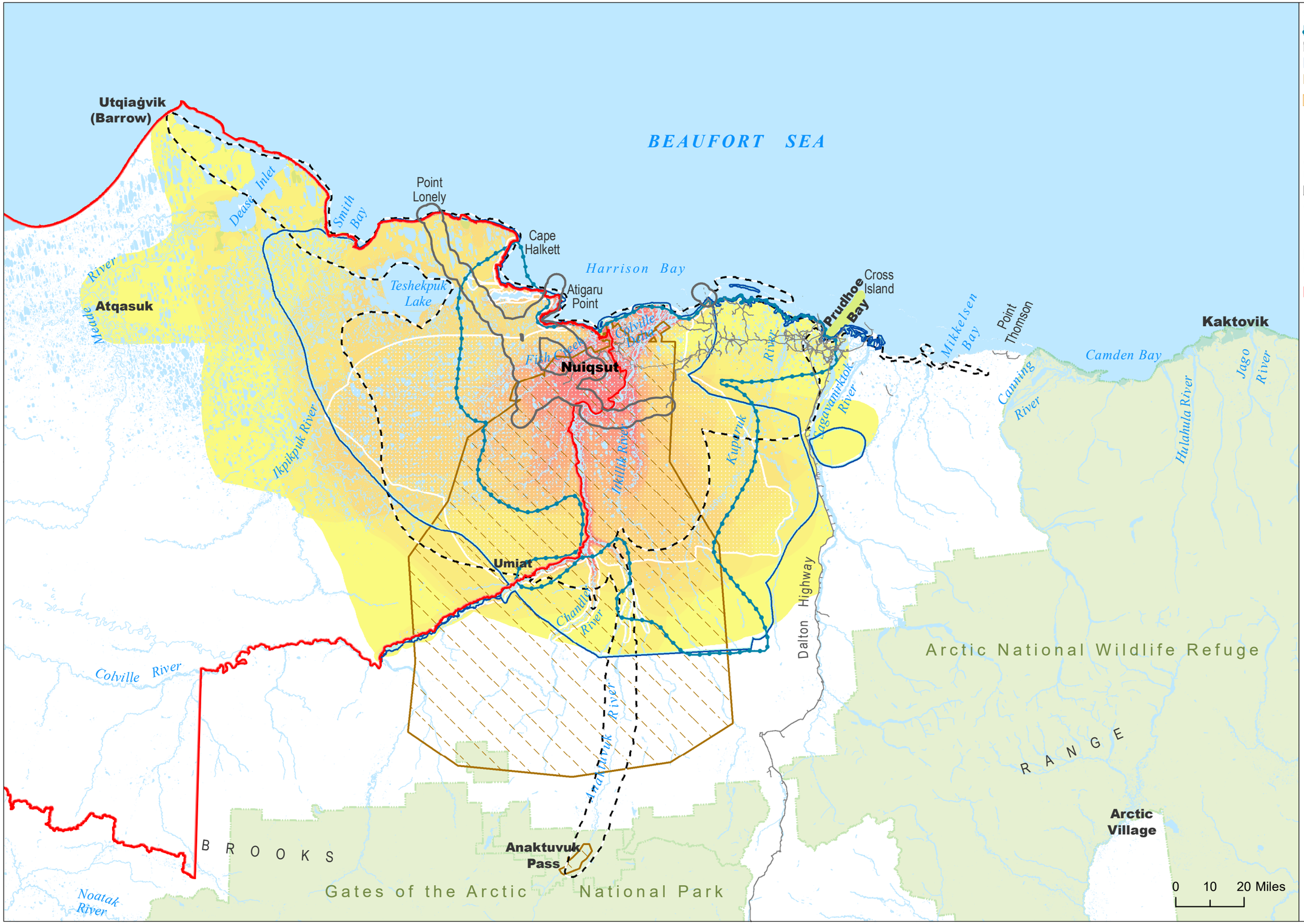
Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. SRB&A 2010a

Figure E.16.1



Subsistence Data

- Caribou, Lifetime prior to 1979 [a]
- Caribou, 1973-1986 [b]
- Caribou, 1994-2003 [c]
- Caribou, 2014 [d]
- Caribou, January 2008 - December 2019 [e]
- Overlapping Subsistence Use Areas Caribou, 1995-2006 [f] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

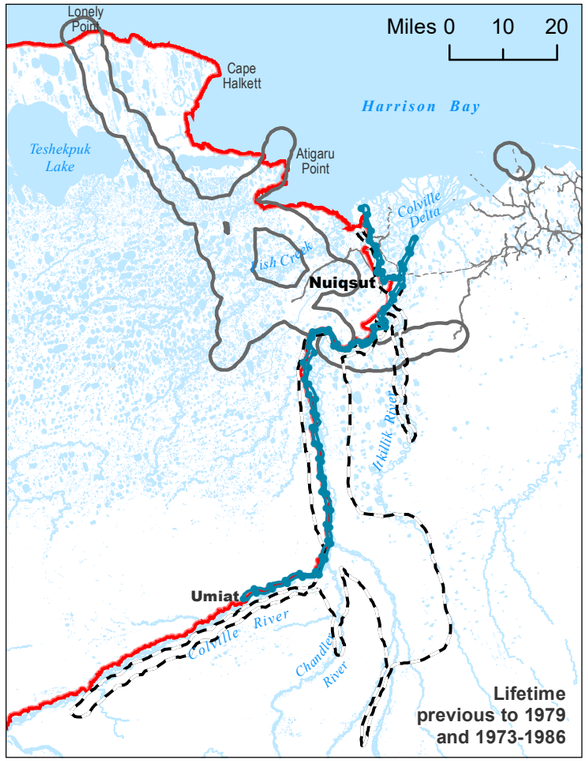
Land Designation

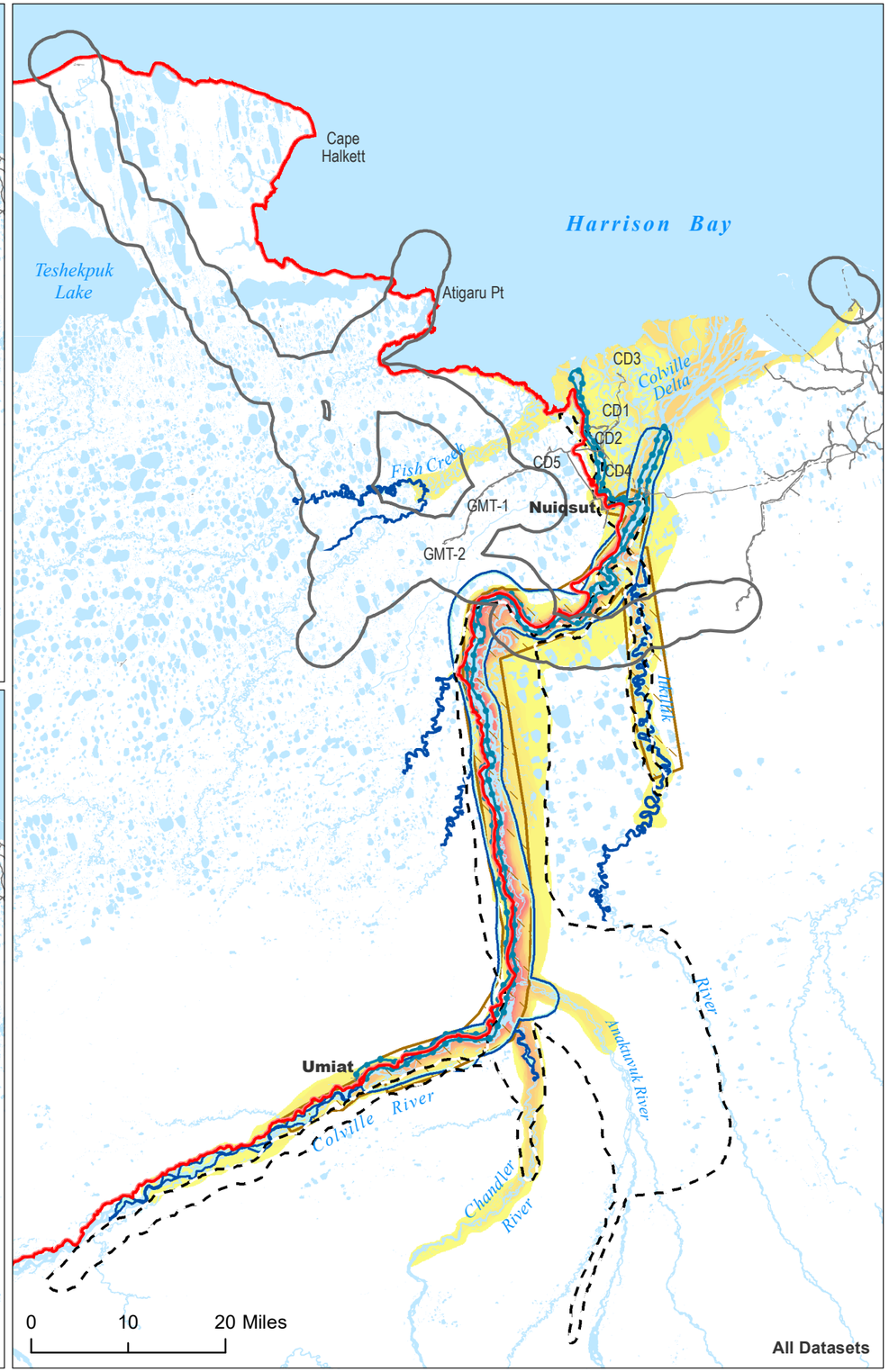
- National Petroleum Reserve in Alaska

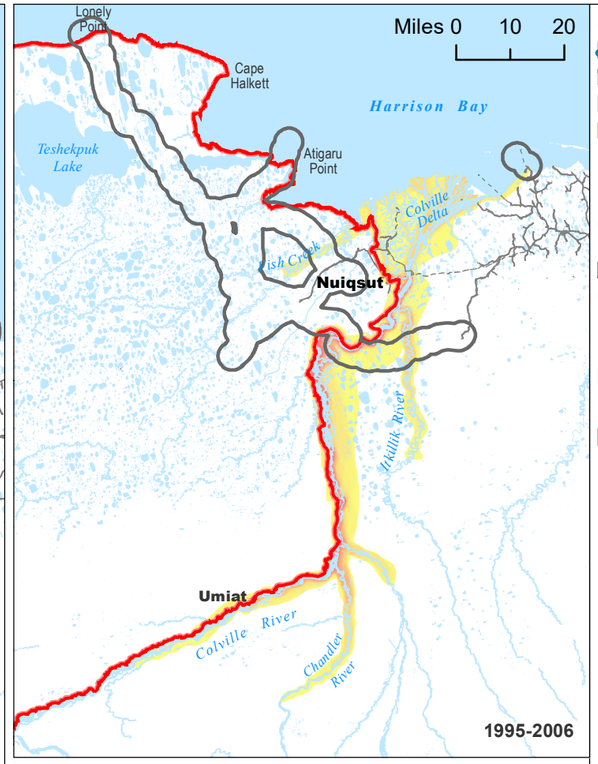
Map prepared by
Stephen R. Braund & Associates

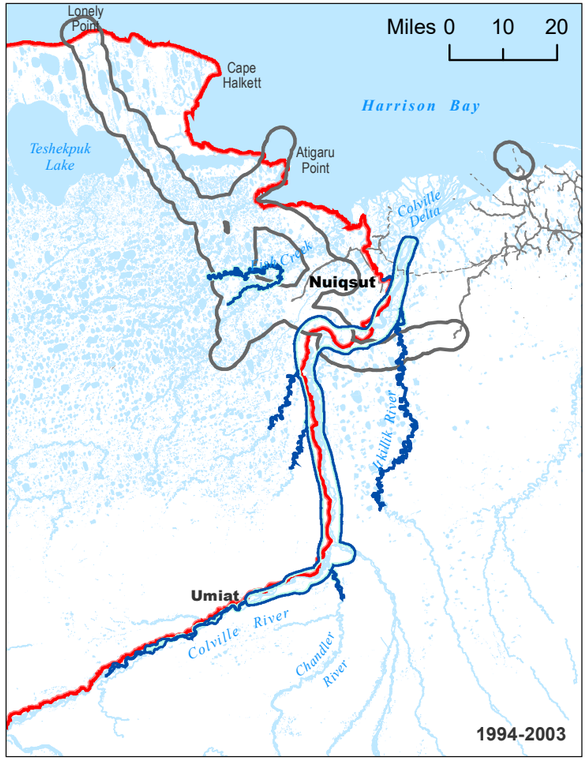
Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. SRB&A 2021
f. SRB&A 2010a

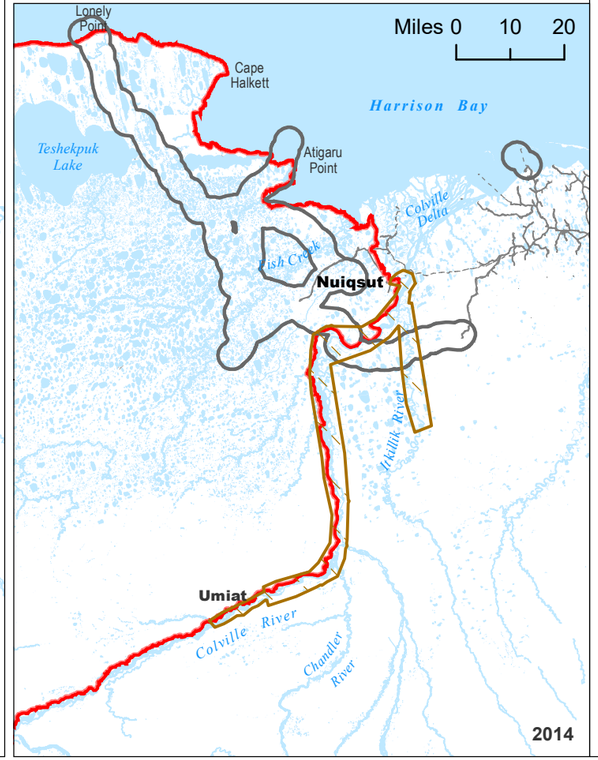
Figure E.16.2











Subsistence Data
- Moose, Lifetime previous to 1979 [a]
- Moose, 1973-1986 [b]
- Moose, 1994-2003 [c]
- Moose, 2014 [d]
- Overlapping Subsistence Use Areas Moose, 1995-2006 [e] (High / Low)

Willow Proposed Development Features
- Direct Effects Area

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. SRB&A 2010a

Figure E.16.3

Subsistence Data

- Grizzly Bear, Lifetime previous to 1979 [a]
- Grizzly Bear, 1973-1986 [b]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

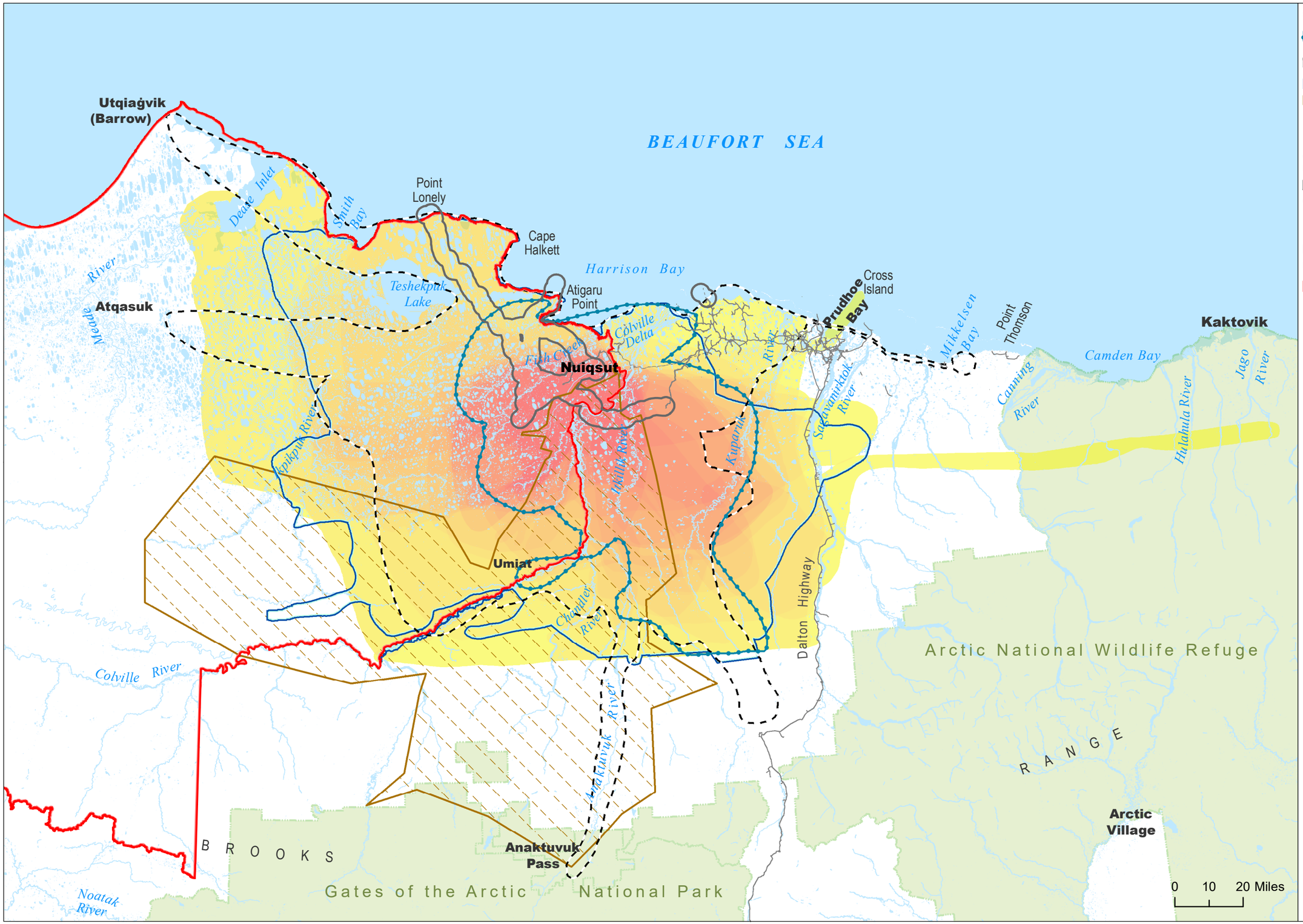
Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986

Figure E.16.4



Subsistence Data

- Furbearer and Trapping, Lifetime previous to 1979 [a]
- Furbearers and Small Land Mammals, 1973-1986 [b]
- Wolf and Wolverine, 1994-2003 [c]
- Small Land Mammals, 2014 [d]
- Overlapping Subsistence Use Areas, Wolf and Wolverine, 1995-2006 [e] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

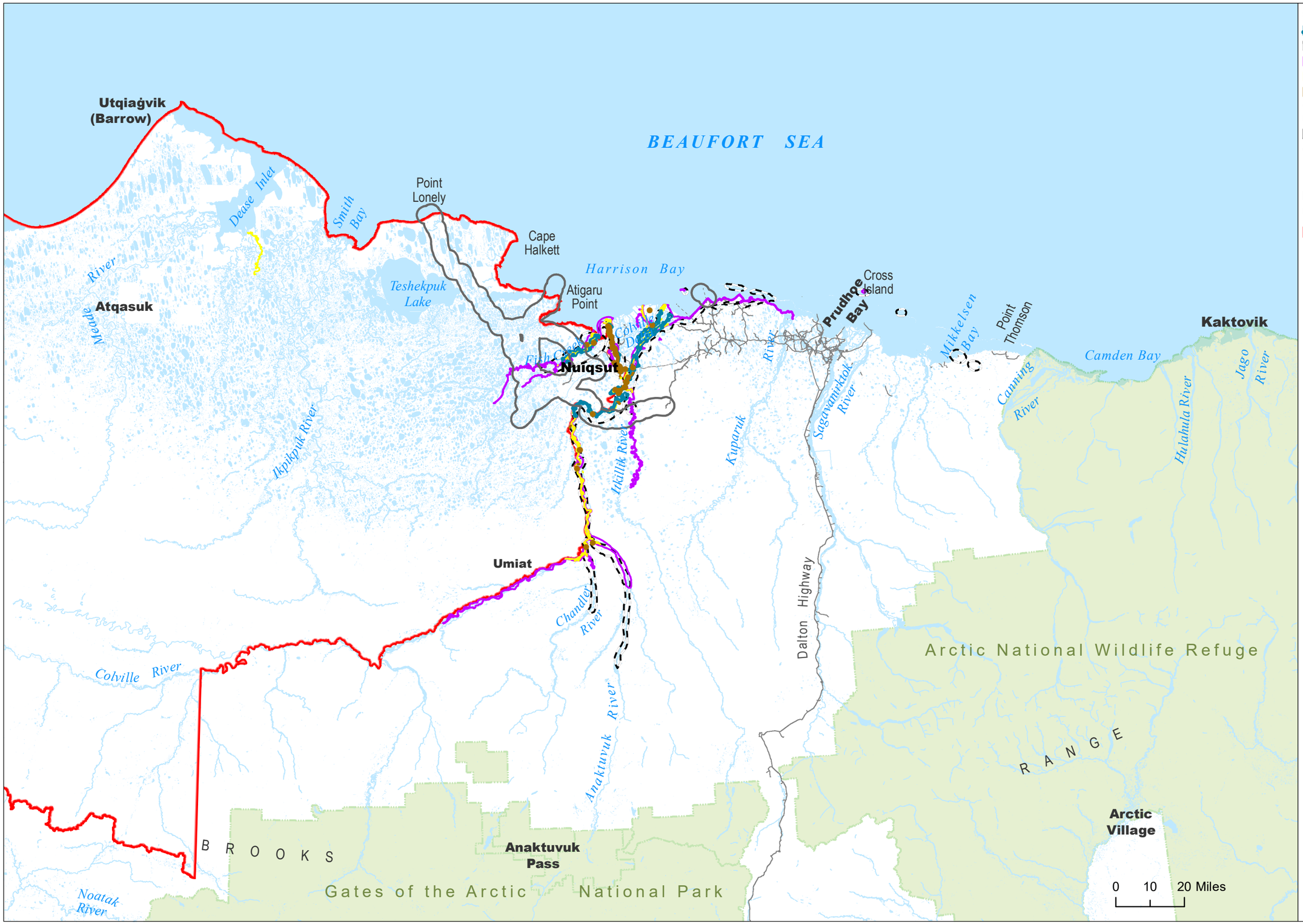
Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. SRB&A 2010a

Figure E.16.5



Subsistence Data
- Fishing, Lifetime previous to 1979 [a]
- Fish, 1973-1986 [b]
- Fish, 1994-2003 [c]
- Fish, 1995-2006 [d]
- Fish, 2014 [e]

Willow Proposed Development Features
- Direct Effects Area

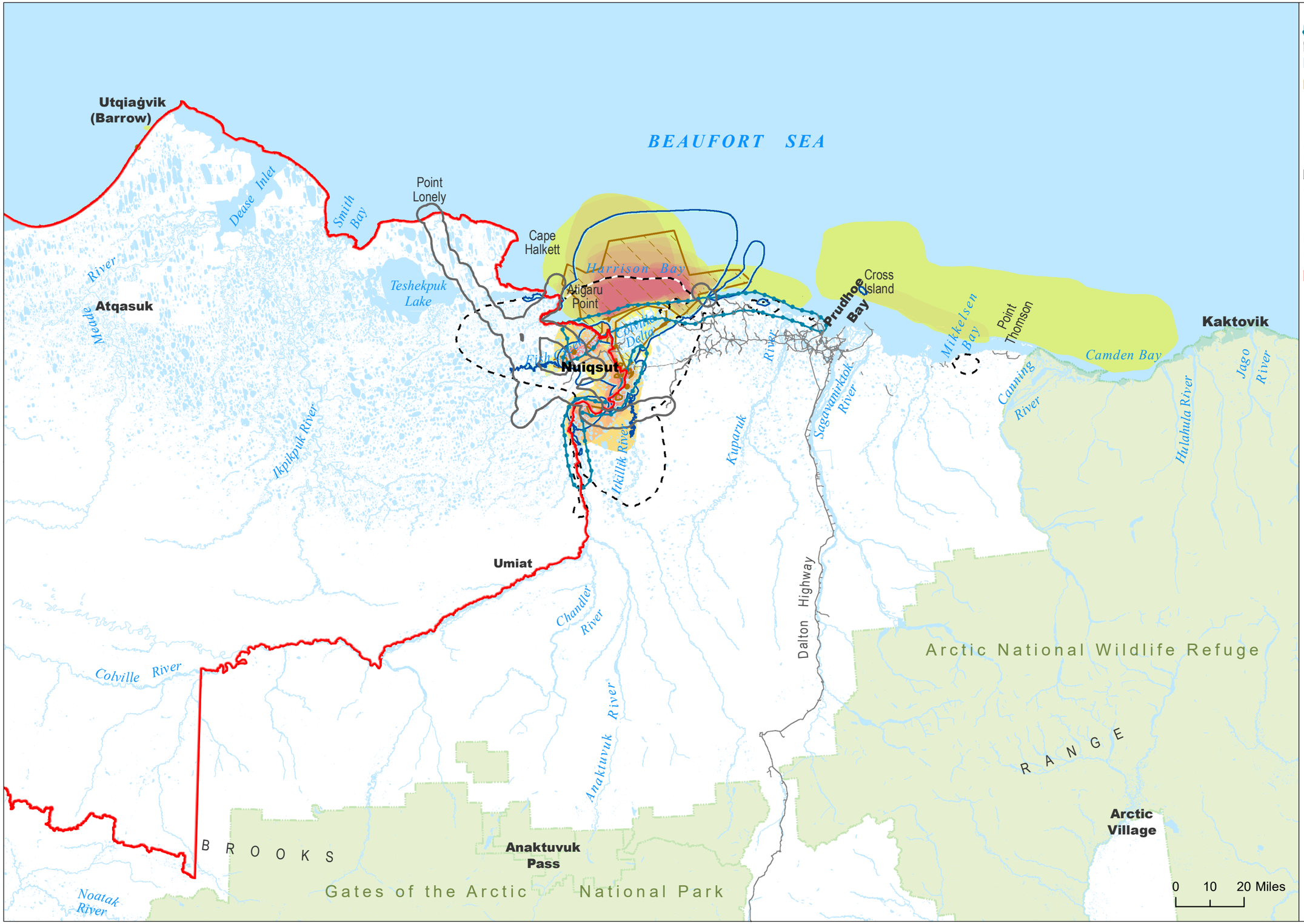
Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. SRB&A 2010a
e. Brown et al. 2016

Figure E.16.6



Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. SRB&A 2010a

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure E.16.7

Subsistence Data
- Vegetation, 1973-1986 [a]
- Berries, 1994-2003 [b]
- Berries and Plants, 2014 [c]

Willow Proposed Development Features
- Direct Effects Area

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

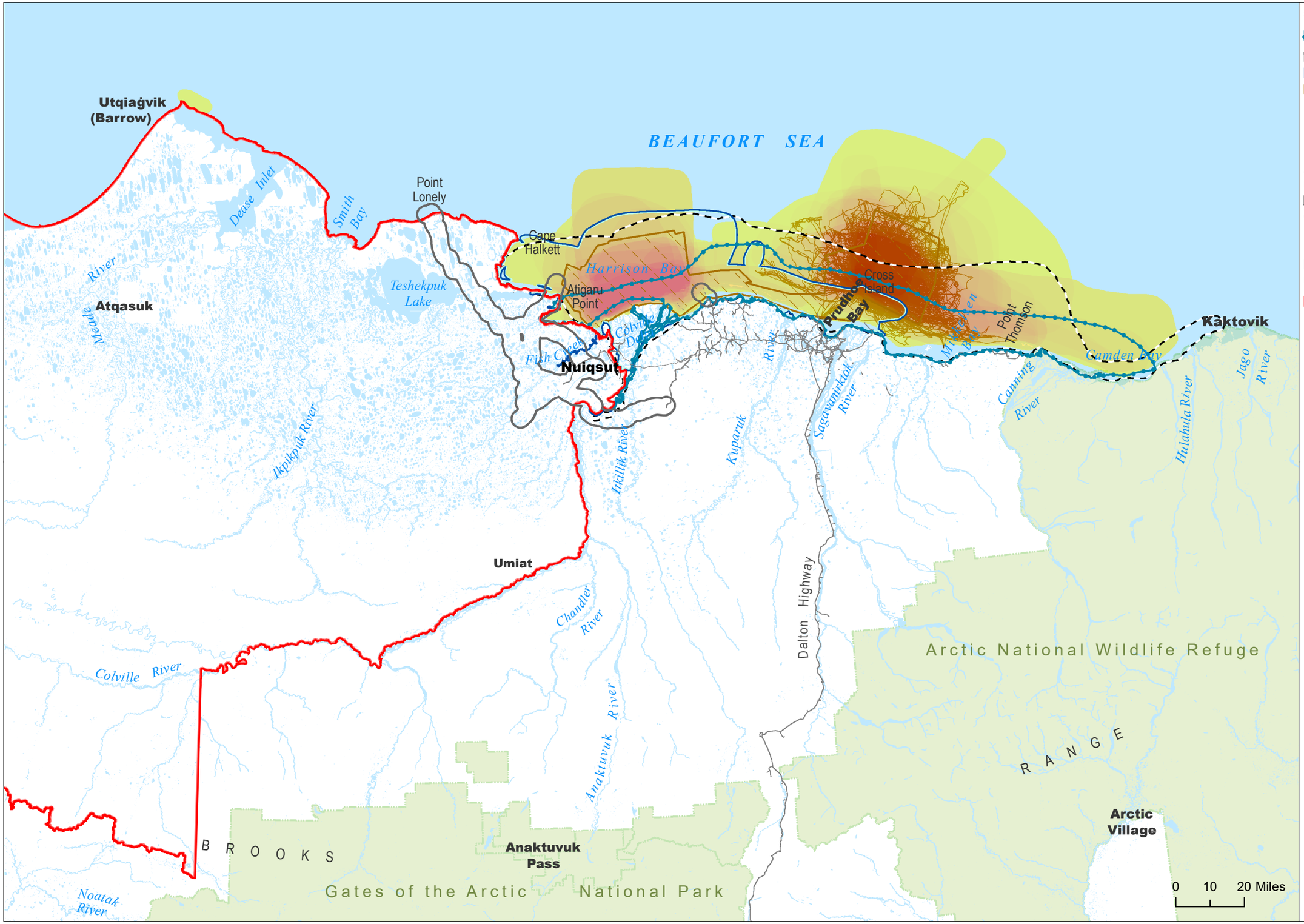
Land Designation
- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1986
b. BLM 2004
c. Brown et al.2016

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure E.16.8



Subsistence Data

- Marine Mammals, Lifetime previous to 1979 [a]
- Marine Mammals, 1973-1986
- Seal, 1994-2003 [c]
- Marine Mammals, 2014
- Whale Hunting GPS Track, 2001-2016 [e]
- Overlapping Subsistence Use Areas Marine Mammals, 1995-2006 [f] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Pedersen 1986
c. BLM 2004
d. Brown et al. 2016
e. Galginaitis 2017
f. SRB&A 2010a

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure E.16.9

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1.2.1.1.1 Direct Effects Analysis Area

Subsistence use of the **direct effects analysis area**, defined as the area within 2.5 miles of Project infrastructure, is relatively high. Analyses specific to the direct effects analysis area are based primarily on *Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow* for the 1995-2006 time period (SRB&A 2010b) and the Nuiqsut Caribou Subsistence Monitoring Project for the 2008-2019 time period (SRB&A 2010a, 2011, 2012, 2013, 2014, 2015, 2016, 2017a, 2018; SRB&A 2019, 2020, 2021). For the 1995–2006 time period, use areas overlapping the direct effects analysis area accounted for 40% of all use areas documented for Nuiqsut harvesters (Table E.16.1). Across 12 years of the Nuiqsut Caribou Subsistence Monitoring Project (2008–2019), over half (53%) of the caribou use areas overlapped the direct effects analysis area. Areas located within the direct effects analysis area include overland areas to the west, south, and southeast of the community; coastal boating areas to the west and east of the CRD; and riverine boating areas along the Colville and Itkillik rivers and Fish Creek.

Table E.16.1. Nuiqsut Use Areas within the Direct Effects Analysis Area*

Source	Resource Type	Time Period	Total Number of Use Areas	Number (%) of Use Areas in Direct Effects Analysis Area
SRB&A 2010b	All resources	1995–2006	758	304 (40%)
SRB&A 2010a, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021	Caribou	2008–2019	2,161	1,145 (53%)

As shown in Figures E.16.1 through E.16.9, Nuiqsut harvesters have reported using the direct effects analysis area to harvest the following resources during one or more study years: caribou, moose, other large land mammals, furbearers and small land mammals, fish, birds, vegetation, and marine mammals. Resources that overlap during most study years include caribou, furbearers and small land mammals, fish, and marine mammals. While some resources overlap with a large proportion of the direct effects analysis area (e.g., caribou, furbearers and small land mammals), others overlap with smaller portions of the area, such as where the direct effects analysis area intersects with fishing or hunting areas along Fish (Iqalliqpik) Creek and the Colville River (e.g., fish, birds) or in offshore waters near Atigaru Point or Oliktok Point (e.g., marine mammals).

1.2.1.2 Harvest and Use Data

Tables E.16.2 and E.16.3 provide Nuiqsut harvest data for various years between 1985 and 2019; data are not available for all years within this time period because harvest studies were not conducted in all years. While certain studies address all resources (all resources study years), others address individual species or resources (single-resource study years). Eleven study years only include data on caribou harvests (Braem, Kaleak et al. 2011; SRB&A 2012, 2013, 2014, 2015, 2016, 2017a, 2018; SRB&A 2019, 2020, 2021) (Table E.16.3). During available study years, Nuiqsut households have harvested between 399 (in 1985, one of two years when the community did not successfully harvest a bowhead whale) and 896 (in 2014) pounds of subsistence resources per capita (Table E.16.2). Land mammals, marine mammals, and fish are all major subsistence resources in Nuiqsut. During 4 study years, marine mammals contributed more total edible pounds than any other resource. Non-salmon fish were the top harvested resource during the remaining 3 study years and accounted for between 173 (in 1985) and 248 (in 1993) edible pounds per capita during years with per capita harvest data. Large land mammals were generally the second- or third-most harvested resource during all study years and provided between 169 (in 1985) and 261 (in 2014) edible pounds per capita. Nuiqsut residents harvest other resources such as migratory birds, upland game birds, salmon, bird eggs, and vegetation in much smaller quantities. Small land mammals are also harvested, but because they are harvested primarily for their fur, they contribute little in the way of edible pounds.

In terms of species, bowhead whales, whitefish (Arctic cisco, or *qaaktaq*, and broad whitefish), and caribou are the primary subsistence species harvested in Nuiqsut. Bowhead whale harvests have accounted for between 28.7% and 60.3% of the total harvest during all study years (except for 1985 and 1994–1995, when Nuiqsut did not successfully harvest a bowhead whale) (Table E.16.3). Arctic cisco harvests have accounted for between 1.9% and 14.9% of the total harvest; broad whitefish have accounted for between 5.3% and 45% of the total harvest; and caribou have accounted for between 21.7% and 37.5% of the total harvest. Other subsistence species with substantial contributions to Nuiqsut subsistence harvests include moose, seals, goose, Arctic grayling, least cisco, and burbot.

Data on subsistence participation and use by Nuiqsut households are available for various study years (Tables E.16.2 and E.16.3). As shown in Table E.16.2, 100% of households report using subsistence resources during study years, and over 90% of households participate in subsistence activities (i.e., attempting to harvest). Across all study years, participation in subsistence activities was highest for non-salmon fish, large land mammals, and

migratory birds. Specifically, in 2014, over half of Nuiqsut households participated in harvests of caribou, broad whitefish, white-fronted goose, cloudberries, and Arctic cisco. In 2019, 98% of households participated in caribou hunting activities. Sharing of subsistence resources, a core Iñupiat value, is also high among Nuiqsut households; between 95% and 100% of households report receiving subsistence foods during available study years. In particular, households commonly share marine mammals (between 95% and 100% of households receiving), large land mammals (between 70% and 92% receiving), and non-salmon fish (between 71% and 90% receiving).

Table E.16.2. Nuiqsut Subsistence Harvest Estimates by Resource Category, All Resources Study Years

Study Year	Resource	Percentage of Households Use (%)	Percentage of Households Try to Harvest (%)	Percentage of Households Harvest (%)	Percentage of Households Give (%)	Percentage of Households Receive (%)	Estimated Harvest Number[a]	Estimated Harvest Total Pounds[b]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest (%)
1985	All resources	100	98	98	95	100	–	160,035	2,106	399	100.0
1985	Salmon	60	43	40	23	23	441	1,366	18	3	0.9
1985	Non-salmon fish	100	93	93	83	75	67,712	69,243	911	173	43.3
1985	Large land mammals	98	90	90	80	70	536	67,621	890	169	42.3
1985	Small land mammals	65	63	58	23	13	688	245	3	1	0.2
1985	Marine mammals	100	48	23	30	100	59	13,355	176	33	8.3
1985	Migratory birds	90	90	85	60	55	1,733	6,626	87	17	4.1
1985	Upland game birds	88	88	88	58	13	1,957	1,370	18	3	0.9
1985	Bird eggs	25	25	23	8	10	262	40	1	<1	<0.1
1985	Vegetation	38	50	18	10	20	–	169	2	<1	0.1
1992[c]	All resources	–	–	–	–	–	–	150,195	–	–	100.0
1992[c]	Salmon	–	–	–	–	–	6	65	–	–	0.0
1992[c]	Non-salmon fish	–	74	–	–	–	36,701	51,890	–	–	34.5
1992[c]	Large land mammals	–	–	–	–	–	299	41,386	–	–	27.6
1992[c]	Small land mammals	–	–	–	–	–	46	1	–	–	0.0
1992[c]	Marine mammals	–	–	–	–	–	49	52,865	–	–	35.2
1992[c]	Migratory birds	–	–	–	–	–	1,105	3,655	–	–	2.4
1992[c]	Upland game birds	–	–	–	–	–	378	265	–	–	0.2
1992[c]	Eggs	–	–	–	–	–	25	4	–	–	<0.1
1992[c]	Vegetation	–	32	–	–	–	–	66	–	–	<0.1
1993	All resources	100	94	90	92	98	–	267,818	2,943	742	100.0
1993	Salmon	71	45	36	39	47	272	1,009	11	3	0.4
1993	Non-salmon fish	97	79	79	87	90	71,626	89,481	983	248	33.4
1993	Large land mammals	98	76	74	82	92	691	87,306	959	242	32.6
1993	Small land mammals	53	45	42	27	18	599	84	1	<1	<0.1
1993	Marine mammals	97	58	37	79	97	113	85,216	936	236	31.8
1993	Migratory birds	87	74	73	63	65	2,238	3,540	39	10	1.3
1993	Upland game birds	60	45	45	42	26	973	681	7	2	0.3
1993	Eggs	40	21	19	15	23	346	104	1	<1	<0.1
1993	Vegetation	79	71	71	27	40	–	396	4	1	0.1
1994–1995[d]	All resources	–	–	–	–	–	–	83,228	–	–	100.0
1994–1995[d]	Salmon	–	–	–	–	–	10	31	–	–	<0.1
1994–1995[d]	Non-salmon fish	–	–	–	–	–	15,190	46,569	–	–	56.0
1994–1995[d]	Large land mammals	–	–	–	–	–	263	32,686	–	–	39.3
1994–1995[d]	Small land mammals	–	–	–	–	–	42	0	–	–	0.0
1994–1995[d]	Marine mammals	–	–	–	–	–	25	1,504	–	–	1.8
1994–1995[d]	Migratory birds	–	–	–	–	–	569	2,289	–	–	2.8
1994–1995[d]	Upland game birds	–	–	–	–	–	58	58	–	–	0.1
1994–1995[d]	Vegetation	–	–	–	–	–	14	91	–	–	0.1

Study Year	Resource	Percentage of Households Use (%)	Percentage of Households Try to Harvest (%)	Percentage of Households Harvest (%)	Percentage of Households Give (%)	Percentage of Households Receive (%)	Estimated Harvest Number[a]	Estimated Harvest Total Pounds[b]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest (%)
1995–1996	All resources	–	–	–	–	–	–	183,576	–	–	100.0
1995–1996	Salmon	–	–	–	–	–	42	131	–	–	0.1
1995–1996	Non-salmon fish	–	–	–	–	–	10,612	16,822	–	–	9.2
1995–1996	Large land mammals	–	–	–	–	–	364	43,554	–	–	23.7
1995–1996	Small land mammals	–	–	–	–	–	27	0	–	–	0.0
1995–1996	Marine mammals	–	–	–	–	–	178	120,811	–	–	65.8
1995–1996	Migratory birds	–	–	–	–	–	683	2,166	–	–	1.2
1995–1996	Upland birds	–	–	–	–	–	19	13	–	–	<0.1
1995–1996	Vegetation	–	–	–	–	–	12	78	–	–	<0.1
2000–2001	All resources	–	–	–	–	–	–	183,246	–	–	100.0
2000–2001	Salmon	–	–	–	–	–	10	75	–	–	<0.1
2000–2001	Non-salmon fish	–	–	–	–	–	26,545	27,933	–	–	15.2
2000–2001	Large land mammals	–	–	–	–	–	504	62,171	–	–	33.9
2000–2001	Small land mammals	–	–	–	–	–	108	2	–	–	<0.1
2000–2001	Marine mammals	–	–	–	–	–	31	87,929	–	–	48.0
2000–2001	Migratory birds	–	–	–	–	–	1,192	5,108	–	–	2.8
2000–2001	Upland birds	–	–	–	–	–	23	16	–	–	<0.1
2000–2001	Vegetation	–	–	–	–	–	2	13	–	–	<0.1
2014	All resources	100	95	90	91	97	–	371,992	3,444	896	100.0
2014	Salmon	64	41	40	31	35	–	3,889	36	9	1.0
2014	Non-salmon fish	93	78	71	72	71	–	85,106	788	205	22.9
2014	Large land mammals	91	66	64	67	72	–	108,359	1,003	261	29.1
2014	Small land mammals	17	16	10	2	7	–	0	0	0	0.0
2014	Marine mammals	95	55	40	71	95	–	169,367	1,568	408	45.5
2014	Migratory birds	79	71	66	52	38	–	4,742	44	11	1.3
2014	Upland birds	16	12	12	9	5	–	78	1	<1	<0.1
2014	Vegetation	67	55	53	21	38	–	414	4	1	0.1

Source: 1985 (ADF&G 2018); 1992 (Fuller and George 1999); 1993 (Pedersen 1995a); 1994–1995 (Brower and Hepa 1998); 1995–1996, 2000–2001 (Bacon, Hepa et al. 2009); 2014 (Brown, Braem et al. 2016)

Note: "–" (No Data). "All Resources" study years are years where studies addressed all subsistence resources harvested by the community, rather than selected resources or species. The estimated harvest numbers for the 1994–1995, 1995–1996, and 2000–2001 data were derived by summing individual species in each resource category. Also for those study years, total pounds were derived from conversion rates found at ADF&G (2018), and total (usable) pounds for bowhead whales were calculated based on the method presented in SRB&A and ISER (1993). These estimates do not account for whale girth and should be considered approximate; more exact methods for estimating total whale weights are available in George, Philo et al. (n.d.).

[a] Estimated numbers represent individuals in all cases except vegetation, where they represent gallons.

[b] Estimated pounds include only edible pounds and therefore do not include estimates for resources that are not typically eaten by community residents (e.g., furbearers).

[c] The estimated pounds of moose harvested in 1992 is likely too high (Fuller and George 1999).

[d] The 1994–1995 study year underrepresents the harvest of Arctic cisco and humpback whitefish (Brower and Hepa 1998); Nuiqsut did not successfully harvest a bowhead whale in 1994–1995.

Table E.16.3. Nuiqsut Subsistence Harvest Estimates by Selected Species, All Study Years*

Study Year	Resource[a]	Percentage of Households Use (%)	Percentage of Households Try to Harvest (%)	Percentage of Households Harvest (%)	Percentage of Households Give (%)	Percentage of Households Receive (%)	Estimated Harvest Number[b]	Estimated Harvest Total Pounds[c]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest (%)
1985	Caribou	98	90	90	80	60	513	60,021	790	150	37.5
1985	Cisco	98	75	73	65	60	46,478	29,354	386	73	18.3
1985	Broad whitefish	95	80	78	70	40	7,900	26,861	353	67	16.8
1985	Bowhead whale	100	23	5	8	100	0	7,458	98	19	4.7
1985	Moose	40	40	18	20	25	13	6,650	88	17	4.2
1985	White-fronted goose	90	90	85	55	48	1,340	6,028	79	15	3.8
1985	Arctic grayling	78	65	63	48	35	4,055	3,650	48	9	2.3
1985	Humpback whitefish	48	45	38	33	13	4,345	3,476	46	9	2.2
1985	Arctic char	75	63	60	33	35	1,060	2,969	39	7	1.9
1985	Burbot	75	60	60	43	33	669	2,675	35	7	1.7
1985	Bearded seal	48	25	15	15	35	15	2,675	35	7	1.7
1985	Ringed seal	53	25	18	23	40	40	1,676	22	4	1.0
1992	Bowhead whale	–	–	–	–	–	2	48,715	–	–	32.4
1992	Caribou	–	81	–	–	–	278	32,551	–	–	21.7
1992	Arctic cisco	–	–	–	–	–	22,391	22,391	–	–	14.9
1992	Broad whitefish	–	–	–	–	–	6,248	15,621	–	–	10.4
1992	Moose[d]	–	–	–	–	–	18	8,835	–	–	5.9
1992	Humpback whitefish	–	–	–	–	–	1,802	4,504	–	–	3.0
1992	Arctic char	–	–	–	–	–	1,544	4,324	–	–	2.9
1992	Bearded seal	–	–	–	–	–	16	2,760	–	–	1.8
1992	Arctic grayling	–	–	–	–	–	3,114	2,491	–	–	1.7
1992	Canada goose	–	–	–	–	–	319	1,437	–	–	1.0
1993	Caribou	98	74	74	79	79	672	82,169	903	228	30.7
1993	Bowhead whale	97	37	5	76	97	3	76,906	845	213	28.7
1993	Broad whitefish	90	66	66	65	66	12,193	41,455	456	115	15.5
1993	Arctic cisco	89	69	68	81	60	45,237	31,666	348	88	11.8
1993	Ringed seal	65	42	31	40	55	98	7,277	80	20	2.7
1993	Burbot	79	63	57	53	55	1,416	5,949	65	16	2.2
1993	Moose	69	47	10	29	63	9	4,403	48	12	1.6
1993	Arctic grayling	79	69	65	44	27	4,515	4,063	45	11	1.5
1993	Least cisco	63	52	47	36	27	6,553	3,277	36	9	1.2
1994–1995[e]	Broad whitefish	–	–	–	–	–	3,237	37,417	–	–	45.0
1994–1995[e]	Caribou	–	–	–	–	–	258	30,186	–	–	36.3
1994–1995[e]	Arctic cisco	–	–	–	–	–	9,842	6,889	–	–	8.3
1994–1995[e]	Moose	–	–	–	–	–	5	2,500	–	–	3.0
1994–1995[e]	Goose, unidentified	–	–	–	–	–	474	2,133	–	–	2.6
1994–1995[e]	Ringed seal	–	–	–	–	–	24	1,008	–	–	1.2
1995–1996	Bowhead whale	–	–	–	–	–	4	110,715	–	–	60.3
1995–1996	Caribou	–	–	–	–	–	362	42,354	–	–	23.1
1995–1996	Broad whitefish	–	–	–	–	–	2,863	9,735	–	–	5.3
1995–1996	Ringed seal	–	–	–	–	–	155	6,527	–	–	3.6
1995–1996	Arctic cisco	–	–	–	–	–	5,030	3,521	–	–	1.9
1995–1996	Bearded seal	–	–	–	–	–	17	2,974	–	–	1.6
1995–1996	Least cisco	–	–	–	–	–	1,804	1,804	–	–	1.0
1999–2000	Caribou	–	–	–	–	–	413	–	–	112	–
2000–2001	Bowhead whale	–	–	–	–	–	4	86220	–	–	47.1
2000–2001	Caribou	–	–	–	–	–	496	57,985	–	–	31.6
2000–2001	Arctic cisco	–	–	–	–	–	18,222	12,755	–	–	7.0
2000–2001	Broad whitefish	–	–	–	–	–	2,968	10,092	–	–	5.5
2000–2001	White-fronted goose	–	–	–	–	–	787	3,543	–	–	1.9
2000–2001	Moose	–	–	–	–	–	6	3,000	–	–	1.6
2002–2003	Caribou	95	47	45	49	80	397	–	–	118	–
2003–2004	Caribou	97	74	70	81	81	564	–	–	157	–
2004–2005	Caribou	99	62	61	81	96	546	–	–	147	–
2005–2006	Caribou	100	60	59	97	96	363	–	–	102	–

Study Year	Resource[a]	Percentage of Households Use (%)	Percentage of Households Try to Harvest (%)	Percentage of Households Harvest (%)	Percentage of Households Give (%)	Percentage of Households Receive (%)	Estimated Harvest Number[b]	Estimated Harvest Total Pounds[c]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest (%)
2006–2007	Caribou	97	77	74	66	69	475	–	–	143	–
2010	Caribou	94	86	76	–	–	562	65,754	707	–	–
2011	Caribou	92	70	56	49	58	437	51,129	544	134	–
2012	Caribou	99	68	62	65	79	501	58,617	598	147	–
2013	Caribou	95	79	63	62	75	586	68,534	692	166	–
2014	Bowhead	93	29	21	57	91	5	148,087	1,371	357	39.8
2014	Caribou	90	66	64	67	59	774	105,193	974	253	28.3
2014	Broad whitefish	72	60	59	52	40	11,439	36,605	339	88	9.8
2014	Arctic cisco	83	52	48	59	53	46,277	32,394	300	78	8.7
2014	Bearded seal	67	38	22	40	62	13,846	13,846	128	33	3.7
2014	Least cisco	33	28	28	19	7	13,332	9,333	86	22	2.5
2014	Ringed seal	52	40	35	38	33	108	6,156	57	15	1.7
2015	Caribou	96	84	78	74	72	621	72,631	719	178	–
2016	Caribou	96	76	67	73	73	489	56,277	592	132	–
2017	Caribou	96	72	60	74	85	635	74,338	715	164	–
2018	Caribou	99	84	74	88	88	608	71,113	658	157	–
2019[f]	Caribou	100	98	91	87	78	636	74,439	658	153	–

Source: 1985 (ADF&G 2018); 1992 (Fuller and George 1999); 1993 (Pedersen 1995a); 1994–1995 (Brower and Hepa 1998); 1995–1996, 2000–2001 (Bacon, Hepa et al. 2009); 1999–2000, 2002–2007 (Braem, Kaleak et al. 2011); 2010, 2011, 2012, 2013 (SRB&A 2012, 2013, 2014, 2015); 2014 (Brown, Braem et al. 2016); 2015, 2016, 2017, 2018, 2019 (SRB&A 2017a, 2018; SRB&A 2019, 2020, 2021).

Note: "–" (No Data). For all resources study years (1985, 1992, 1993, 1994–1995, 1995–1996, 2000–2001), species are listed in descending order by percentage of the total harvest and are limited to species accounting for at least 1.0% of the total harvest; for single-resource study years, species are listed in descending order by total estimated pounds (or total number harvested, in the case of salmon study years) and limited to the five top species. Years lacking "percentage of total harvest" data were not comprehensive (i.e., all resources) study years. The estimated harvest numbers for the 1992, 1994–1995, 1995–1996, and 2000–2001 data were derived by summing individual species in each resource category. Also, for those study years, total pounds were derived from conversion rates found at ADF&G (2018) and total (usable) pounds for bowhead whales were calculated based on the method presented in SRB&A and ISER (1993). These estimates do not account for whale girth and should be considered approximate; more exact methods for estimating total whale weights are available in George, Philo et al. (n.d.). For the 2002–2003, 2003–2004, 2004–2005, 2005–2006, 2006–2007, 2010, and 2011 study years, total pounds were derived from conversion rates from (Braem, Kaleak et al. 2011).

[a] This table shows individual species unless they are not available for a given study year.

[b] Estimated numbers represent individuals in all cases except vegetation, where they represent gallons.

[c] Estimated pounds include only edible pounds and therefore do not include estimates for resources that are not typically eaten by community residents (e.g., furbearers).

[d] The estimated pounds of moose harvested in 1992 is likely too high (Fuller and George 1999).

[e] The 1994–1995 study year underrepresents the harvest of Arctic cisco and humpback whitefish (Brower and Hepa 1998); Nuiqsut did not successfully harvest a bowhead whale in 1994–1995.

[f] This study year had a low response rate due to COVID-19; thus, results and community-wide estimates should be viewed with this in mind.

1.2.1.2.1 Direct Effects Analysis Area

Nuiqsut residents harvest various resources within the direct effects analysis area, including caribou, furbearers (wolf and wolverine), seal, goose, eiders, and fish (broad whitefish and burbot). As shown in Tables E.16.2 and E.16.3, caribou are among the top species harvested, in terms of edible weight, by the community of Nuiqsut, as are broad whitefish. During most years, over half of Nuiqsut households participate in the harvests of these resources. Seals, particularly bearded seals, are another important resource that is harvested within the direct effects analysis area. Although not harvested in the same quantities as resources such as caribou and broad whitefish, seals are hunted by a substantial proportion of households (Table E.16.2). Similarly, while migratory birds generally account for less than 5% of the total annual harvest, a high percentage of households participate in harvests of these resources (between 70% and 90% across available study years; Table E.16.2). Wolf and wolverine hunting is an important, specialized activity that is practiced by a more limited subset of the community but which provides income and supports traditional crafts (e.g., providing skins and furs for sewing, craft making, and clothing).

Harvest amounts specific to the direct effects analysis area are available only for caribou. These data show the percentage of the reported caribou harvest that came from the direct effects analysis area between 2008 and 2019. These data represent only the harvests reported by a sample of active harvesters interviewed during each study

year and are not based on the total estimated community harvest; thus, other harvests may have occurred within the direct effects analysis area during the study.

As shown in Table E.16.4, across 12 years of the Nuiqsut Caribou Subsistence Monitoring Project, between 14% and 36% of the annual caribou harvests have occurred within the direct effects analysis area. As noted above, residents often travel to the west of their community to hunt caribou by four-wheeler or snow machine in an area east and south of the direct effects analysis area. Caribou often travel through the analysis area before arriving in hunting areas closer to the community.

Table E.16.4. Nuiqsut Caribou Harvests Within the Direct Effects Analysis Area, 2008–2019*

Study Year	Percentage of Caribou Harvests within Direct Effects Analysis Area
Year 1 (2008)	20
Year 2 (2009)	17
Year 3 (2010)	16
Year 4 (2011)	26
Year 5 (2012)	22
Year 6 (2013)	14
Year 7 (2014)	21
Year 8 (2015)	14
Year 9 (2016)	18
Year 10 (2017)	34
Year 11 (2018)	36
Year 12 (2019)	21

Source: (SRB&A 2021)

Based on data from SRB&A (2010b), which collected subsistence use area data for key resources for the 1995–2006 time period, the direct effects analysis area is used by a majority of wolf/wolverine hunters (100% during the 1995–2006 time period), caribou hunters (94%), moose hunters (94%), goose hunters (70%), and bearded seal hunters (56%) (Table E.16.5). In addition, a substantial percentage of harvesters use the direct effects analysis area for eider hunting (50%), ringed seal hunting (43%), and broad whitefish harvest (19%). For resources as a whole, the vast majority (97%) of Nuiqsut harvesters reported using the direct effects analysis area during the study period. Based on more recent caribou harvesting data for the 2008–2019 time period, on an annual basis, between 79% and 97% of respondents use the direct effects analysis area (Table E.16.6); thus, the area is a key caribou hunting ground for the community.

Table E.16.5. Percent of Nuiqsut Harvesters Using the Direct Effects Analysis Area, 1995–2006

Resource	Total Number of Respondents for Resource	Number of Respondents in Direct Effects Analysis Area	Percentage of Nuiqsut Resource Respondents
Caribou	32	30	94%
Wolverine	24	24	100%
Wolf	23	23	100%
Goose	33	23	70%
Bearded seal	27	15	56%
Ringed seal	23	10	43%
Eiders	28	14	50%
Broad whitefish	26	5	19%
Arctic char	26	4	15%
Moose	31	29	94%
Burbot	30	1	3%
All resources	**33**	**32**	**97%**

Source: SRB&A 2010b

Table E.16.6. Percent of Nuiqsut Caribou Harvesters Using the Direct Effects Analysis Area, 2008–2019*

Study Year	Number Using Direct Effects Analysis Area	Percentage Using Direct Effects Analysis Area	Total Respondents
Year 1	35	97%	36
Year 2	51	96%	53
Year 3	51	89%	57
Year 4	56	97%	58
Year 5	52	91%	57
Year 6	46	81%	57

Study Year	Number Using Direct Effects Analysis Area	Percentage Using Direct Effects Analysis Area	Total Respondents
Year 7	56	93%	60
Year 8	49	84%	58
Year 9	50	79%	63
Year 10	60	88%	68
Year 11	43	86%	50
Year 12	20	91%	22

Source: (SRB&A 2021)

1.2.1.3 Timing of Subsistence Activities

Table E.16.7 provides data on the timing of Nuiqsut subsistence activities based on studies from the 1970s through the 2010s. Overall, Nuiqsut harvesters target the highest numbers of resources, including non-salmon fish, caribou, moose and other large land mammals, seals and bowhead whales, and plants and berries, during August and September.

Table E.16.7. Nuiqsut Annual Cycle of Subsistence Activities

Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon	M	L	M	M	L	L	M	H	H	H	H	L
Marine non-salmon	ND	ND	ND	ND	ND	ND	ND	ND	H	H	ND	ND
Salmon	ND	ND	ND	ND	ND	ND	H	M	ND	ND	ND	ND
Caribou	L	L	M	L	L	M	H	H	M	M	L	L
Moose	L	ND	ND	ND	ND	ND	L	H	H	M	L	L
Bear	M	M	M	L	L	L	L	L	H	M	M	M
Muskox	ND	ND	ND	ND	ND	ND	ND	H	H	H	ND	ND
Furbearers	H	H	H	H	M	L	L	L	L	L	M	H
Small land mammals	ND	ND	ND	ND	L	L	H	H	L	ND	ND	ND
Marine mammals	ND	ND	M	H	L	L	M	H	H	L	L	L
Upland birds	M	M	H	H	M	L	ND	L	L	M	M	M
Waterfowl	ND	ND	ND	L	H	H	M	M	M	M	L	L
Eggs	ND	ND	ND	ND	ND	H	ND	ND	ND	ND	ND	ND
Plants and berries	ND	ND	ND	ND	L	L	H	H	ND	ND	ND	ND
Total number of resource categories by month	**6**	**5**	**6**	**7**	**9**	**10**	**10**	**12**	**11**	**10**	**8**	**8**

Source: 1995–1996, 2000–2001 (Bacon, Hepa et al. 2009); 2002–2007 (Braem, Kaleak et al. 2011); 1994–1995 (Brower and Hepa 1998); Pre-1979 (Brown 1979); 2014 (Brown, Braem et al. 2016); 2004 (EDAW Inc., Adams/Russel Consulting et al. 2008); 1992 (Fuller and George 1999); 2001–2012 (Galginaitis 2014); 1988 (Hoffman, Libbey et al. 1988); 1979 (Libbey, Spearman et al. 1979); 1995–2006 (SRB&A 2010b); 2008–2019 (SRB&A 2021)
Note: ND (no documented activity and/or harvests); L (limited activity and/or harvests); M (moderate activity and/or harvests); H (high activity and/or harvests).

The month of April marks the beginning of the spring waterfowl hunting season, which peaks in May and June. Some residents also harvest goose eggs after the birds begin nesting in June. Beginning as early as May (depending on the timing of breakup), residents travel by boat along the local river system and into the Beaufort Sea to harvest various resources, including caribou, waterfowl, seals, and fish. Caribou hunting occurs throughout the year, but with the most intensity during July and August. During this time, residents also set nets for broad whitefish in local river systems or harvest fish such as Arctic grayling and Dolly Varden with rods and reels, often while hunting caribou along the Colville River. Throughout the summer months, residents also travel to the ocean to hunt for ringed seals, bearded seals, and king and common eiders, with some coastal caribou hunting occurring as well (SRB&A 2010b). Most berry and plant gathering occurs in July and August.

Beginning in August and continuing throughout September, some residents shift their focus upriver in search of moose, with caribou often a secondary pursuit during these trips. Summer rod-and-reel harvests of non-salmon fish, particularly Arctic grayling, continue into the fall as well. Preparation for the bowhead whale hunt begins in August, with whaling crews generally traveling to Cross Island in September. While at Cross Island, Nuiqsut hunters may harvest polar bears and other marine resources; these harvesting events generally occur when whaling is not active due to weather or travel conditions. The fall Arctic cisco fishery, a major community event, may begin in September but is most productive between October and mid-November when the fish are running upriver; residents harvest them in the CRD with gillnets. Other fish, including humpback whitefish, broad whitefish, and least cisco, are caught incidentally during this time. Caribou are also harvested during October and November, as available, to the west of the community.

Starting in November and December and continuing through April, hunters pursue wolves and wolverines and target caribou and ptarmigan as needed and available. Residents may also fish for burbot through the ice during winter.

1.2.1.3.1 Direct Effects Analysis Area

Nuiqsut harvesters use the direct effects analysis area at varying levels throughout the year (Figure E.16.10). For all resources for the 1995–2006 time period, uses of the direct effects analysis area are somewhat consistent throughout the year but with a peak in summer (July and August) and again in mid-to late winter (January through March). During both the 1995–2006 and 2008–2019 time periods, caribou hunting in the direct effects analysis area peaked from July through September but continued through winter. Data from the more recent time period (2008–2019) show decreasing use of the direct effects analysis area in the winter months, consistent with the increasing use of ATVs instead of snow machines to access areas west of Nuiqsut (SRB&A 2021). Summer hunting activities in the direct effects analysis area occur in overland areas to the west of the community, along the Colville River, and, to a lesser extent, in coastal areas to the west and east of the CRD. Wolf and wolverine hunters use the direct effects analysis area solely during November through April, with goose hunting peaking in April and May and occurring to a lesser extent in June. Seal and eider hunting occur offshore primarily during the open-water months of June through September, although some eider hunting occurs as early as May. Fishing occurs in the direct effects analysis area between June and October, peaking in July and August, with minimal activity in November and December. Fishing occurs primarily along the Colville River and in Fish (Iqalliqpik) Creek.

1.2.1.4 Travel Methods

As shown in Table E.16.8, boat is the primary travel method used for subsistence pursuits of most resources, including various non-salmon fish, caribou, moose, bowhead whale, seals, and eider. Snow machine is the primary method of travel used for the late fall, winter, and early spring pursuits of Arctic cisco, burbot, wolf and wolverine, and goose; recent data shows that while boats remain the primary method of travel to caribou use areas, ATVs and trucks have become much more common in recent years, while snow machines have become less common (SRB&A 2021).

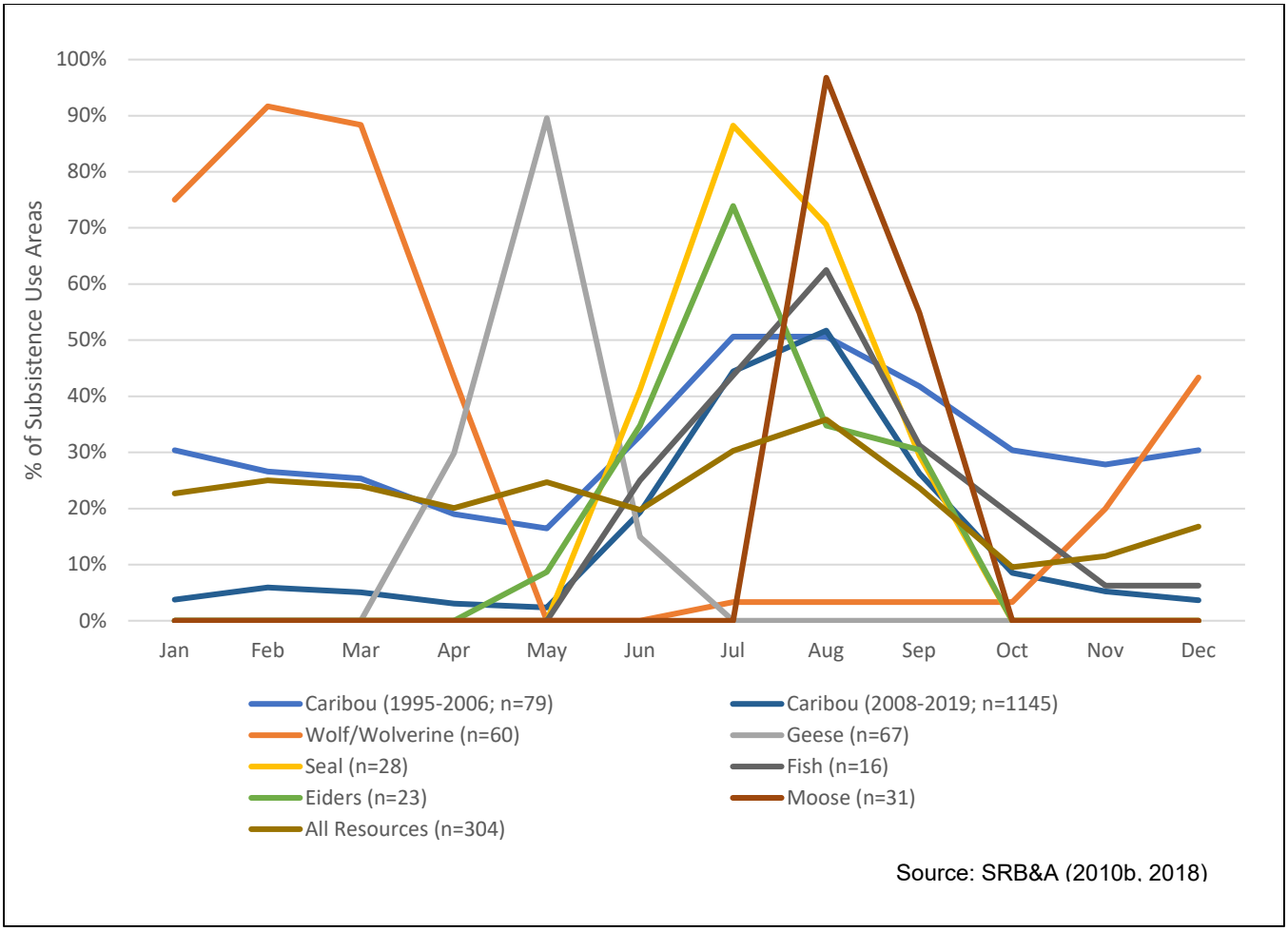

Figure E.16.10. Nuiqsut Subsistence Use Areas by Month in the Direct Effects Analysis Area, by Resource

Table E.16.8. Nuiqsut Travel Method to Subsistence Use Areas

Resource	Boat	Snow Machine	Foot	Car/Truck	ATV	Plane
Arctic cisco and burbot	L	H	L	M	ND	ND
Arctic char/Dolly Varden and broad whitefish	H	M	M	ND	ND	ND
Caribou	H	M	ND	L	M	ND
Moose	H	ND	M	ND	ND	ND
Wolf and wolverine	M	H	ND	ND	ND	M
Bowhead whale	H	ND	ND	ND	ND	ND
Seals	H	M	ND	ND	ND	ND
Goose	M	H	M	L	L	ND
Eider	H	M	ND	ND	ND	ND
Total number of resources targeted	**9**	**7**	**4**	**3**	**2**	**1**

Source: 1995–2006 (SRB&A 2010b); 2008–2019 (SRB&A 2021)
Note: ND (no documented use of travel method); ATV (all-terrain vehicle); L (limited use of travel method); M (moderate use of travel method); H (high use of travel method). Caribou based on SRB&A (2017a; 2021). All others based on SRB&A (2010a).

1.2.1.4.1 Direct Effects Analysis Area

Because the direct effects analysis area includes terrestrial, riverine, and marine areas, travel methods used by Nuiqsut harvesters vary by location. As shown in Figure E.16.11, for the 1995–2006 time period, snow machine was the primary method used to access the direct effects analysis area, followed closely by boat. No other travel methods were used (except minimally) within the direct effects analysis area. During the 2008–2019 time period, Nuiqsut caribou hunters primarily accessed the direct effects analysis area by boat (65% of use areas). A smaller percentage of use areas were accessed during that time period by snow machine (17%) or ATV (four-wheeler) (16%). Figure E.16.11 shows an increase in the use of ATVs in the direct effects analysis area during the 2008–2019 time period. Recent data from the Nuiqsut Caribou Subsistence Monitoring Project also show the increased

use of trucks to access caribou hunting areas west of the community due to the construction of easily accessible gravel roads (SRB&A 2021).

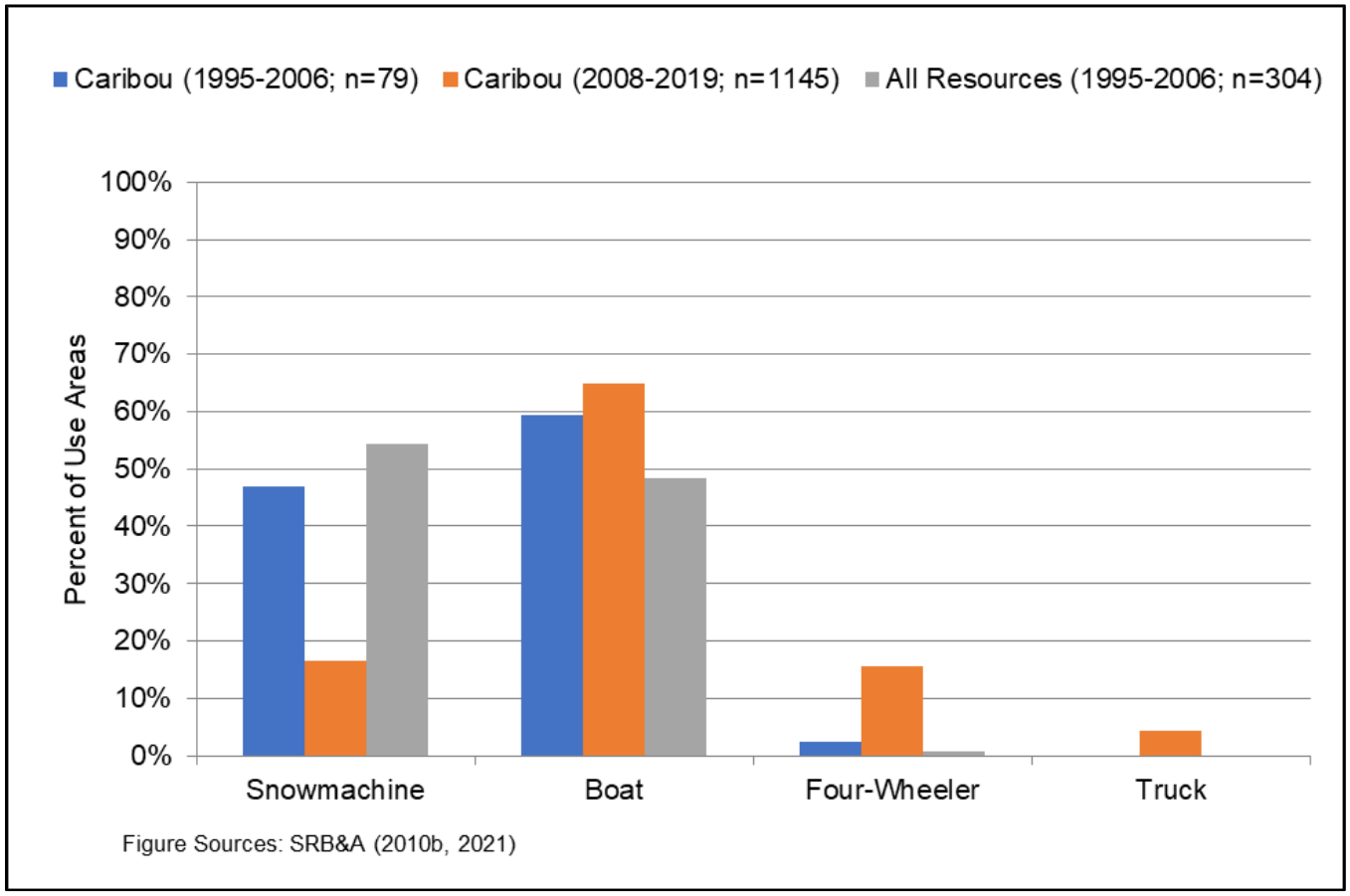

Figure E.16.11. Nuiqsut Travel Methods in the Direct Effects Analysis Area

1.2.1.5 Resource Importance

An analysis of resource importance based on harvest (average percentage of total harvest), harvest effort (average percentage of households attempting to harvest), and sharing (average percentage of households receiving) variables is provided in Table E.16.9. Based on this analysis, resources of major importance in Nuiqsut are Arctic cisco, Arctic grayling, bearded seal, bowhead whale, broad whitefish, burbot, caribou, cloudberry, white-fronted goose, and wood (driftwood).

Table E.16.9. Relative Importance of Subsistence Resources Based on Selected Variables, Nuiqsut

Resource Category	Resource[a]	Percentage of Households Trying to Harvest	Percentage of Households Receiving	Percentage of Total Harvest
Major resources[b]	Arctic cisco	61	57	8.8
Major resources[b]	Arctic grayling	50	24	1.0
Major resources[b]	Bearded seal	32	50	1.6
Major resources[b]	Bowhead whale[c]	30	96	30.4
Major resources[b]	Broad whitefish	69	49	15.5
Major resources[b]	Burbot	51	35	1.0
Major resources[b]	Caribou	75	77	29.9
Major resources[b]	Cloudberry	55	29	0.0
Major resources[b]	White-fronted goose	62	36	1.4
Major resources[b]	Wood[d]	50	3.2	0.0
Moderate resources[e]	Arctic char	38	22	0.9
Moderate resources[e]	Arctic fox	14	1	0.0
Moderate resources[e]	Beluga	2	24	0.0
Moderate resources[e]	Bird eggs	16	12	0.0
Moderate resources[e]	Blueberries	29	16	0.0
Moderate resources[e]	Brant	17	9	0.1

Resource Category	Resource[a]	Percentage of Households Trying to Harvest	Percentage of Households Receiving	Percentage of Total Harvest
Moderate resources[e]	Brown bear	14	18	0.2
Moderate resources[e]	Canada goose	42	24	0.4
Moderate resources[e]	Chum salmon	23	11	0.6
Moderate resources[e]	Ground squirrel	45	8	0.1
Moderate resources[e]	Humpback whitefish	26	9	1.0
Moderate resources[e]	King eider	24	19	0.0
Moderate resources[e]	Least cisco	40	17	1.1
Moderate resources[e]	Long-tailed duck	8	13	0.0
Moderate resources[e]	Moose	40	41	2.5
Moderate resources[e]	Pink salmon	28	17	0.4
Moderate resources[e]	Polar bear	7	29	0.2
Moderate resources[e]	Ptarmigan	48	15	0.2
Moderate resources[e]	Rainbow smelt	13	22	0.1
Moderate resources[e]	Red fox	22	2	0.0
Moderate resources[e]	Ringed seal	36	43	1.6
Moderate resources[e]	Snow goose	19	7	0.0
Moderate resources[e]	Spotted seal	13	5	0.1
Moderate resources[e]	Walrus	7	43	0.2
Moderate resources[e]	Wolf	18	6	0.0
Moderate resources[e]	Wolverine	22	5	0.0
Minor resources[f]	Arctic cod	7	7	0.0
Minor resources[f]	Chinook salmon	2	9	0.0
Minor resources[f]	Coho salmon	3	5	0.0
Minor resources[f]	Common eider duck	7	3	0.1
Minor resources[f]	Cranberries	9	5	0.0
Minor resources[f]	Crowberries	7	2	0.0
Minor resources[f]	Dall sheep	–	9	0.0
Minor resources[f]	Dolly Varden	10	3	0.4
Minor resources[f]	Lake trout	3	8	0.0
Minor resources[f]	Muskox	–	8	0.3
Minor resources[f]	Northern pike	7	7	0.0
Minor resources[f]	Northern pintail	5	1.6	0.0
Minor resources[f]	Round whitefish	5	1	0.1
Minor resources[f]	Saffron cod	7	–	0.0
Minor resources[f]	Sheefish	–	6	0.0
Minor resources[f]	Sockeye salmon	3	6	0.0
Minor resources[f]	Sourdock	5	7	0.0
Minor resources[f]	Weasel	5	–	0.0

Source: 1985 (ADF&G 2018); 1992 (Fuller and George 1999); 1993 (Pedersen 1995b); 1994–1995 (Brower and Hepa 1998); 1995–1996, 2000–2001 (Bacon, Hepa et al. 2009); 1999–2000, 2002–2007 (Braem, Kaleak et al. 2011); 2010–2013, 2015-2019 (SRB&A 2021); 2014 (Brown, Braem et al. 2016)
Note: "–" (No Data).
[a] For space considerations, resources that contributed an average of less than 1% of the harvest, less than 5% attempting to harvest, and less than 5% of receiving resources are categorized as minor and are not shown.
[b] Major resources contribute > 9% of the total harvest, have ≥ 50% of households attempting to harvest, or have ≥ 50% of households receiving resources.
[c] Averages include unsuccessful bowhead whale harvest years.
[d] The inclusion of wood is based on a single study year (1993); data on wood were not collected during any other study year.
[e] Moderate resources contribute 2% to 9% of the total harvest, have 11% to 49% of households attempting to harvest, or have 11% to 49% of households receiving resources.
[f] Minor resources contribute < 2% of the total harvest, have ≤ 10% of households attempting to harvest, or have ≤ 10% of households receiving resource.

1.2.2 Utqiaġvik

Utqiaġvik (Barrow) is the North Slope's most populous community and is located on the northern coast of the Chukchi Sea. The town site is approximately 7.5 miles south of Point Barrow, the demarcation point between the Chukchi and Beaufort seas. In 2016, the residents of Barrow voted to formally rename the town to its original Iñupiaq name of Utqiaġvik. The community is also traditionally known as Ukpeagvik, which means "place where snowy owls are hunted" (NSB 2018). Continuous occupation of the Utqiaġvik area began approximately 1,300 years ago. Following European contact in the early 1800s, the growth of the commercial whaling and trapping industries brought Iñupiat from across the North Slope to Utqiaġvik in pursuit of employment and trade opportunities. The Naval Petroleum Reserve 4 was established in 1923, and in the late 1940s, the U.S. Navy established a base camp in Utqiaġvik from which to launch oil exploration in the reserve (Jensen 2009). The established mission of the naval base camp shifted away from oil exploration in the 1950s, and the base became the Naval Arctic Research Laboratory. Throughout the late 1900s, Utqiaġvik continued to grow as new economic

opportunities, including oil and gas exploration, arose on the North Slope. Today, Utqiaġvik is the headquarters for various regional organizations and corporations, including the NSB and the Arctic Slope Regional Corporation (NSB 2016). In 2020, the population of Utqiaġvik was estimated at 4,927 residents living in 1,334 occupied households; 63.4% were Alaska Native (USCB 2021). The community remains primarily Iñupiat, and subsistence remains an important part of the community's identity and social fabric.

1.2.2.1 Subsistence Use Areas

Figure E.16.12 depicts Utqiaġvik subsistence use areas for all resources for various historic and contemporary time periods (BLM 2004; Brown, Braem et al. 2016; Pedersen 1979; SRB&A 2010b, Unpublished; SRB&A and ISER 1993). Time periods range from lifetime use areas documented in 1979 (Pedersen 1979) to single-year use areas documented in 2014 (Brown, Braem et al. 2016). Lifetime (pre-1979) use areas include locations as far south as the Colville River near Umiat, beyond Nuiqsut in the east, offshore from the community to the southeast and southwest, and inland beyond Wainwright toward Point Lay. Harvest sites and use areas for the 1987–1989 time period are similar to those recorded for the pre-1979 time period but extend farther offshore from the community. The harvest sites for the 1987–1989 time period are concentrated in offshore areas between Peard Bay and Smith Bay and onshore areas extending south from the community beyond the Colville River and into the foothills of the Brooks Range. More recent use areas studies for the 1994–2003 and 1997–2006 time periods show somewhat larger use area extents, with use areas extending well offshore to the north of the community, east toward the Kuparuk River area, south to the Colville River, and as far west as Point Lay. Overlapping subsistence use areas for the 1997–2006 time period show the greatest concentration of use areas occurring offshore from the community up to 20 miles and in an overland area south of the community and along the Chipp and Ikpikpuk rivers. Use areas for the 2014 time period are consistent with these areas of highest overlapping use. In addition, some isolated use areas were reported for the 2014 time period offshore from Icy Cape and near Point Lay.

Resource-specific use area maps for Utqiaġvik are shown in Figures E.16.13 through E.16.20 for the time periods mentioned above. Utqiaġvik subsistence use areas for large land mammals are shown in Figures E.16.13 through E.16.15. Caribou use areas (Figure E.16.13) cover an extensive area from Icy Cape to Prudhoe Bay and as far south as the Colville River. Caribou use areas for the 1997–2006 time period extend farther south and east than previous time periods; the highest number of overlapping caribou use areas extend in an overland area approximately 30 miles south of the community and along local river systems. Caribou use areas for the most recent time period (2014) are generally within those documented for the 1997–2006 time period. Figure E.16.14 depicts Utqiaġvik moose use areas, and for most time periods, shows use concentrated along the Colville River, where moose are more likely to be found. Use areas from the 1997–2006 and 2014 time periods indicate a considerably larger area extending between Utqiaġvik and the Colville River. Utqiaġvik use areas for other large land mammals (e.g., grizzly/brown bear, Dall sheep, and polar bear) are shown on Figure E.16.15. Polar bear use areas occur in the Chukchi Sea at distances of no more than 20 miles from shore, while grizzly bear use areas are concentrated in various inland areas bounded by Wainwright and the Kuk River in the west and the Ikpikpuk River in the east.

Utqiaġvik small land mammal use areas (Figure E.16.16) cover an extensive area from Point Lay to the Kuparuk River and beyond the Colville River in the south. The extent of furbearer and small land mammal use areas has expanded over time. Lifetime furbearer and small land mammal use areas cover areas from Wainwright in the west to Nuiqsut in the east, and as far south as the Colville River, while 1997–2006 use areas for wolf and wolverine extend beyond Icy Cape to Point Lay in the west, past Nuiqsut to the Kuparuk River in the east, and well beyond the Colville River in the south. High numbers of overlapping use areas occur south and east of the community toward the Colville River. Small land mammal use areas for the most recent time period (2014) occurred primarily along the Ikpikpuk River toward the Colville River.

Utqiaġvik fishing areas for all available time periods are depicted in Figure E.16.17 and show residents fishing across a large river and lake system to the south of the community, west to the Kuk River near Wainwright, and as far east as Teshekpuk Lake and the Colville River. Most time periods also show fish harvesting in coastal waters and lagoon systems in the Chukchi and Beaufort seas. More recent use areas from the 1994–2003, 1997–2006, and 2014 time periods occur along river and lake systems to the south and east of the community as far as the Teshekpuk Lake and upper Judy Creek areas.

Utqiaġvik use areas for birds (Figure E.16.18), including eiders and goose, are relatively consistent over time, although they extend considerably farther offshore during the 1997–2006 time period (SRB&A 2010b). Use areas are located offshore at a distance greater than 40 miles from the community, inland beyond Atqasuk in the west,

and east as far as Nuiqsut. Bird use areas from more recent time periods (1994–2003, 1997–2006, and 2014) are concentrated along the Meade, Chipp, and Ikpikpuk rivers. Utqiaġvik harvests of vegetation (including berries and plants) and wood are depicted in Figure E.16.19 for various time periods. Vegetation and wood harvests generally occur to the south and southeast of the community, in addition to coastal areas (primarily for driftwood). More recent use areas for the 2014 time period occur over a large area that extends southwest to Wainwright and southeast to the Ikpikpuk River. Several isolated berry and plant harvesting areas have also been reported as far as Point Lay and Colville River.

Utqiaġvik subsistence use areas for marine mammals are shown on Figure E.16.20 and occur at varying offshore distances in the Beaufort and Chukchi seas. The offshore extent of marine mammal use areas has grown over time. SRB&A's (2010b) 1997–2006 marine mammals use areas show Utqiaġvik residents traveling beyond Wainwright in the west and offshore more than 80 miles, with the highest numbers of overlapping use areas occurring between 10 and 25 miles from shore. During the 2014 time period, marine mammal use areas occurred between Icy Cape and Dease Inlet and up to approximately 40 miles from shore.

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CHUKCHI SEA

BEAUFORT SEA

Utqiaġvik (Barrow)

Wainwright

Atqasuk

Nuiqsut

Umiat

Point Lonely

Cape Halkett

Harrison Bay

Teshekpuk Lake

Atigaru Point

Fish Creek

Cross Island

Prudhoe Bay

Mikkelsen Bay

Point Thomson

Camden Bay

Canning River

Sagavanirktok River

Kuparuk River

Ikpikpuk River

Itkillik River

Chandler River

Colville River

Dalton Highway

Arctic National Wildlife Refuge

Anaktuvuk River

Anaktuvuk Pass

Arctic Village

Gates of the Arctic National Park

0 10 20 Miles

Subsistence Data

- All Resources, Lifetime Previous to 1979 [a]
- All Resource Harvest Sites Buffered, 1987-1989 [b]
- All Resources, 1987-1989 [c]
- All Resources, 1994-2003 [d]
- All Resources, 2014 [e]
- High / Low — Overlapping Subsistence Use Areas All Resources, 1997-2006 [f]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

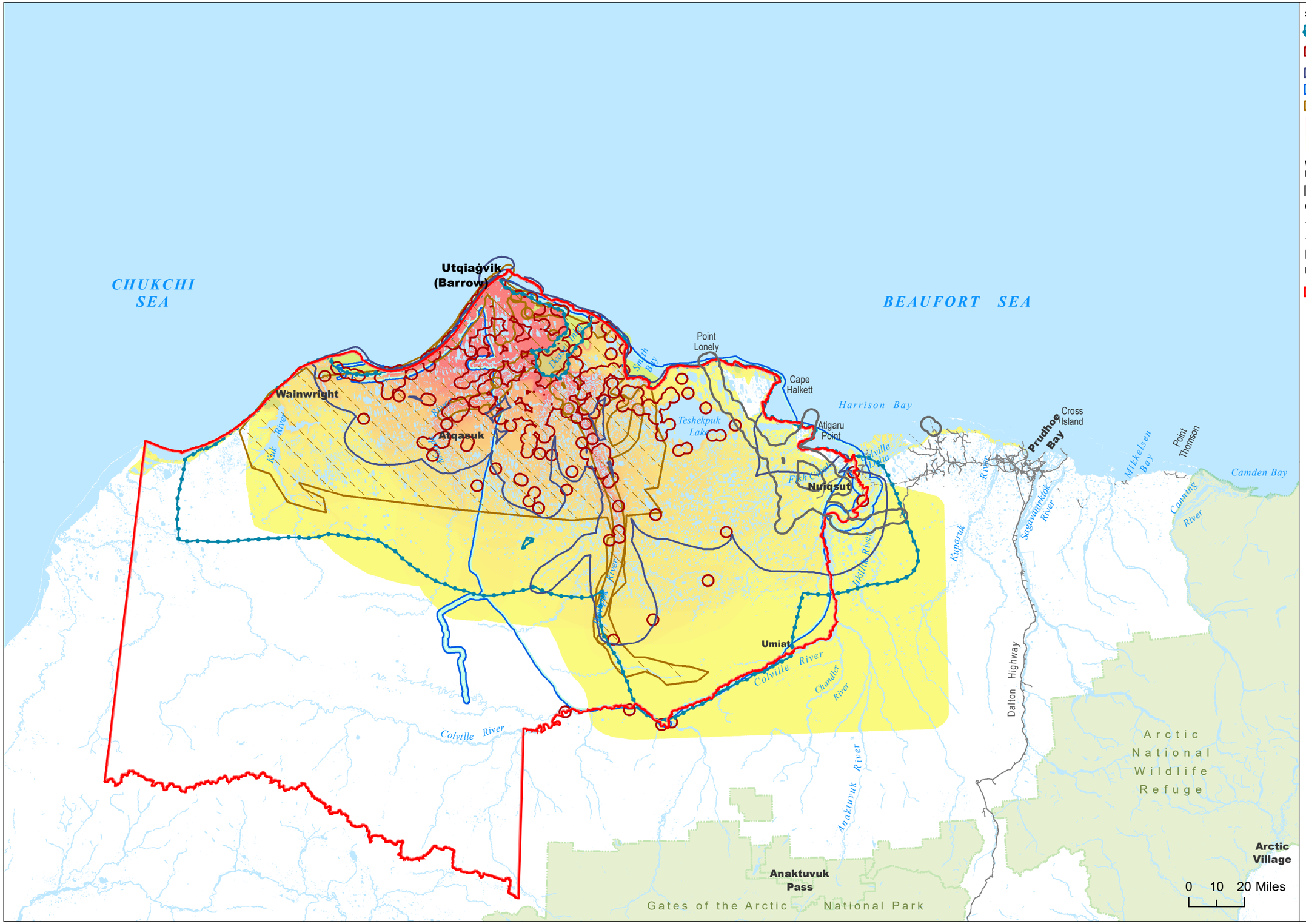
Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. SRB&A and ISER 1993
c. SRB&A Unpublished
d. BLM 2004
e. Brown et al. 2016
f. SRB&A 2010a

Figure E.16.12



Subsistence Data

- Caribou, Lifetime Prior to 1979 [a]
- Caribou Harvest Sites Buffered, 1987-1989 [b]
- Caribou, 1987-1989 [c]
- Caribou, 1994-2003 [d]
- Caribou, 2014 [e]
- High / Low — Overlapping Subsistence Use Areas Caribou, 1997-2006 [f]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
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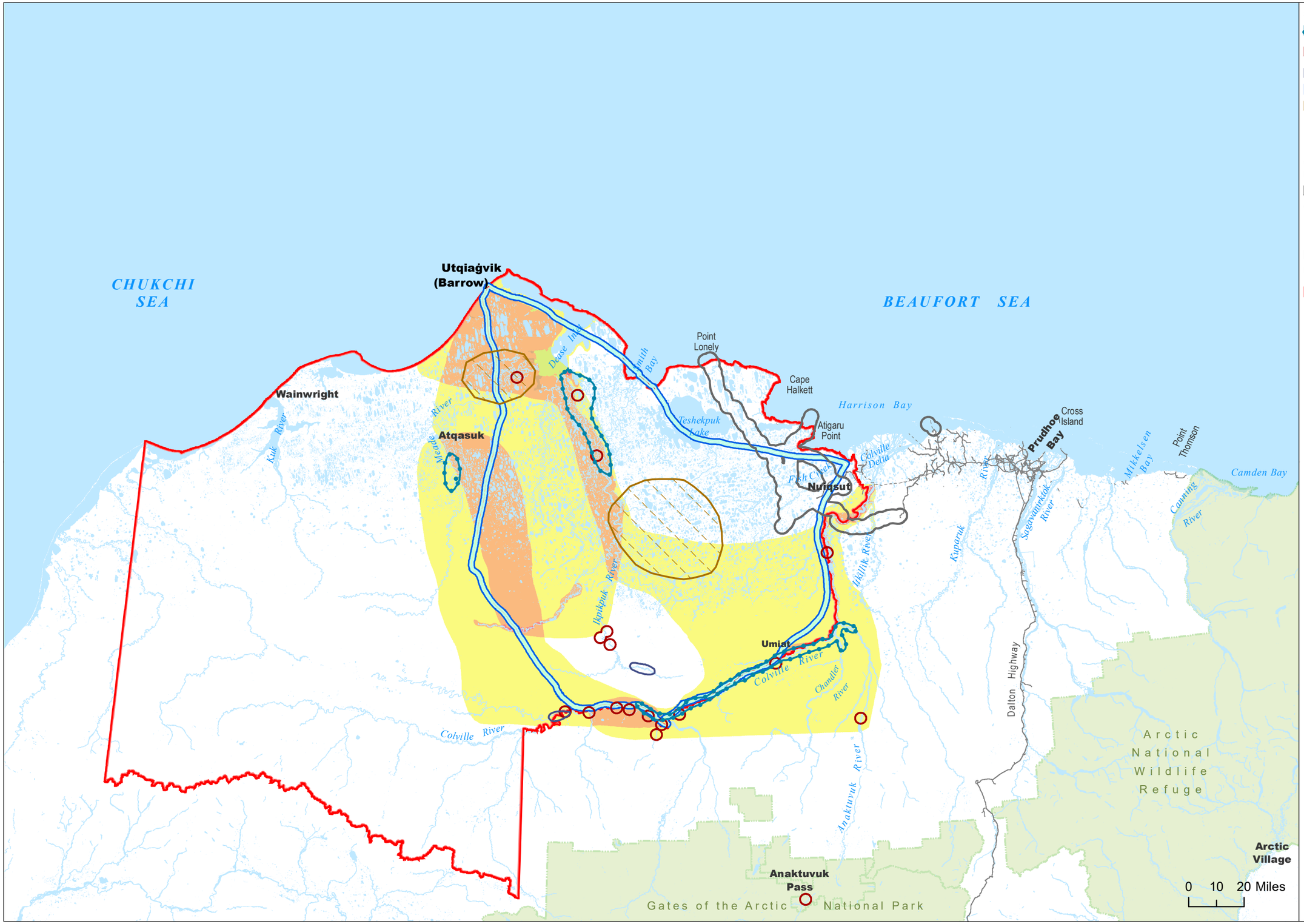
Source
a. Pedersen 1979
b. SRB&A and ISER 1993
c. SRB&A Unpublished
d. BLM 2004
e. Brown et al. 2016
f. SRB&A 2010a

Figure E.16.13



Subsistence Data

- Moose, Lifetime Previous to 1979 [a]
- Moose Harvest Sites Buffered, 1987-1989 [b]
- Moose, 1987-1989 [c]
- Moose, 1994-2003 [d]
- Moose, 2014 [e]
- Overlapping Subsistence Use Areas Moose, 1997-2006 [f] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
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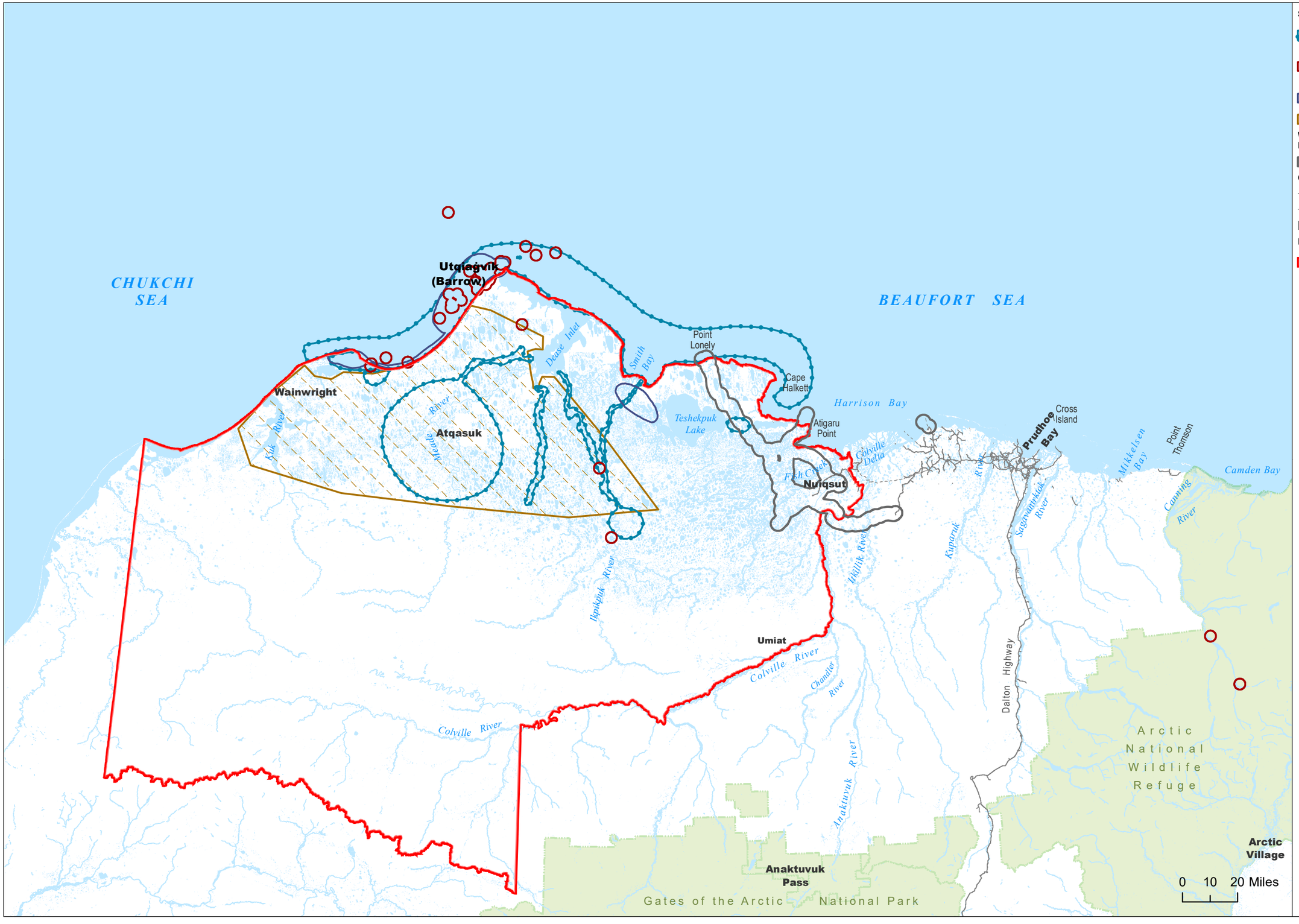
Source
a. Pedersen 1979
b. SRB&A and ISER 1993
c. SRB&A Unpublished
d. BLM 2004
e. Brown et al. 2016
f. SRB&A 2010a

Figure E.16.14



Subsistence Data

- Grizzly Bear and Polar Bear, Lifetime Previous to 1979 [a]
- Brown Bear, Dall Sheep and Polar Bear Harvest Sites Buffered, 1987-1989 [b]
- Brown Bear and Polar Bear, 1987-1989 [c]
- Brown Bear, 2014 [d]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. SRB&A and ISER 1993
c. SRB&A Unpublished
d. Brown et al. 2016

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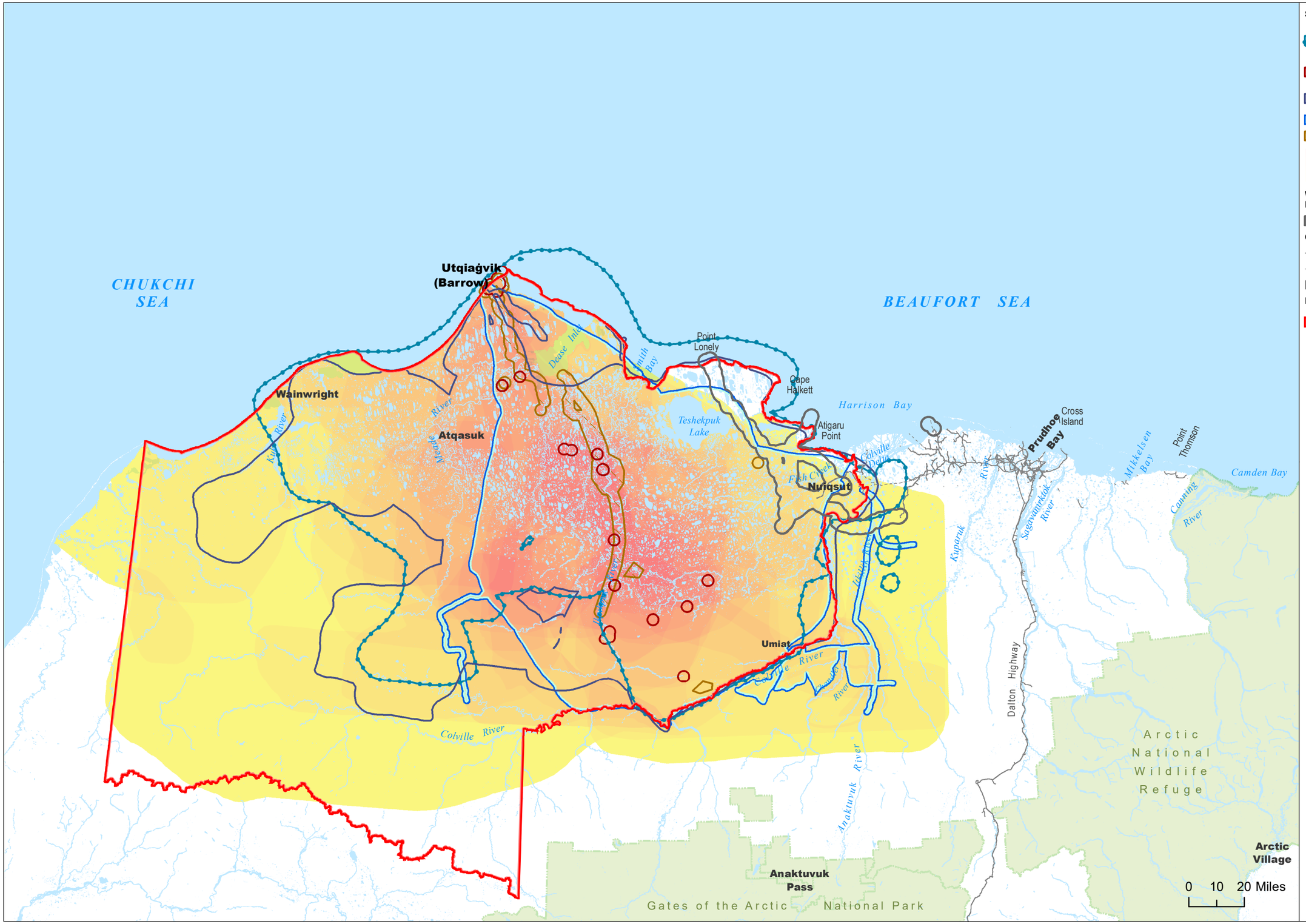
Figure E.16.15



Subsistence Data

- Furbearers, Small Land Mammals and Trapping, Lifetime Previous to 1979 [a]
- Furbearer and Small Land Mammal Harvest Sites Buffered, 1987-1989 [b]
- Furbearer and Small Land Mammals, 1987-1989 [c]
- Wolf and Wolverine, 1994-2003
- Small Land Mammals, 2014
- Overlapping Subsistence Use Areas Wolf and Wolverine 1997-2006 [f] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
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Source
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b. SRB&A and ISER 1993
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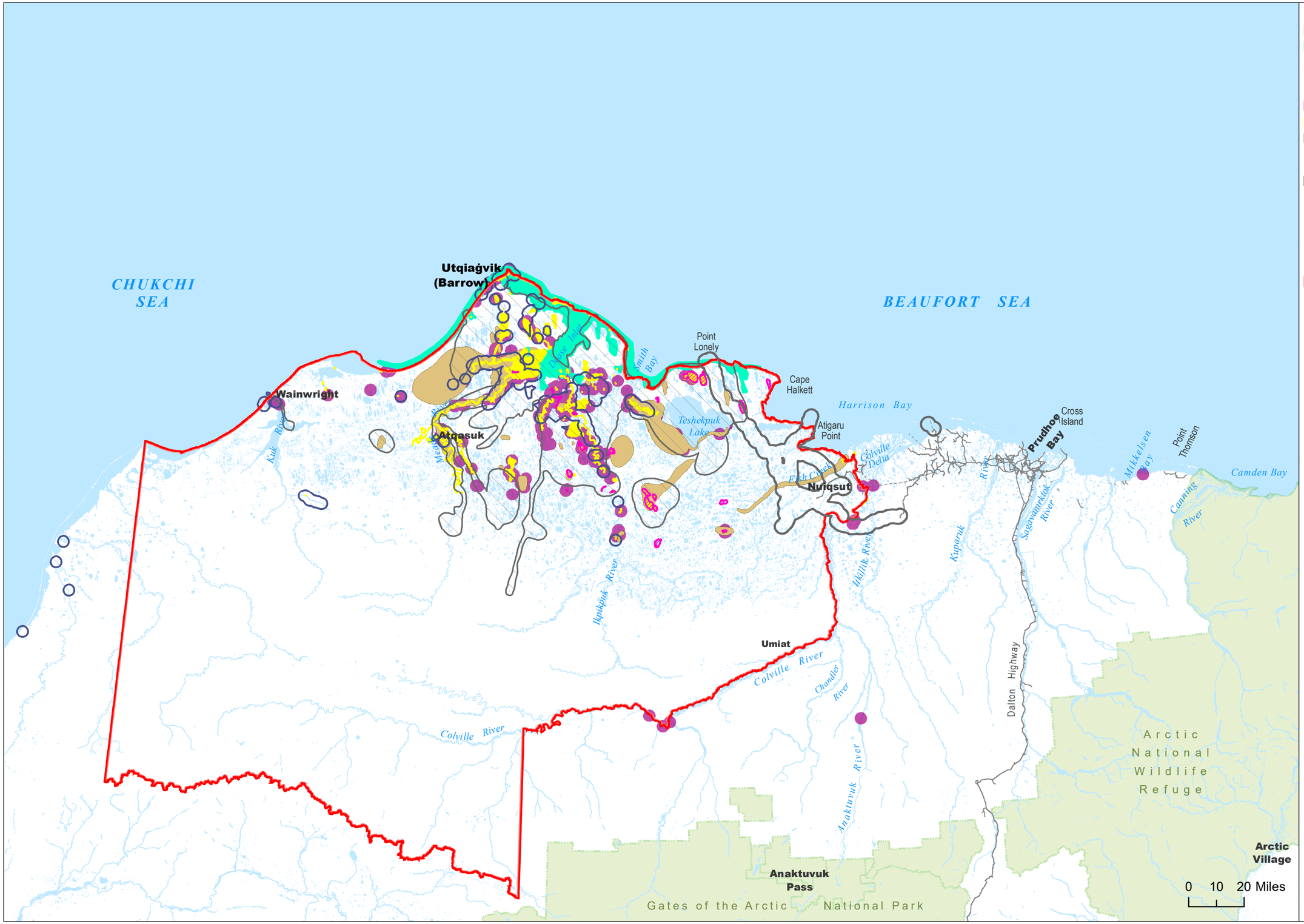
Figure E.16.16



Subsistence Data
- Fishing, Lifetime Previous to 1979
- Fish, 1979-1983 [b]
- Fish Harvest Sites Buffered, 1987-1989 [c]
- All Fish, 1987-1989 [d]
- Fish, 1994-2003 [e]
- Fish, 1997-2006 [f]
- Non-Salmon and Salmon, 2014

Willow Proposed Development Features
- Direct Effects Area

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Map prepared by
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Source
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d. SRB&A Unpublished
e. BLM 2004
f. SRB&A 2010a
g. Brown et al. 2016

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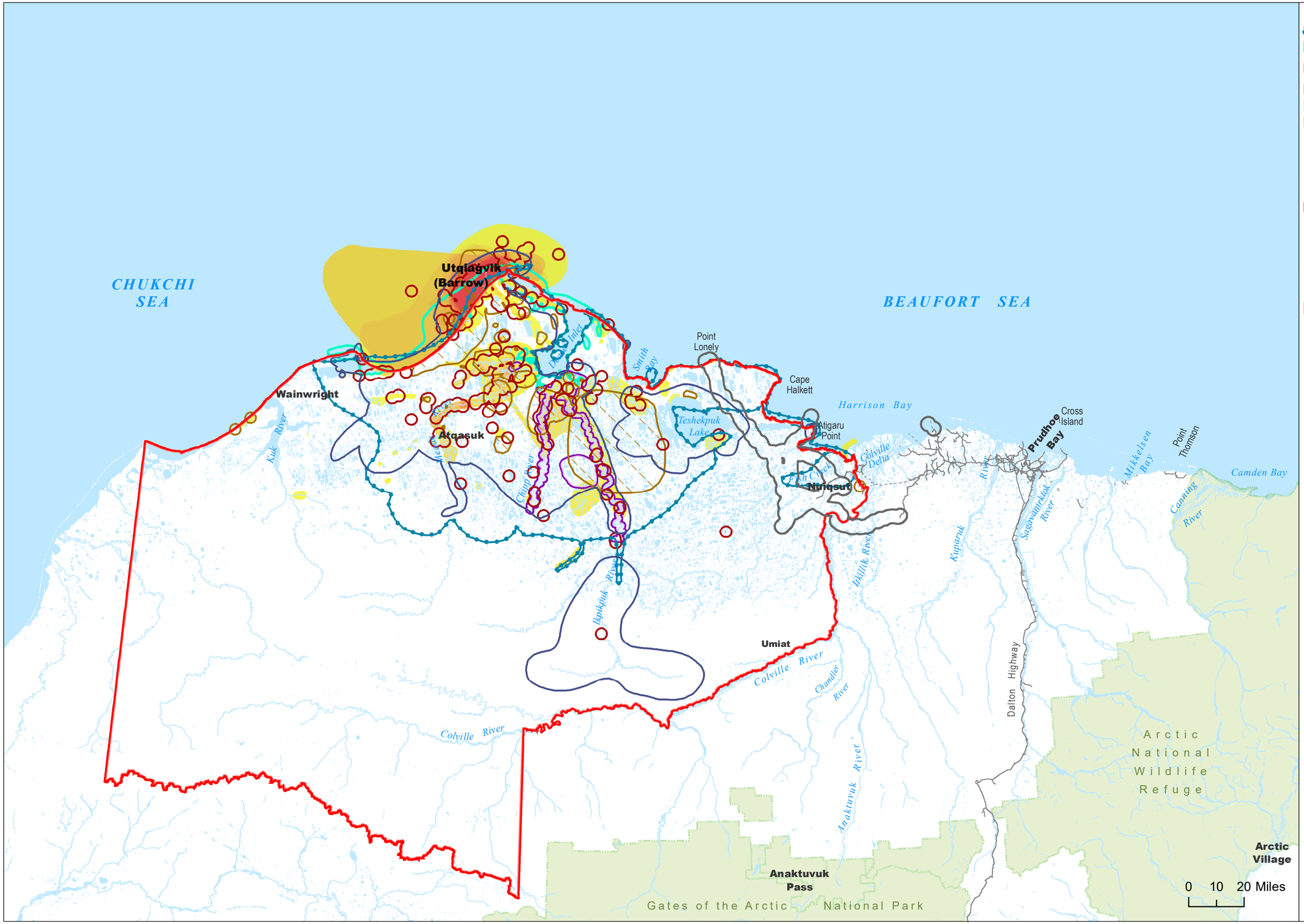
Figure E.16.17



Subsistence Data

- Wildfowl, Lifetime Previous to 1979 [a]
- Birds, 1979-1983 [b]
- Bird Harvest Sites Buffered, 1987-1989 [c]
- Birds, 1987-1989 [d]
- Geese, 1994-2003 [e]
- Birds, 2014 [f]
- High / Low — Overlapping Subsistence Use Areas Eider and Geese, 1997-2006 [g]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
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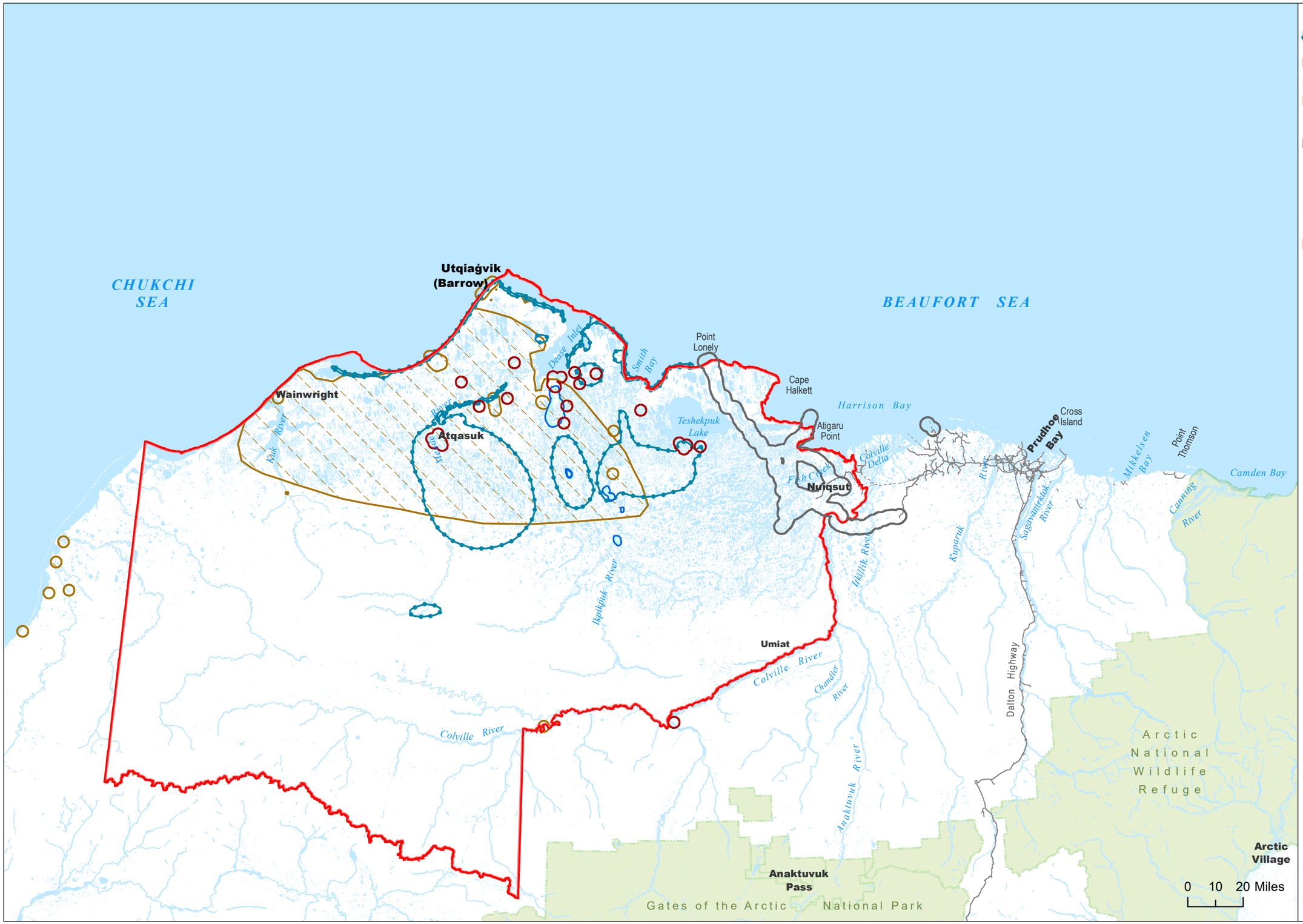
Figure E.16.18



Subsistence Data

- Vegetation and Wood, Lifetime Previous to 1979 [a]
- Berry and Plant Harvest Sites Buffered, 1987-1989 [b]
- Berries, 1994-2003 [c]
- Berries and Plants, 2014 [d]

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

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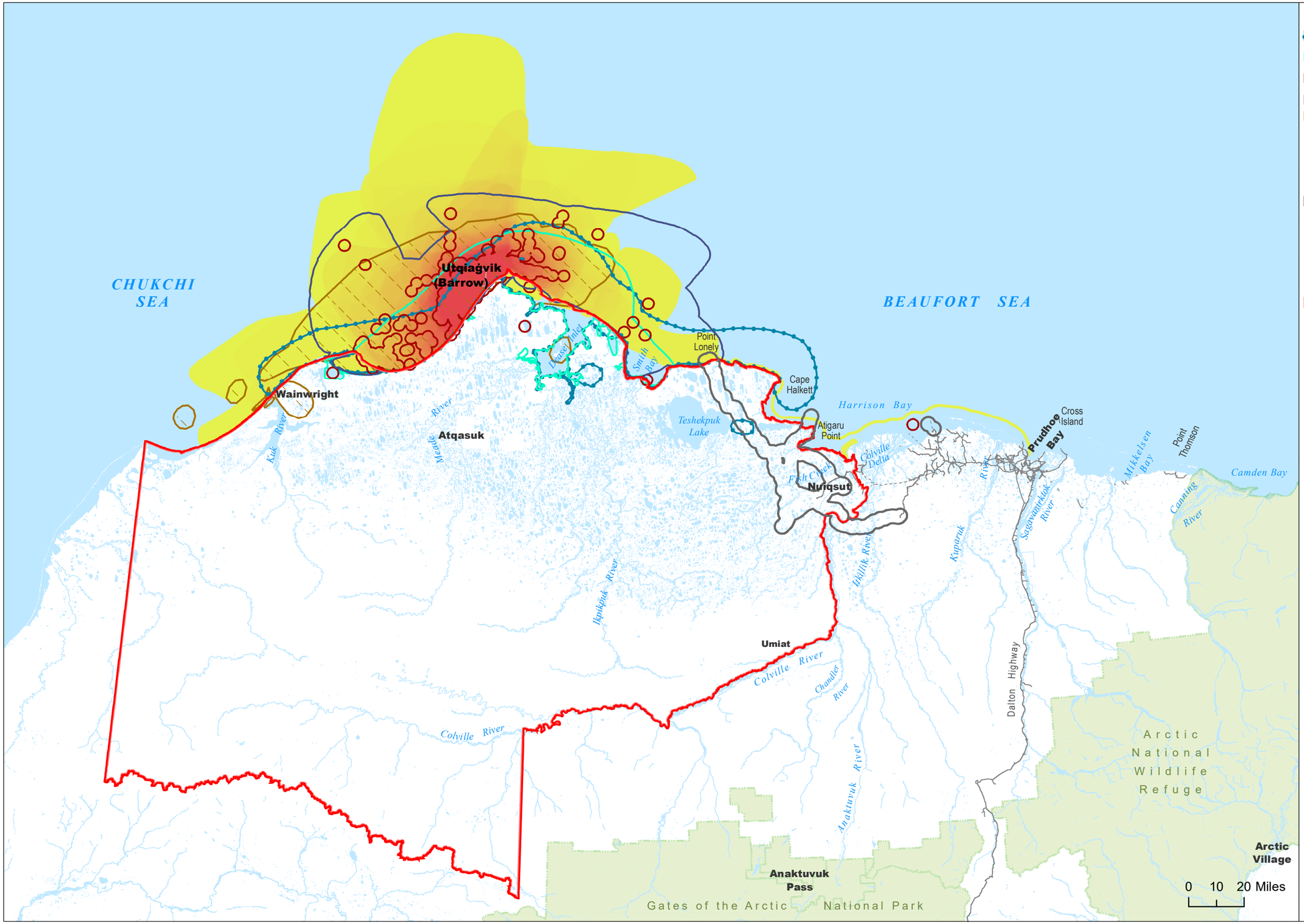
Figure E.16.19



Subsistence Data

- Marine Mammals, Lifetime Previous to 1979 [a]
- Marine Mammals, 1979-1983 [b]
- Marine Mammal Harvest Sites Buffered, 1987-1989 [c]
- Marine Mammals, 1987-1989 [d]
- Marine Mammals, 2014 [e]
- Overlapping Subsistence Use Areas Marine Mammals, 1997-2006 [f] (High / Low)

Willow Proposed Development Features

- Direct Effects Area

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Map prepared by
Stephen R. Braund & Associates

Source
a. Pedersen 1979
b. Alaska Consultants, Inc. 1984
c. SRB&A and ISER 1993
d. SRB&A Unpublished
e. Brown et al. 2016
f. SRB&A 2010a

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure E.16.20

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1.2.2.1.1 Direct Effects Analysis Area

Subsistence use of the direct effects analysis area, defined as the area within 2.5 miles of Project infrastructure, is limited among Utqiaġvik harvesters. For the 1995–2006 time period, use areas overlapping the direct effects analysis area accounted for only 3% of all use areas documented for Utqiaġvik harvesters (Table E.16.10).

Table E.16.10. Utqiaġvik Use Areas within the Direct Effects Analysis Area

Source	Resource Type	Time Period	Total Number of Use Areas	Number (%) of Use Areas in Direct Effects Analysis Area
SRB&A 2010b	All resources	1995–2006	2,029	50 (3%)

In general, the direct effects analysis area is located in the northeastern periphery of Utqiaġvik's extensive subsistence use areas. Resource uses that overlap include caribou, moose, other large land mammals, furbearers and small land mammals, fish, birds, and marine mammals (Figures E.16.12 through E.16.20). Resources that overlap during a majority of study years include caribou, moose, and furbearers and small land mammals. While most resource uses overlap a smaller portion of the direct effects analysis area or overlap areas of low overlapping use, the direct effects analysis area is directly to the east of Teshekpuk Lake, which is an area of high subsistence activity for caribou, furbearers and small land mammals, and fish. In addition, the direct effects analysis area overlaps the Colville River upriver from the community of Nuiqsut, an area used by some Utqiaġvik harvesters for moose hunting during fall.

1.2.2.2 Harvest and Use Data

Tables E.16.11 through E.16.13 provide subsistence harvest data for Utqiaġvik. Intermittent subsistence harvest studies exist for Utqiaġvik harvests from 1987 through 2014, consisting of 10 comprehensive (i.e., all resources) studies (Tables E.16.11 and E.16.13) (Bacon, Hepa et al. 2009; Brown, Braem et al. 2016; Fuller and George 1999; SRB&A and ISER 1993) and four single-resource studies (Table E.16.12) (Naves and Braem 2014). Studies show Utqiaġvik households harvesting between 204 and 362 per capita pounds of subsistence resources during available study years. Marine mammals have contributed the highest amount toward the total subsistence harvests in Utqiaġvik (at least 50% of pounds of usable weight), followed by large land mammals (between 20% and 40% of pounds of usable weight). Non-salmon fish and migratory birds provided a smaller, but substantial, portion of the yearly harvest during most years. While bird harvests appear modest in terms of pounds, residents of Utqiaġvik harvest large numbers of both migratory and upland game birds. In 2014, Utqiaġvik residents harvested an estimated 19,049 migratory birds and 911 upland game birds. The single-resource bird harvest study from the mid-to-late 2000s shows varying levels of bird and egg harvests by Utqiaġvik residents from year to year (Table E.16.12).

In terms of species, bowhead whales have been the most harvested resource during all but 2 study years (1987 and 2014), providing between 28.4% and 64.4% of the subsistence harvest (Table E.16.13). Caribou was the second-most harvested resource during all but 2 study years, accounting for between 16.4% and 31.8% of Utqiaġvik harvests. Other species that have contributed highly to Utqiaġvik subsistence harvests over the study years include seal (bearded and ringed), walrus, whitefish (especially broad whitefish), white-fronted goose, eiders, polar bear, Arctic grayling, and moose. The most recent comprehensive study year (2014) also showed beluga and salmon (chum and sockeye) among the top 10 species harvested. Although only accounting for a small portion of Utqiaġvik's yearly harvest, vegetation (e.g., berries and plants), marine invertebrates (e.g., clams), and eggs are also harvested annually by Utqiaġvik residents.

Table E.16.11. Utqiaġvik Subsistence Harvest Estimates by Resource Category, All Resources Study Years

Study Year	Resource	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[a]	Estimated Harvest Total Pounds[b]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
1987	All resources	–	–	58	–	–	–	621,067	663	206	100.0
1987	Salmon	–	–	3	–	–	196	1,190	1	<1	0.2
1987	Non-salmon fish	–	–	–	–	–	45,367	67,262	72	22	10.8
1987	Large land mammals	–	–	–	–	–	1,660	213,777	228	71	34.4
1987	Small land mammals	–	–	–	–	–	233	58	<1	<1	<0.1
1987	Marine mammals	–	–	41	–	–	–	316,229	337	105	50.9
1987	Migratory birds	–	–	–	–	–	8,125	20,618	22	7	3.3
1987	Upland game birds	–	–	16	–	–	2,454	1,717	2	1	0.3
1987	Vegetation	–	–	3	–	–	–	216	<1	<1	<0.1
1988	All resources	–	–	50	–	–	–	614,669	656	204	100.0
1988	Salmon	–	–	1	–	–	80	490	1	<1	0.1
1988	Non-salmon fish	–	–	14	–	–	38,005	50,571	54	17	8.2
1988	Large land mammals	–	–	27	–	–	1,599	207,005	221	69	33.7
1988	Small land mammals	–	–	–	–	–	152	0	0	0	0.0
1988	Marine mammals	–	–	39	–	–	654	334,069	357	111	54.3
1988	Migratory birds	–	–	34	–	–	7,832	21,419	23	7	3.5
1988	Upland game birds	–	–	9	–	–	1,350	945	1	<1	0.2
1988	Vegetation	–	–	2	–	–	–	169	<1	<1	<0.1
1989	All resources	–	–	61	–	–	–	872,092	931	289	100.0
1989	Salmon	–	–	10	–	–	2,088	12,244	13	4	1.4
1989	Non-salmon fish	–	–	13	–	–	66,199	106,226	113	35	12.2
1989	Large land mammals	–	–	39	–	–	1,705	214,676	229	71	24.6
1989	Small land mammals	–	–	2	–	–	68	7	<1	0	<0.1
1989	Marine mammals	–	–	45	–	–	591	508,181	542	169	58.3
1989	Migratory birds	–	–	37	–	–	12,539	29,215	31	10	3.3
1989	Upland game birds	–	–	5	–	–	329	231	<1	<1	<0.1
1989	Vegetation	–	–	–	–	–	–	1,312	1	<1	0.2
1992[c]	All resources	–	–	–	–	–	–	1,363,738	–	–	100.0
1992[c]	Salmon	–	–	–	–	–	1,161	8,236	–	–	0.6
1992[c]	Non-salmon fish	–	–	–	–	–	50,596	87,769	–	–	6.4
1992[c]	Large land mammals	–	–	–	–	–	2,033	250,447	–	–	18.4
1992[c]	Small land mammals	–	–	–	–	–	260	35	–	–	<0.1
1992[c]	Marine mammals	–	–	–	–	–	1,080	991,528	–	–	72.7
1992[c]	Migratory birds	–	37	–	–	–	10,223	22,922	–	–	1.7
1992[c]	Upland game birds	–	–	–	–	–	1,332	933	–	–	0.1
1992[c]	Eggs	–	–	–	–	–	89	13	–	–	<0.1
1992[c]	Marine invertebrates	–	–	–	–	–	1,774	694	–	–	0.1
1992[c]	Vegetation	–	16	–	–	–	291	1,164	–	–	0.1
1995–1996	All resources	–	–	–	–	–	-	1,179,541	922	282	100.0
1995–1996	Salmon	–	–	–	–	–	288	1,326	1	<1	0.1

Study Year	Resource	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[a]	Estimated Harvest Total Pounds[b]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
1995–1996	Non-salmon fish	–	–	–	–	–	29,334	53,794	42	13	4.6
1995–1996	Large land mammals	–	–	–	–	–	2,155	293,094	229	70	24.8
1995–1996	Small land mammals	–	–	–	–	–	220	115	<1	<1	<0.1
1995–1996	Marine mammals	–	–	–	–	–	886	788,185	616	189	66.8
1995–1996	Migratory birds	–	–	–	–	–	14,725	35,032	27	8	3.0
1995–1996	Upland game birds	–	–	–	–	–	152	117	<1	<1	<0.1
1995–1996	Eggs	–	–	–	–	–	21	3	<1	<1	<0.1
1995–1996	Marine invertebrates	–	–	–	–	–	2,208	6,624	5	2	0.6
1995–1996	Vegetation	–	–	–	–	–	27	109	<1	<1	<0.1
1996–1997	All resources	–	–	–	–	–	–	957,306	837	225	100.0
1996–1997	Salmon	–	–	–	–	–	345	2,011	2	<1	0.2
1996–1997	Non-salmon fish	–	–	–	–	–	27,469	38,333	34	9	4.0
1996–1997	Large land mammals	–	–	–	–	–	1,158	157,420	138	37	16.4
1996–1997	Small land mammals	–	–	–	–	–	157	181	<1	<1	<0.1
1996–1997	Marine mammals	–	–	–	–	–	482	746,965	653	176	78.0
1996–1997	Migratory birds	–	–	–	–	–	4,472	12,210	11	3	1.3
1996–1997	Upland game birds	–	–	–	–	–	224	172	<1	<1	<0.1
1996–1997	Vegetation	–	–	–	–	–	4	14	<1	<1	<0.1
2000	All resources	–	–	–	–	–	–	1,436,020	1255	313	100.0
2000	Salmon	–	–	–	–	–	2,100	11,302	10	2	0.8
2000	Non-salmon fish	–	–	–	–	–	78,065	117,945	103	26	8.2
2000	Large land mammals	–	–	–	–	–	3,382	459,632	402	100	32.0
2000	Small land mammals	–	–	–	–	–	424	453	<1	<1	<0.1
2000	Marine mammals	–	–	–	–	–	1,491	800,582	700	175	55.8
2000	Migratory birds	–	–	–	–	–	15,645	43,949	38	10	3.1
2000	Upland game birds	–	–	–	–	–	1,071	824	1	<1	0.1
2000	Eggs	–	–	–	–	–	2	2	<1	<1	<0.1
2000	Marine invertebrates	–	–	–	–	–	36	109	<1	<1	<0.1
2000	Vegetation	–	–	–	–	–	71	240	<1	<1	<0.1
2001	All resources	–	–	–	–	–	–	1,015,248	887	228	100.0
2001	Salmon	–	–	–	–	–	332	1,949	2	<1	0.2
2001	Non-salmon fish	–	–	–	–	–	4,453	10,165	9	2	1.0
2001	Large land mammals	–	–	–	–	–	1,825	247,991	217	56	24.4
2001	Small land mammals	–	–	–	–	–	91	91	<1	<1	<0.1
2001	Marine mammals	–	–	–	–	–	777	733,448	641	165	72.2
2001	Migratory birds	–	–	–	–	–	6,390	18,815	16	4	1.9
2001	Upland game birds	–	–	–	–	–	1,029	793	1	<1	0.1
2001	Marine invertebrates	–	–	–	–	–	13	38	<1	<1	<0.1
2001	Vegetation	–	–	–	–	–	3	14	<1	<1	<0.1
2003	All resources	–	–	–	–	–	–	1,357,357	970	305	100.0
2003	Salmon	–	–	–	–	–	3,995	24,463	17	5	1.8
2003	Non-salmon fish	–	–	–	–	–	20,109	67,680	48	15	5.0

Study Year	Resource	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[a]	Estimated Harvest Total Pounds[b]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
2003	Large land mammals	–	–	–	–	–	2,093	284,587	203	64	21.0
2003	Small land mammals	–	–	–	–	–	94	50	<1	<1	<0.1
2003	Marine mammals	–	–	–	–	–	1,551	952,837	681	214	70.2
2003	Migratory birds	–	–	–	–	–	8,119	21,261	15	5	1.6
2003	Upland game birds	–	–	–	–	–	443	343	<1	<1	<0.1
2003	Eggs	–	–	–	–	–	12	12	<1	<1	<0.1
2003	Marine invertebrates	–	–	–	–	–	1,733	5,198	4	1	0.4
2003	Vegetation	–	–	–	–	–	61	219	<1	<1	<0.1
2014	All resources	89	57	52	63	87	–	–	1,214	362	100.0
2014	Salmon	69	26	24	26	55	12,087	57,262	36	11	3.0
2014	Non-salmon fish	69	29	27	37	60	106,555	196,049	124	37	10.2
2014	Large land mammals	72	39	33	39	57	4,335	595,004	376	112	30.9
2014	Small land mammals	8	6	5	2	4	1,474	0	0	0	0.0
2014	Marine mammals	71	30	18	45	70	1,792	1,020,943	645	192	53.1
2014	Migratory birds	53	32	29	29	35	19,049	48,271	31	9	2.5
2014	Upland game birds	9	9	8	4	1	911	638	0	0	<0.1
2014	Eggs	13	7	7	3	7	3,688	1,113	1	0	0.1
2014	Marine invertebrates	7	2	2	2	5	561	1,096	1	0	0.1
2014	Vegetation	43	18	16	15	35	853	2,975	2	1	0.2

Source: 1995–1996, 1996–1997, 2000, 2001, 2003 (Bacon, Hepa et al. 2009); 2014 (Brown, Braem et al. 2016); 1992 (Fuller and George 1999); 1987–1989 (SRB&A and ISER 1993)
Note: "–" (No Data). "All Resources" study years are years where studies addressed all subsistence resources harvested by the community, rather than selected resources or species.
[a] Estimated numbers represent individuals in all cases except vegetation, where they represent gallons. The estimated harvest numbers for the 1995–1996, 1996–1997, 2000, 2001, and 2003 data were derived by summing individual species in each resource category.
[b] Estimated pounds include only edible pounds and therefore do not include estimates for resources that are not typically eaten by community residents (e.g., furbearers). The total pounds for the 1995–1996, 1996–1997, 2000, 2001, and 2003 data were derived from conversion rates found at ADF&G (2018) and total (usable) pounds for bowhead whales were calculated based on the method presented in SRB&A and ISER (1993). These estimates do not account for whale girth and should be considered approximate; more exact methods for estimating total whale weights are available in George et al. (n.d.).
[c] Household participation for the 1992 study year is based on Table A5 in Fuller and George (1999); participation in migratory bird harvests includes waterfowl and eggs. Participation in vegetation harvests includes only berries.

Participation in subsistence activities by Utqiaġvik households is relatively high. Available data show that at least half of Utqiaġvik households successfully harvested subsistence resources during each of the study years (Table E.16.11). An even higher percentage of households used subsistence resources; in 2014, 89% of Utqiaġvik households used subsistence resources. Household participation rates were particularly high in harvests of marine mammals, migratory birds, large land mammals, and non-salmon fish (Table E.16.11). Sharing is an important tool for maintaining social networks and distributing food throughout the community. In 2014, 87% of Utqiaġvik households received subsistence resources and 63% gave subsistence resources away. The most commonly received resources included marine mammals, non-salmon fish, and large land mammals.

Table E.16.12. Utqiaġvik Subsistence Harvest Estimates by Resource Category, Single-Resource Study Years

Study Year	Resource	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number	Estimated Harvest Total Pounds	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds
2005	Birds	–	–	–	–	–	10,943	–	–	–
2007	Birds	–	–	–	–	–	38,152	–	–	–
2008	Birds	–	–	–	–	–	35,250	–	–	–
2009	Birds*	–	–	–	–	–	8,664	–	–	–
2005	Eggs	–	–	–	–	–	32	–	–	–
2007	Eggs	–	–	–	–	–	1,783	–	–	–
2008	Eggs	–	–	–	–	–	204	–	–	–
2009	Eggs	–	–	–	–	–	88	–	–	–

Source: 2005, 2007, 2008, 2009 (Naves and Braem 2014)
Note: "–" (No Data). Estimated harvest number for birds includes upland game birds and migratory birds combined.

Table E.16.13. Utqiaġvik Subsistence Harvest Estimates by Selected Species, All Study Years

Study Year	Resource[a]	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[b]	Estimated Harvest Total Pounds[c]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
1987	Caribou	–	–	26	–	–	1,595	186,669	199	62	30.1
1987	Bowhead whale	–	–	31	–	–	7	184,629	197	61	29.7
1987	Walrus	–	–	11	–	–	84	64,663	69	21	10.4
1987	Bearded seal	–	–	25	–	–	236	41,518	44	14	6.7
1987	Broad whitefish	–	–	11	–	–	10,579	27,519	29	9	4.4
1987	Moose	–	–	6	–	–	52	25,786	28	9	4.2
1987	Ringed seal	–	–	14	–	–	466	19,574	21	6	3.2
1987	White-fronted Geese	–	–	16	–	–	2,417	10,879	12	4	1.8
1987	Unknown whitefish	–	–	3	–	–	5,108	10,215	11	3	1.6
1987	Arctic grayling	–	–	14	–	–	12,664	10,131	11	3	1.6
1987	Unknown Eider	–	–	21	–	–	5,080	7,621	8	3	1.2
1987	Least cisco	–	–	–	–	–	7,024	7,024	8	2	1.1
1988	Bowhead whale	–	–	35	–	–	11	233,313	249	77	38.0
1988	Caribou	–	–	27	–	–	1,533	179,314	191	59	29.2
1988	Walrus	–	–	6	–	–	61	47,215	50	16	7.7
1988	Bearded seal	–	–	11	–	–	179	31,436	34	10	5.1
1988	Broad whitefish	–	–	11	–	–	11,432	29,423	31	10	4.8
1988	Moose	–	–	4	–	–	53	26,367	28	9	4.3
1988	Ringed seal	–	–	10	–	–	388	16,304	17	5	2.7
1988	White-fronted Geese	–	–	19	–	–	3,035	13,657	15	5	2.2

Study Year	Resource[a]	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[b]	Estimated Harvest Total Pounds[c]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
1988	Least cisco	–	–	2	–	–	–	7,505	8	2	1.2
1988	Arctic grayling	–	–	11	–	–	8,684	6,947	7	2	1.1
1988	Unknown Eider	–	–	20	–	–	4,454	6,682	7	2	1.1%
1989	Bowhead whale	–	–	45	–	–	10	377,647	403	125	43.3
1989	Caribou	–	–	39	–	–	1,656	193,744	207	64	22.2
1989	Broad whitefish	–	–	–	–	–	30,047	78,921	84	26	9.0
1989	Walrus	–	–	13	–	–	101	77,987	83	26	8.9
1989	Moose	–	–	6	–	–	40	20,014	21	7	2.3
1989	Polar bear	–	–	4	–	–	39	19,471	21	6	2.2
1989	Bearded seal	–	–	11	–	–	109	19,152	20	6	2.2
1989	Ringed Seal	–	–	11	–	–	328	13,774	15	5	1.6
1989	White-fronted Geese	–	–	12	–	–	2,932	13,193	14	4	1.5
1989	Unknown Eider	–	–	37	–	–	8,406	12,610	13	4	1.4
1989	Humpback Whitefish	–	–	10	–	–	3,648	9,119	10	3	1.0
1992[d]	Bowhead whale	–	–	–	–	–	22	729,952	–	–	53.5
1992[d]	Caribou	–	46	–	–	–	1,993	233,206	–	–	17.1
1992[d]	Walrus	–	26	–	–	–	206	159,236	–	–	11.7
1992[d]	Bearded seal	–	–	–	–	–	463	81,471	–	–	6.0
1992[d]	Broad whitefish	–	–	–	–	–	23,997	59,993	–	–	4.4
1992[d]	Moose	–	–	–	–	–	34	17,115	–	–	1.3
1995–1996	Bowhead Whale	–	–	–	–	–	19	582,283	455	139	49.4
1995–1996	Caribou	–	–	–	–	–	2,155	293,094	229	70	24.8
1995–1996	Bearded Seal	–	–	–	–	–	431	123,352	96	30	10.5
1995–1996	Walrus	–	–	–	–	–	74	56,672	44	14	4.8
1995–1996	Unknown Eider	–	–	–	–	–	12,064	26,631	21	6	2.3
1995–1996	Ringed Seal	–	–	–	–	–	345	19,665	15	5	1.7
1995–1996	Broad Whitefish	–	–	–	–	–	5,130	16,415	13	4	1.4
1995–1996	Rainbow Smelt	–	–	–	–	–	2,164	12,983	10	3	1.1
1996–1997	Bowhead Whale	–	–	–	–	–	24	616,555	539	145	64.4
1996–1997	Caribou	–	–	–	–	–	1,158	157,420	138	37	16.4
1996–1997	Walrus	–	–	–	–	–	78	59,752	52	14	6.2
1996–1997	Bearded Seal	–	–	–	–	–	192	54,998	48	13	5.7
1996–1997	Broad Whitefish	–	–	–	–	–	6,684	21,388	19	5	2.2
1996–1997	Least Cisco	–	–	–	–	–	16,519	11,563	10	3	1.2
1996–1997	Ringed Seal	–	–	–	–	–	180	10,243	9	2	1.1
2000	Bowhead Whale	–	–	–	–	–	18	462,822	405	101	32.2
2000	Caribou	–	–	–	–	–	3,359	456,851	399	100	31.8
2000	Bearded Seal	–	–	–	–	–	729	208,380	182	45	14.5
2000	Walrus	–	–	–	–	–	115	88,781	78	19	6.2
2000	Broad Whitefish	–	–	–	–	–	21,318	68,217	60	15	4.8
2000	Ringed Seal	–	–	–	–	–	586	33,379	29	7	2.3
2000	White-fronted Geese	–	–	–	–	–	7,455	23,708	21	5	1.7
2000	Least Cisco	–	–	–	–	–	23,839	16,687	15	4	1.2
2000	Grayling	–	–	–	–	–	15,228	13,705	12	3	1.0
2001	Bowhead Whale	–	–	–	–	–	27	525,899	460	118	51.8
2001	Caribou	–	–	–	–	–	1,820	247,520	216	56	24.4
2001	Walrus	–	–	–	–	–	123	95,018	83	21	9.4
2001	Bearded Seal	–	–	–	–	–	327	93,522	82	21	9.2
2001	Ringed Seal	–	–	–	–	–	287	16,342	14	4	1.6
2001	White-fronted Geese	–	–	–	–	–	3,939	12,526	11	3	1.2
2003	Bowhead Whale	–	–	–	–	–	16	457,034	327	103	33.7
2003	Caribou	–	–	–	–	–	2,092	284,444	203	64	21.0
2003	Walrus	–	–	–	–	–	313	241,318	172	54	17.8

Study Year	Resource[a]	Percentage of Households Use	Percentage of Households Try to Harvest	Percentage of Households Harvest	Percentage of Households Give	Percentage of Households Receive	Estimated Harvest Number[b]	Estimated Harvest Total Pounds[c]	Estimated Harvest Average Household Pounds	Estimated Harvest Per Capita Pounds	Percentage of Total Harvest
2003	Bearded Seal	–	–	–	–	–	776	221,965	159	50	16.4
2003	Capelin (grunion)	–	–	–	–	–	5,285	31,708	23	7	2.3
2003	Broad Whitefish	–	–	–	–	–	8,207	26,263	19	6	1.9
2003	Ringed Seal	–	–	–	–	–	413	23,513	17	5	1.7
2014	Caribou	70	38	33	38	52	4,323	587,897	371	111	30.6
2014	Bowhead	70	24	12	43	67	18	546,085	345	103	28.4
2014	Bearded seal	44	22	15	27	32	1,070	306,097	193	58	15.9
2014	Broad whitefish	54	22	20	29	40	43,962	140,679	89	26	7.3
2014	Walrus	31	11	4	17	27	135	103,602	65	19	5.4
2014	White-fronted Geese	39	23	22	20	22	9,595	29,745	19	6	1.5
2014	Ringed seal	19	10	8	11	11	428	24,402	15	5	1.3
2014	Beluga	15	4	0	9	14	25	24,341	15	5	1.3
2014	Chum salmon	24	13	11	10	15	4,039	24,312	15	5	1.3
2014	Sockeye salmon	29	9	9	11	23	4,630	18,667	12	4	1.0
2015	Caribou	–	44	–	–	–	3,000	351,000	–	–	–
2019	Caribou	–	–	–	–	–	3,273	–	–	–	–

Source: 1995–1996, 1996–1997, 2000, 2001, 2003 (Bacon, Hepa et al. 2009); 1995–1996, 1996–1997, 2000, 2001, 2003 (Brown, Braem et al. 2016); 1992 (Fuller and George 1999); 1987, 1988, 1999 (SRB&A and ISER 1993); 2015 (SRB&A 2017b); 2019 (NSB 2020).
Note: "–" (No Data).
[a] This table shows individual species unless they are not available for a given study year. For all resources study years (1987, 1988, 1989, 1992, 1995–1996, 1996–1997, 2000, 2001, and 2003), species are listed in descending order by their percentage of the total harvest and are limited to species accounting for at least 1% of the total harvest; for single-resource study years, species are listed in descending order by the total estimated pounds (or total number harvested in the case of salmon study years) and limited to the five top species. Years lacking "percentage of total harvest" data were not comprehensive (i.e., all resources) study years.
[b] Estimated numbers represent individuals in all cases except vegetation, where they represent gallons. The estimated harvest numbers for the 1995–1996, 1996–1997, 2000, 2001, and 2003 data were derived by summing individual species in each resource category.
[c] Estimated pounds include only edible pounds and therefore do not include estimates for resources that are not typically eaten by community residents (e.g., furbearers). The total pounds for the 1995–1996, 1996–1997, 2000, 2001, and 2003 data were derived from conversion rates found at ADF&G (2018), and total (usable) pounds for bowhead whales were calculated based on the method presented in SRB&A and ISER (1993). These estimates do not account for whale girth and should be considered approximate; more exact methods for estimating total whale weights are available in George et al. (n.d.).
[d] Household participation for the 1992 study year based on Table A5 in Fuller and George (1999).

1.2.2.2.1 Direct Effects Analysis Area

Utqiaġvik harvesters primarily use the direct effects analysis area to hunt for wolf, wolverine, moose, and caribou; a small number of Utqiaġvik harvesters have reported using the area for harvests of seal and goose. As shown in Table E.16.13, caribou are among the top species harvested, in terms of edible weight, by the community of Utqiaġvik. During the most recent study year (2014), over one-third (38%) of Utqiaġvik households participated in hunting caribou (the percentage would likely be higher among Native households only). Moose harvests have accounted for up to 4% of the harvest in some years; however, in recent years, these harvests have contributed less than 1% of the harvest. Similar to Nuiqsut, wolf and wolverine hunting is practiced by a smaller proportion of households; 6% of households participated in the harvest of small land mammals in 2014 (Table E.16.11; this percentage was also likely higher among Native households). However, furbearer hunting and associated income and activities are an important component of Iñupiat culture, and Utqiaġvik furbearer harvesters often expend substantial time, money, and effort in their pursuits. Data on harvest amounts specific to the direct effects analysis area are not available for Utqiaġvik.

Based on data from SRB&A (2010b), which collected subsistence use areas for key resources for the 1997–2006 time period, the direct effects analysis area is used by moose hunters (44% of harvesters), wolf and wolverine hunters (29% of harvesters), and caribou hunters (26% of harvesters) (Table E.16.14). The Colville River drainage is a primary moose hunting area on the North Slope, and some Utqiaġvik residents will travel to the Nuiqsut area by plane or boat to access this harvesting area. A small number of individuals have reported traveling to the direct effects analysis area to harvest bearded seal, ringed seal, and goose (2% of harvesters or less). For resources as a whole, approximately one-quarter (31%) of Utqiaġvik harvesters reported using the direct effects analysis area for subsistence purposes during the 1997–2006 time period (Table E.16.14).

Table E.16.14. Utqiaġvik Harvesters Using the Direct Effects Analysis Area, 1997–2006

Resource Category	Total Number of Respondents for Resource	Number of Respondents in Direct Effects Analysis Area	Percentage of Utqiaġvik Resource Respondents
Wolverine	31	9	29%
Wolf	31	9	29%
Caribou	73	19	26%
Moose	9	4	44%
Bearded seal	63	1	2%
Ringed seal	48	1	2%
Goose	71	1	1%
All resources	**75**	**23**	**31%**

Source: SRB&A 2010b

1.2.2.3 Timing of Subsistence Activities

Table E.16.15 provides data on the timing of Utqiaġvik subsistence activities based on reports from the 1980s through the 2010s. Overall, Utqiaġvik harvesters target the greatest number of resources in August and September. These months are a primary time for harvests of non-salmon fish, salmon, caribou, moose and other large land mammals, marine mammals, and plants and berries.

Table E.16.15. Utqiaġvik Annual Cycle of Subsistence Activities

Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater non-salmon	L	L	L	L	M	M	H	H	H	H	M	L
Marine non-salmon	L	L	L	ND	ND	L	M	H	H	M	L	ND
Salmon	ND	ND	ND	ND	L	L	H	H	M	L	ND	ND
Caribou	L	L	L	L	L	L	H	H	H	H	L	L
Moose	ND	L	L	M	M	M	M	H	H	ND	ND	ND
Bear	ND	ND	ND	L	L	L	L	M	H	L	ND	ND
Dall sheep	ND	ND	H	ND	ND	ND	ND	L	ND	ND	ND	ND
Muskox	ND	ND	H	ND	ND	ND	ND	ND	H	ND	ND	ND
Furbearers	H	H	H	M	L	L	ND	ND	L	M	H	H
Small land mammals	ND	L	L	H	H	L	M	L	M	L	L	ND
Marine mammals	L	L	L	M	M	M	H	H	H	M	M	L
Upland birds	L	L	L	M	H	M	L	L	L	L	L	L
Waterfowl	L	L	L	M	H	M	L	L	L	L	L	L
Marine invertebrates	ND	ND	ND	ND	ND	M	L	M	H	L	L	ND
Plants and berries	ND	ND	ND	ND	L	L	L	H	M	ND	ND	ND
Total number of resource categories by month	**7**	**9**	**11**	**9**	**11**	**13**	**12**	**13**	**14**	**11**	**9**	**6**

Source: (Bacon, Hepa et al. 2009; Braem, Kaleak et al. 2011; Brown, Braem et al. 2016; EDAW Inc., Adams/Russel Consulting et al. 2008; Schneider, Pedersen et al. 1980; SRB&A 2010b; SRB&A and ISER 1993; SRB&A 2017b)
Note: ND (no documented activity and/or harvests); H (high activity and/or harvests); L (limited activity and/or harvests); M (moderate activity and/or harvests).

The spring subsistence season (April and May) in Utqiaġvik is primarily dedicated to hunting bowhead whales, with some additional harvests of other marine mammals, including seals and polar bears. Hunting waterfowl such as eiders and white-fronted goose begins during these spring months (Brown, Braem et al. 2016) and, particularly for eiders, continues into the summer months. Harvests of goose peak in May and eider hunting occurs offshore during the spring whaling season (generally when leads are closed and whaling crews are not actively hunting whales).

The summer months (June–August) are a time of diversified subsistence activity when residents travel into the ocean and along various river systems in pursuit of marine, terrestrial, and riverine resources. A primary focus during the summer and fall months is hunting marine mammals (e.g., bearded and ringed seals, walruses) offshore as they migrate north with the floe ice, with eiders often a secondary target. Residents travel along the coast and inland during the summer months to hunt caribou and harvest a variety of fish in lagoons and rivers. The peak caribou hunting season is in July and August when they are available to hunters traveling by boat along the coast and on local waterways. Residents also harvest berries and other vegetation during these boating trips.

The fall bowhead whale hunt is a major focus during September and October. In addition, caribou, fish, and birds remain sought-after resources throughout fall. During August and September, some Utqiaġvik residents may travel to the Colville River to harvest moose and berries (Brown, Braem et al. 2016; Fuller and George 1999). Bacon et al. (2009) and SRB&A (2010b) also show some eider duck harvesting continuing into these fall months. The subsistence fish harvest generally peaks in October (under-ice fishery) when whitefish and Arctic grayling

are concentrated at overwintering areas. The winter months (November–March) are primarily spent hunting and trapping furbearers, in addition to harvesting caribou, ringed seals, upland birds (ptarmigan), the occasional polar bear, and fish.

1.2.2.3.1 Direct Effects Analysis Area

Utqiaġvik harvesters use the direct effects analysis area at varying levels throughout the year (Figure E.16.21). For all resources for the 1997–2006 time period, use of the direct effects analysis area is highest in February and March, with lower levels occurring throughout the rest of the year. Caribou hunting in the direct effects analysis area peaks during February and March and during July and August. Moose hunting occurs solely in August and September. Wolf and wolverine hunters use the direct effects analysis area solely during November through April, with a peak in February and March, when snow conditions allow for extensive overland travel and furs are prime. The limited seal and goose hunting reported by Utqiaġvik harvesters occurs primarily during the spring (April and May for seal; May and June for goose).

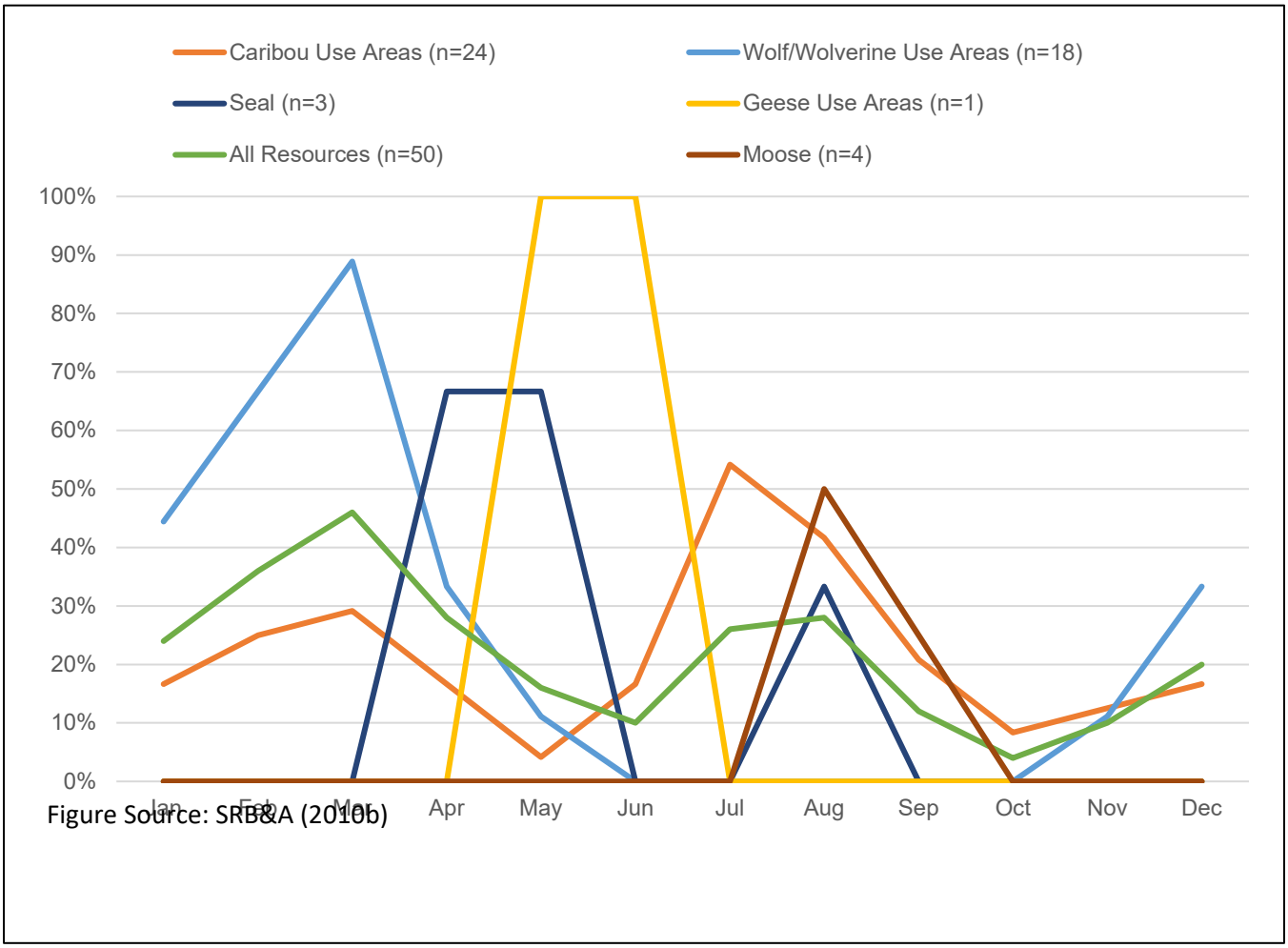

Figure Source: SRB&A (2010b)

Figure E.16.21. Utqiaġvik Subsistence Use Areas by Month in the Direct Effects Analysis Area, by Resource

1.2.2.4 Travel Methods

Table E.16.16 shows the primary travel methods used for key species, as documented in SRB&A (2010b). Boat is the primary method of travel used by Utqiaġvik residents for subsistence pursuits of certain non-salmon fish, caribou, bowhead whale, seals, walrus, and eider. Snow machine is the primary method for late fall and winter pursuits of Arctic cisco, burbot, moose, wolf, wolverine, and goose. To a lesser extent, Utqiaġvik residents also travel by foot, car/truck, ATV, and plane to access subsistence use areas.

Table E.16.16. Utqiaġvik Travel Method to Subsistence Use Areas

Resources	Boat	Snow Machine	Foot	Car/Truck	ATV	Plane
Arctic cisco and burbot	M	H	ND	L	L	M
Arctic char/Dolly Varden and broad whitefish	H	M	ND	M	M	L
Caribou	H	M	L	L	M	L
Moose	M	H	ND	ND	ND	ND
Wolf and wolverine	ND	H	ND	ND	ND	ND
Bowhead whale	H	M	ND	ND	ND	ND
Seals	H	M	ND	ND	ND	ND
Walrus	H	L	ND	ND	ND	ND
Goose	M	H	L	L	M	L
Eider	H	M	L	M	L	ND

Source: 1996–2007 (SRB&A 2010b)
Note: ND (no documented use of travel method); ATV (all-terrain vehicle); H (high use of travel method); L (limited use of travel method); M (moderate use of travel method).

1.2.2.4.1 Direct Effects Analysis Area

As shown in Figure E.16.22, for the 1997–2006 time period, snow machine was the primary method used to access the direct effects analysis area (58% of use areas), followed by boat (42%). Snow machine/overland travel generally occurs between November and April (Figure E.16.21), whereas coastal and riverine boat travel generally occurs from June through September.

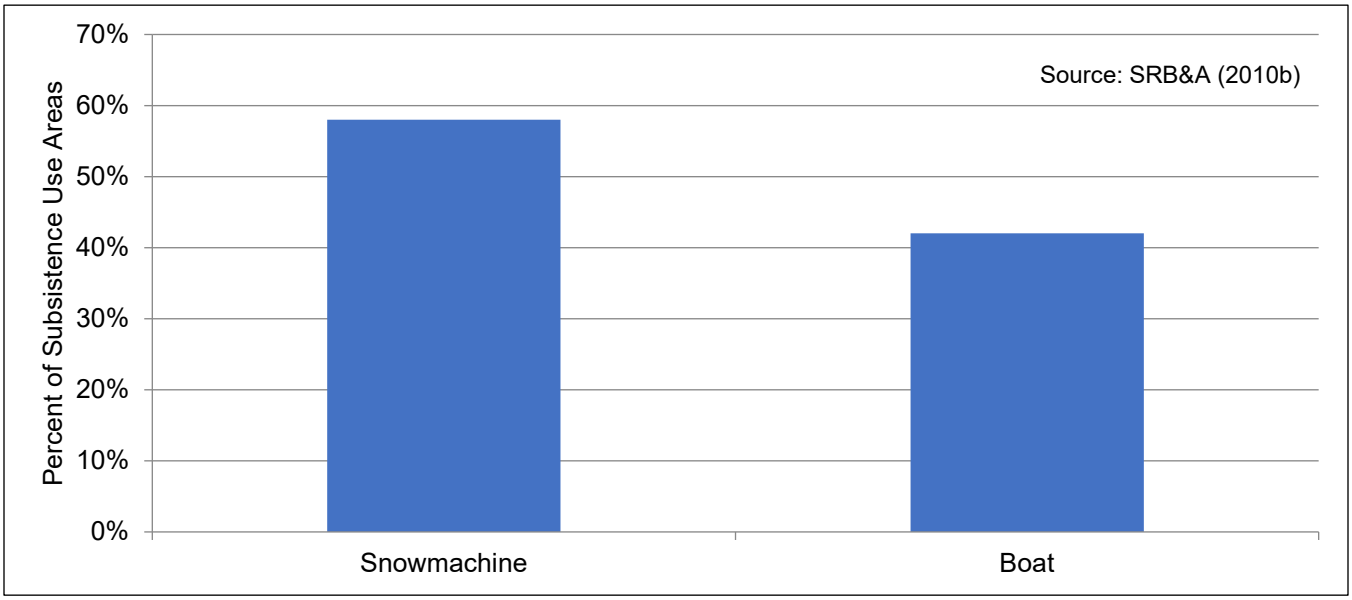

Figure E.16.22. Utqiaġvik Travel Methods, Direct Effects Analysis Area

1.2.2.5 Resource Importance

An analysis of resource importance for Utqiaġvik based on harvest (average percentage of total harvest), harvest effort (average percentage of households attempting to harvest) and sharing (average percentage of households receiving) variables is provided in Table E.16.17. Based on this analysis, resources of major importance in Utqiaġvik are bearded seal, bowhead whale, and caribou.

Table E.16.17. Relative Importance of Subsistence Resources Based on Selected Variables, Utqiaġvik

Resource Importance	Resource[a]	Percentage of Households Trying to Harvest	Percentage of Households Receiving	Percentage of Total Harvest
Major resources[b]	Bearded seal	22	32	9.2
Major resources[b]	Bowhead whale	24	67	42.4
Major resources[b]	Caribou	43	52	24.8
Moderate resources[c]	Walrus	19	27	8.8
Moderate resources[c]	Broad whitefish	22	40	4.1

Resource Importance	Resource[a]	Percentage of Households Trying to Harvest	Percentage of Households Receiving	Percentage of Total Harvest
Moderate resources[c]	Moose	2	13	2.5
Moderate resources[c]	Ringed seal	10	11	1.8
Moderate resources[c]	White-fronted goose	23	22	1.3
Moderate resources[c]	Sockeye salmon	9	23	1
Moderate resources[c]	Arctic cisco	5	33	<1
Moderate resources[c]	Arctic grayling	13	17	<1
Moderate resources[c]	Beluga	4	14	<1
Moderate resources[c]	Blueberry	4	14	<1
Moderate resources[c]	Chinook/king salmon	5	12	<1
Moderate resources[c]	Chum/dog salmon	13	15	<1
Moderate resources[c]	Coho/silver salmon	9	20	<1
Moderate resources[c]	King eider	16	14	<1
Moderate resources[c]	Pink/humpback salmon	9	12	<1
Moderate resources[c]	Rainbow smelt	2	18	<1
Moderate resources[c]	Salmonberry/Cloudberry	12	30	<1
Minor resources[d]	Common eider	9	9	<1
Minor resources[d]	Halibut	3	8	<1
Minor resources[d]	Humpback whitefish	7	5	<1
Minor resources[d]	Least cisco	6	7	<1
Minor resources[d]	Polar bear	2	6	<1
Minor resources[d]	Ptarmigan	9	1	<1
Minor resources[d]	Sheefish	–	6	–
Minor resources[d]	Snow goose	5	2	<1
Minor resources[d]	Wolf	<5	<5	<1
Minor resources[d]	Wolverine	<5	<5	<1

Source: 1995 to 1996, 1996 to 1997, 2000, 2001, 2003 (Bacon, Hepa et al. 2009); 2014 (Brown, Braem et al. 2016); 1992 (Fuller and George 1999); 1987 to 1989 (SRB&A and ISER 1993); 2015 (SRB&A 2017b); 2019 (NSB 2020)

Note: "–" (resource was not harvested or no households attempted to harvest the resource).

[a] For space considerations, resources that contributed an average of less than 1% of the harvest, less than 5% attempting to harvest, and less than 5% receiving resources are categorized as minor and are not shown.

[b] Major resources contribute >9% of the total harvest, have ≥50% of households attempting to harvest, or have ≥50% of households receiving resources.

[c] Moderate resources contribute 2% to 9% of the total harvest, have 11% to 49% of households attempting to harvest, or have 11% to 49% of households receiving resources.

[d] Minor resources contribute <2% of the total harvest, have ≤10% of households attempting to harvest, or have ≤10% of households receiving resources. For space considerations, resources contributing an average of less than 1% of the harvest, less than 5% attempting to harvest, and less than 5% receiving resources are categorized as minor and are not shown. While wolf and wolverine fall below the threshold for inclusion (less than 1% of material importance and less than 5% of cultural importance), they are included because of their relevance to the analysis area.

2.0 COMPARISON OF ACTION ALTERNATIVES AND OPTIONS

Tables E.16.18 and E.16.19 summarize and compare impacts to subsistence use areas among the action alternatives and module delivery options.

Table E.16.18. Comparison of Impacts to Subsistence Uses for Nuiqsut*

Effects To	Alternative B: Proponent's Project	Alternative C: Disconnected Infield Roads	Alternative D: Disconnected Access	Alternative E: Three-Pad Alternative (Fourth Pad Deferred)	Option 1: Atigaru Point Module Transfer Island	Option 2: Point Lonely Module Transfer Island	Option 3: Colville River Crossing
Resources (importance)	Caribou (major) Furbearers (minor)[a] Waterfowl (major) Fish (major)	Same as Alternative B	Same as Alternative B	Same as Alternative B	Caribou (major) Furbearers (minor)[a] Waterfowl (major) Seals (major)	Caribou (major) Furbearers (minor)[a] Waterfowl (major)	Caribou (major) Furbearers (minor) Waterfowl (major)
Resource abundance	No impacts to overall abundance expected	Same as Alternative B	Same as Alternative B	Same as Alternative B	No impacts to overall abundance expected	Same as Option 1	Same as Option 1
Resource availability	Caribou: Greatest potential for impacts to resource availability Furbearers: High likelihood of reduced furbearer availability near the Project Waterfowl, fish: Low likelihood as Project does not overlap with areas of high overlapping subsistence use and large-scale contamination events are unlikely	Caribou: Impacts to caribou resource availability reduced from Alternative B. Increase in air traffic impacts would be offset by decreased infrastructure and potential for deflection. Furbearers, waterfowl, fish: Same as Alternative B	Caribou: Least potential for impacts to resource availability. Increase in air traffic impacts would be offset by decreased infrastructure and potential for deflection. Furbearers, waterfowl, fish: Same as Alternative B	Caribou: Impacts to caribou resource availability reduced from Alternative B due to the reduction in length of road and other infrastructure. Furbearers, waterfowl, fish: Same as Alternative B	Caribou: Impacts are minimal due to the winter timing of activities Furbearers: High likelihood of reduced availability near ice roads Waterfowl: Moderate likelihood of reduced availability during one spring hunting season Seals: Moderate likelihood of reduced availability to individual hunters during multiple summers	Caribou: Impacts are minimal due to the winter timing of activities Furbearers: High likelihood of reduced furbearer availability near ice roads Waterfowl: Moderate likelihood of reduced waterfowl during one spring hunting season	Caribou: Impacts are minimal due to the winter timing of activities Furbearers: Moderate likelihood of reduced furbearer availability near ice roads during two hunting seasons Waterfowl: Low likelihood of reduced availability during two spring hunting seasons

Effects To	Alternative B: Proponent's Project	Alternative C: Disconnected Infield Roads	Alternative D: Disconnected Access	Alternative E: Three-Pad Alternative (Fourth Pad Deferred)	Option 1: Atigaru Point Module Transfer Island	Option 2: Point Lonely Module Transfer Island	Option 3: Colville River Crossing
Harvester access	High likelihood of impacts during the construction phase due to the lack of ice road access on gravel haul ice roads near the community and barriers to overland travel due to high traffic levels Moderate likelihood of impacts during operation due to physical obstructions and safety considerations while hunting along roads Moderate likelihood of increased access although the use of roads may decrease with distance from the community	Same as Alternative B	High likelihood of impacts during the construction phase due to the lack of ice road access on gravel haul ice roads near the community and barriers to overland travel due to high traffic levels Lower likelihood of impacts to access during operation due to fewer physical obstructions to access. Impacts related to safety considerations would remain Low likelihood of increased access although the use of roads may decrease with distance from the community	Same as Alternative B	Caribou, furbearers, waterfowl: High likelihood of impacts during the construction phase due to the lack of ice road access on gravel haul and module transport ice roads near the community and barriers to overland travel due to high traffic levels Seals: Low to moderate likelihood of impacts as the module transfer island is on the periphery of the hunting area General: Low likelihood of changes to access in nearshore/coastal areas due to erosion/sedimentation	Caribou, furbearers, waterfowl: High likelihood of impacts during the construction phase due to the lack of ice road access on gravel haul ice roads near the community and barriers to overland travel due to high traffic levels	Caribou, furbearers: Moderate likelihood of impacts during the construction phase due to the periodic lack of ice road access on module transport ice roads in high-use winter hunting areas and potential barriers to overland travel
Community-level impacts	Impacts are most likely to occur for Nuiqsut Harvesters (up to 91% directly affected)	Same as Alternative B	Same as Alternative B	Same as Alternative B	Impacts are most likely to occur for Nuiqsut Harvesters (up to 94% directly affected)	Impacts are most likely to occur for Nuiqsut Harvesters (up to 94% directly affected)	Impacts are most likely to occur for Nuiqsut Harvesters (up to 91% directly affected)

[a] Despite being characterized as a resource of minor importance based on selected measures, furbearer hunting and trapping is a specialized activity with unique importance to Nuiqsut and Utqiaġvik.

Table E.16.19. Comparison of Impacts to Subsistence Uses for Utqiaġvik*

Effects To	Alternative B: Proponent's Project	Alternative C: Disconnected Infield Roads	Alternative D: Disconnected Access	Alternative E: Three -Pad Alternative	Option 1: Atigaru Point Module Transfer Island	Option 2: Point Lonely Module Transfer Island	Option 3: Colville River Crossing
Resources (importance)	Caribou (major) Furbearers (minor)[a]	Same as Alternative B	Same as Alternative B	Same as Alternative B	Caribou (major) Furbearers (minor)[a]	Same as Option 1	Same as Option 1
Resource abundance	No impacts to overall abundance expected	Same as Alternative B	Same as Alternative B	Same as Alternative B	No impacts to overall abundance expected	Same as Option 1	Same as Option 1
Resource availability	Caribou: Low potential for impacts to resource availability Furbearers: Low to moderate likelihood of reduced availability as the Project does not overlap with areas of high overlapping subsistence use but occurs to the east of moderate overlapping use	Same as Alternative B	Same as Alternative B	Same as Alternative B	Caribou: Low potential for impacts to resource availability Furbearers: Low to moderate likelihood of reduced availability as the Project does not overlap with areas of high overlapping subsistence use but occurs to the east of moderate overlapping use	Furbearers and caribou: Low to moderate likelihood of reduced availability as high-volume ice roads would occur directly to the east of high overlapping use to the south of Teshekpuk Lake	Caribou and furbearers: Low potential for impacts to resource availability due to the location of the ice road in the periphery of community use areas
Harvester access	Low likelihood of reduced access as the Project does not overlap with areas of high overlapping subsistence use Low likelihood of increased access	Same as Alternative B	Same as Alternative B	Same as Alternative B	Low likelihood of reduced access as the Project does not overlap with areas of high overlapping subsistence use	Same as Option 1	Same as Option 1
Community-level impacts	Impacts may occur for Utqiaġvik but are less likely (up to 12% directly affected)	Same as Alternative B	Same as Alternative B	Same as Alternative B	Impacts may occur for Utqiaġvik but are less likely (up to 11% directly affected)	Impacts are more likely to occur for Utqiaġvik harvesters under Option 2 (up to 23% of harvesters) compared to Option 1 (up to 11% of harvesters). In addition, the Point Lonely option is more likely to cause indirect impacts to Utqiaġvik harvesters than Option 1 because of its proximity to key Utqiaġvik harvesting areas at Teshekpuk Lake	Impacts could affect a higher percentage of Utqiaġvik harvesters under Option 3 (15% of harvesters) compared to Option 1 (11% of harvesters) but would be less likely because of the greater distance of the ice road infrastructure from the community

[a] Despite being characterized as a resource of minor importance based on selected measures, furbearer hunting and trapping is a specialized activity with unique importance to Nuiqsut and Utqiaġvik.

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Appendix E.17
Environmental Justice Technical Appendix

There is no technical appendix for this resource

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Appendix E.18
Public Health Technical Appendix

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List of Acronyms

BLM	Bureau of Land Management
DHSS	Alaska Department of Health and Social Services
HEC	health effects category
NSB	North Slope Borough

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1.0 PUBLIC HEALTH

Table E.18.1 describes the health effects categories (HECs) and Table E.18.2 provides an overview of the technical guidance for evaluating health impacts from resource development used to inform the health impact analysis. Guidance for evaluation comes from:

- Alaska Department of Health and Social Services (DHSS), *Alaska Health Impact Analysis Technical Guidance* (2015)
- North Slope Borough (NSB), *Health Impact Assessment for Natural Resource Development in Alaska Collaborative Guidance* (2015)
- Bureau of Land Management (BLM), *National Petroleum Reserve in Alaska Integrated Activity Plan/Environmental Impact Statement* (2020) health effects analysis

Table E.18.1. Health Effects Category Descriptions

Health Effects Category	Description
HEC1: Social determinants of health	Economic status, educational status, social support systems, employment status, mental health, maternal and child health, substance use, social exclusion, psychosocial distress, historical trauma, and family dynamics
HEC2: Accidents and injuries	Intentional and unintentional injuries with fatal and nonfatal results; traffic patterns, alcohol involvement, emergency services availability, presence of law enforcement, and presence of prevention programs
HEC3: Exposure to potentially hazardous materials	Documented illnesses or exacerbation of illnesses commonly associated with pollutants through inhalation, ingestion, or physical contact
HEC4: Food, nutrition, and subsistence activities	Nutrient levels, malnutrition, or improvements in nutrient intake, diet composition, food security, and consumption of subsistence foods
HEC5: Infectious disease	Rates of increase or decrease for a range of infectious diseases, such as sexually transmitted infections, respiratory illness, or skin infections; immunization rates; and the presence of infectious disease prevention efforts
HEC6: Water and sanitation	Changes to access, quantity, and quality of water supplies; distance to clean water, water fluoridation, indoor plumbing, water treatment facilities, and existence of community facilities, such as washaterias or community showers
HEC7: Non-communicable and chronic diseases	Increases/decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases, and mental health disorders; smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centers, and cancer-screening rates
HEC8: Health services infrastructure and capacity	Increase or decrease in the number of medical evacuations, clinic or hospital visit trends, health expenditures, and medication usage; distance to health facilities, medevac facilities/aircraft, the presence of community health aides, and the frequency of physician visits to the area

Source: DHSS 2015
Note: HEC (health effects category)

Table E.18.2. Health Effect Factors from Relevant Guidance Documents*

Alaska HIA Technical Guidance (ADHSS 2015)	HIA for Natural Resource Development in Alaska Collaborative Guidance (NSB 2015)	National Petroleum Reserve in Alaska IAP/EIS Health Effects Analysis (BLM 2020)	"Public Health Information for the Willow Master Development Plan." (EXP Energy Services Inc. 2022)
HEC1: Social determinants of health	Overall health and well-being Psychological and gender issues Maternal and child health	Acculturative stress Economic impacts on health	Employment, Economic status, Household income, Poverty levels Social connections and cultural continuity Mental health
HEC2: Accidents and injuries	Accidents and injuries	Safety	Accidents and injuries
HEC3: Exposure to potentially hazardous materials	Contaminant exposure	Environmental exposures	Air quality and air pollutant emissions Water Quality
HEC4: Food, nutrition, and subsistence activities	Food, nutrition, and physical activity	Diet and nutrition	Food and nutrition Subsistence activities
HEC5: Infectious disease	Infectious disease	Infectious disease	Communicable diseases Infectious diseases Immunizations
HEC6: Water and sanitation	Water and sanitation	NA	Water and sanitation
HEC7: Non-communicable and chronic diseases	Non-communicable/chronic diseases	NA	Non-communicable/chronic diseases
HEC8: Health services infrastructure and capacity	Health services infrastructure and capacity Occupational/community health interface	Health-care services	Health-care services

Note: HEC (health effects category); HIA (Health Impact Assessment); IAP/EIS (Integrated Activity Plan/Environmental Impact Statement); NA (not applicable)

2.0 REFERENCES

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Appendix E.19
Wilderness Characteristics Technical Appendix

There is no technical appendix for this resource

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Appendix E.20
Cumulative Effects Technical Appendix

There is no technical appendix for this resource

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Appendix F
Cultural Resources Findings: Process and Analysis

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List of Acronyms

AHRS	Alaska Heritage Resources Survey
BLM	Bureau of Land Management
BMP	best management practice
DEW	Distant Early Warning
EIS	Environmental Impact Statement
IAP	Integrated Activity Plan
LS	lease stipulation
MDP	Master Development Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPR-A	National Petroleum Reserve in Alaska
NSB	North Slope Borough
OHA	Office of History and Archaeology
Project	Willow Master Development Plan Project
RFFAs	reasonably foreseeable future actions
ROD	Record of Decision
ROP	required operating procedure
TLUI	Traditional Land Use Inventory

Note to Readers

To assist readers in identifying new information in this Supplemental EIS, new or substantially revised text is highlighted in light yellow (as shown in this paragraph). Substantial revisions include changes to the text or underlying data that have changed the analysis or analysis conclusion. All sections that are new or include significant or substantial revisions include an asterisk ("*") at the end of the section header; all new or substantially revised tables and figures also include an asterisk at the end of the table or figure caption.

1.0 CULTURAL RESOURCES FINDINGS: PROCESS AND ANALYSIS*

The cultural history of northern Alaska is described in detail in Bureau of Land Management's (BLM's) National Petroleum Reserve in Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) (BLM 2020b). Cultural resources found on the North Slope broadly represent a long prehistory of land use, followed by more recent historic land use by Iñupiat and influences from Euro-Americans beginning in the nineteenth century. Cultural resources on the North Slope can represent a broad variety of types, ranging from distinctly human-made objects and changes to the landscape, to places with less definitive expressions of use by people in the past, albeit with great significance to North Slope communities. Such resources include but are not limited to the following:

- Prehistoric and historic archaeological sites, features, and artifacts, such as those associated with camps and villages, buildings and structures, dwellings (e.g., sod houses, semi-subterranean houses, and tent rings), production and use of objects (e.g., discarded tools and tool-making debris), subsistence activities (e.g., discarded animal bone accumulations, reindeer herding fences, ice cellars, and caches), and transportation (e.g., boat and sled remains).
- Places significant to Iñupiat heritage and traditional land use (e.g., burial places and hunting, fishing, and trapping and camping areas).
- Cultural landscapes and areas important for reasons of cultural identity or religious significance.
- For purposes of the Willow Master Development Plan Project (Project) Supplemental Environmental Impact Statement (EIS), paleontological resources are also considered.

A variety of federal, state, and local regulations govern how cultural resources are described and analyzed. Although compliance requirements for these regulations are similar, the types of cultural resources considered, as well as the implementation of cultural resources review, differ. The National Environmental Protection Act (NEPA) requires disclosure and consideration of impacts to the human environment, of which cultural resources are considered a subcategory (40 CFR 1508.14). Section 106 of the National Historic Preservation Act (NHPA) (54 USC 306108) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties (prehistoric or historic districts, sites, buildings, structures, or objects listed in or eligible for the National Register of Historic Places). Both NEPA and Section 106 of the NHPA require consultation with agencies and key stakeholders (including tribal and municipal governments and members of the public) and afford a reasonable opportunity for consulting parties to comment on the potential for impacts to cultural resources or to alert the lead agency to the presence of potentially impacted cultural resources. BLM conducted the NHPA Section 106 review concurrently with NEPA. Other regulatory statutes that protect cultural resources include the Antiquities Act (16 USC 431–433), the Historic Sites Act (16 USC 461–467), the Archaeological and Historic Preservation Act (16 USC 469–469c), the American Indian Religious Freedom Act (42 USC 1996), the Archaeological Resources Protection Act (16 USC 470aa–470ll), the Abandoned Shipwreck Act (43 USC 2101–2106), the Native American Graves Protection and Repatriation Act (25 USC 3001 et seq.), EO 13007: Indian Sacred Sites, and the Alaska Historic Preservation Act (AS 41.35). The Project would also require a Certificate of Traditional Land Use Inventory (TLUI) Clearance from the North Slope Borough (NSB), certifying that no TLUI sites would be negatively impacted.

1.1 Supplemental Analysis*

Initial analysis of potential Project impacts was completed as part of the Final EIS for the Willow Master Development Plan (MDP), which concluded with BLM receiving concurrence from the SHPO of a finding of No Adverse Effect to historic properties in September 2020. Additional analysis has been conducted for this Supplemental Environmental Impact Statement, developed in response to the 2021 Alaska District Court decision requiring BLM to address NEPA deficiencies found by the court.[1]

The Office of History and Archaeology's (OHA's) Alaska Heritage Resources Survey (OHA 2022), which contains an inventory of all documented archaeological sites in the state of Alaska, is the primary source of information for archaeological resources in the Project area. A subset of the NSB's TLUI within the Project

[1] Refer to the August 18, 2021, Alaska District Court decision (*Sovereign Iñupiat for a Living Arctic et al. v. BLM* [Case No. 3:20-cv-00290-SLG] and *Center for Biological Diversity et al. v. BLM* [3:20-cv-00308-SLG], United States District Court, D. Alaska) remanding the Willow MDP to BLM for the purpose of addressing NEPA deficiencies found by the Court.

vicinity was acquired from the NSB Department of Iñupiat History, Language and Culture (NSB 2019, 2020); the TLUI is the primary source of information regarding Iñupiat traditional use areas, although BLM pursued additional information through consultation with local and regional tribal and municipal governments and Alaska Native corporations, and the public. Academic literature, agency documents, and cultural resources survey reports from other studies conducted within the Project area provided more robust information about sites documented in the area. Recent cultural resource surveys conducted in support of the Project (Reanier 2017, 2018, 2019b, 2019c, 2020, 2022a, 2022b, 2022c) provided the most current archaeological site location and condition information for the area; however, this analysis reviewed documentation for all known archaeological surveys that overlapped the APE.

1.2 Consultation Efforts*

In accordance with 36 CFR 800.2(c), BLM consulted with the SHPO and other potential consulting parties under NHPA Section 106 for both the Willow MDP EIS and SEIS. Throughout both the Willow MDP EIS and SEIS processes, BLM sought NHPA Section 106 consultation with North Slope regional and local Tribal, municipal, and corporation entities, non-governmental organizations. BLM invited these parties to consult under Section 106 during in-person and/or remote Government-to-Government, NPR-A working group, and public scoping meetings, and using email and certified letters. In accordance with 36 CFR 800.2(d)(3), BLM afforded opportunity for public involvement in the Section 106 process via BLM's online National NEPA Register and throughout the NEPA process.

The State of Alaska, NSB, NVN, City of Nuiqsut, and ICAS are cooperating agencies on the SEIS. As such, these entities had increased authority, responsibility, and involvement in the environmental review process, and additional opportunity to leverage concerns about the Project and effects to cultural resources and historic properties.

To date, no North Slope Tribal, municipal, or corporation representatives, North Slope community members, or non-governmental organizations have elected to consult with BLM regarding places of historic or cultural importance regarding the Willow MDP EIS or SEIS. BLM's consultation efforts did not result in any responses indicating specific or general concerns for documented (i.e., listed in the AHRS or TLUI) or undocumented places of historic or cultural importance or traditional use in the Project areas. BLM did not receive any public comments pertaining to cultural or paleontological resources regarding the Willow MDP SEIS.

1.3 Potential Impacts

Direct impacts are those that are caused by, and occur during, the Project (36 CFR 800.5; 40 CFR 1508.8) and are primarily limited to the Project footprint. Ground-disturbing activities (e.g., drilling, gravel mining, construction and use of grounded ice bridge, etc.) pose the greatest threat of direct impacts to cultural resources, especially archaeological sites, by destabilizing, damaging, or destroying subsurface and aboveground cultural and paleontological resources and contexts. Support activities (including the transport and staging of materials, heavy equipment, and personnel) and manufacture and use of the grounded ice roads and pads could also directly affect surficial and shallowly buried cultural resources through inadvertent ground disturbance, vibration, and compaction.

Indirect impacts are those that occur beyond the Project footprint or after the Project's completion and are reasonably foreseeable. The greatest immediate threats to cultural resources outside the project footprint (i.e., direct effects per NHPA Section 106 or indirect effects per NEPA) involve altering visual, audible, atmospheric, or olfactory qualities in a historic property's surroundings.

Cumulative impacts include those resulting from past, present, and reasonably foreseeable future actions (RFFAs) or effects relating to the Project and can extend beyond the 2.5-mile indirect effects analysis area. Regarding cultural and paleontological resources, the most significant cumulative effects (i.e., indirect effects per NHPA) involve the Project's influence on expanding into future development projects, its contributions to climate change—particularly with degrading permafrost, and increasing erosion, and improving access to otherwise remote and difficult-to-access locations, followed by increased foot or vehicle traffic and subsequent (even unintentional) erosion, vandalism, and/or looting in sensitive areas.

1.4 Previously Identified Cultural Resources and Surveys*

The Alaska Heritage Resources Survey (AHRS) (OHA 2022) lists 93 sites (78 cultural and 15 paleontological) documented within or overlapping the APE, all but 15 of which, discussed further below, fall outside the Project footprint. Of the 78 cultural sites, 23 were determined eligible for NRHP inclusion, eight were determined not eligible, and 47 have not been evaluated for NRHP listing eligibility (Table F.1.1).

1.4.1 Previous Surveys*

The Proponent began conducting surveys to identify cultural resources specifically for the Willow MDP in 2017, which continued through the summer of 2022 and included areas both with and without reported records of previous cultural surveys (Reanier 2018, 2019b, 2019c, 2020, 2022a, 2022b, 2022c). These Willow MDP-specific surveys focused on areas within and surrounding the Project footprints, extending throughout 100% of the proposed permanent infrastructure footprints (including gravel mine locations) under all four development alternatives (Reanier 2018, 2019b, 2019c, 2020, 2022a, 2022b, 2022c), and 90% of the proposed temporary ice road alignments. To date, the Proponent surveyed all proposed ice road alignments falling within the NPR-A boundary, including routes for Module Delivery Options (Reanier 2019c, 2020), the route segment between Ocean Point and just west of GMT2 (Reanier 2019c, 2020), and other ice roads that would be associated with the Project construction phase (Reanier 2017, 2018, 2019b, 2019c, 2020).

In addition, the cultural resources analysis area has been examined repeatedly for cultural resources due to nearby oil and gas development projects and academic studies since 1977 (Hall Jr. 1977, 1978, 1979, 1982; Hemmeter, Teese et al. 2019; Lobdell 1981, 1982, 1985, 1986, 1988, 1991, 1993, 1996, 1998a, 1998b, 1999; Lobdell and Lobdell 1999; Mobley & Associates 2016; Reanier 2003, 2004, 2008, 2013, 2014, 2017, 2018, 2019a, 2019b, 2019c, 2020, 2022a, 2022c; SRB&A 2018).[2] Collectively, the Proponent's and others' surveys have covered 100% of the direct Project footprint, including proposed ice road alignments. Figure F.1.1 depicts aerial and/or ground surveys conducted within the analysis area.

1.4.2 Cultural Resource Sites*

Of the 93 AHRS sites in the APE, 25 sites (22 cultural and three paleontological) have either been destroyed (through excavation, removal, or erosion), duplicated in the AHRS, or could not be located. This includes six sites determined eligible, and eight sites determined not eligible, for listing on the NRHP. The U.S. Air Force removed 12 buildings from Point Lonely during environmental remediation activities at the POW-1 Distant Early Warning (DEW) Line Station (K. Leeper, Archaeologist, personal communication to L. O'Quinn [DOWL], March 18, 2019; report pending to OHA). Agency and contract archaeologists removed four sites through data recovery and/or mitigation excavations and confirmed that erosion destroyed the other six. Agency and contract archaeologists made multiple, unsuccessful attempts to locate two other sites in the APE, indicating that these sites also likely either eroded or have incorrect coordinates. One site was originally identified using only a location from the original 1976 TLUI, and despite being positively identified later in another location and assigned a new AHRS number, the original site card remains listed in the AHRS (Table F.1.1).

Of the remaining 68 AHRS sites, eight are prehistoric, 28 are historic or modern Iñupiaq, 19 are historic or modern Euroamerican, one is a multicomponent site with evidence of historic Iñupiaq and Euroamerican and prehistoric use, and 12 are paleontological. Of these 68 intact sites in the APE, 17 have been determined eligible for listing on the NRHP and the rest remain unevaluated.

The NSB TLUI lists 45 traditional land use sites documented within or overlapping the analysis area, 10 of which correspond with AHRS-documented sites (NSB 2019, 2020). Two of these 10 have been determined eligible for NRHP listing, and the remainder are unevaluated. Four of the eight unevaluated TLUI sites are either destroyed or could not be located. Of the 35 TLUI sites without a corresponding AHRS number, 10 have been destroyed, could not be relocated during recent surveys, or have erroneous location information. Thirteen of the AHRS and/or TLUI sites reportedly contain graves, all of which fall outside the Project footprint and distant from permanent infrastructure. Two of these sites are confirmed, or presumed, to be gone due to erosion, while three sites listed in the TLUI either could not be located or safely accessed (Table F.1.1).

[2] This list is not exhaustive.

Most sites identified in the APE (61 cultural of 73 total,) fall within 2.5 miles of temporary ice infrastructure. As shown in Table F.1.2, new permanent infrastructure associated with the proposed Project (i.e., new gravel and pipeline infrastructure and the proposed mine) in the Willow Area are distant from most documented sites. However, new pipeline between the GMT2 and Kuparuk CPF2 pads and routing for the Module Delivery Options would pass near to, or over, several documented AHRS and TLUI sites. There are seven AHRS and four TLUI sites within one mile of permanent or long-term temporary infrastructure, and 18 AHRS and 10 TLUI sites located within one mile of temporary ice infrastructure. The AHRS sites nearest to any Project components occur near Module Delivery Option 2 and the proposed new pipeline between the GMT2 and Kuparuk CPF2 (Table F.1.2).

Module Delivery Option 2 would use the existing gravel infrastructure at Point Lonely to stage modules prior to transport via ice road to the Project area (note: the gravel infrastructure and TES-00120 are all that remain at Point Lonely). The Point Lonely gravel infrastructure consists of three intact, or largely intact, sites (TES-00043, TES-00044, and TES-00045) all of which were determined eligible for NRHP listing prior to remediation activities at the site. Staging and transport of the Project modules is unlikely to disturb these gravel pads, as the gravel infrastructure was constructed to support heavy loads associated with the POW-1 DEW Line Station (e.g., buildings, vehicles, equipment, etc.), which was later used to support oil exploration operations beginning in the 1970s. Additionally, the site with two graves (TES-00120) at Point Lonely is located on a tundra patch outside the existing gravel infrastructure but within the larger TES-00048 boundary.

Under All Action Alternatives, CPAI would construct new pipeline and VSMs along the existing pipeline between the GMT2 and Kuparuk CPF2 pads. Like the existing pipeline, new pipeline and VSMs pads would bisect HAR-000173 (the Colville #1 Peat Road), which is a raised, 12-15-foot-wide, historic road that extends over approximately 46 miles between the Colville River Delta and 14 miles east of Ocean Point. In 2017, the SHPO and US Army Corps of Engineers determined HAR-000173 eligible for listing on the NRHP under Criteria A and C for its role in the development of the oil and gas industry in Alaska and its unique type and method of construction.

The new pipeline would also pass within 750 feet of HAR-00156/TLUIHAR082 and TLUIHAR059. CPAI would align new VSMs to existing VSMs to the extent practicable and generally within 330 feet of the existing pipeline; however, some deviation may be necessary beyond this due to ground conditions and engineering needs; however, CPAI would continue to route the pipeline away from HAR-00156/TLUIHAR082 by a minimum of 500 feet. The new pipeline, positioned roughly parallel and near to the existing pipeline in this area, is unlikely to impact physical features or traditional land use activities associated with these sites any differently than the current pipeline.

1.5 Findings*

The Project would not likely result in direct or indirect impacts to historic properties or paleontological resources. BLM permit requirements ensure that a cultural resources survey would be undertaken, and cultural resources avoided; NSB requires TLUI clearance before issuance of permits; and the Proponent's voluntary avoidance measures and operating procedures (provided in Appendix I.1, *Avoidance, Minimization, and Mitigation*) are also intended to protect cultural resources. The coverage and results of Project surveys and previous surveys indicate that previously undocumented cultural resources are unlikely to exist in the analysis area (Figure F.1.1).

Table F.1.3 summarizes the applicable NPR-A IAP lease stipulations (LSs) and required operating procedures (ROPs) that would apply to Project actions on BLM-managed lands and are intended to mitigate impacts to cultural resources from development activity (BLM 2022). The LSs and ROPs would reduce impacts to cultural resources associated with the construction, drilling, and operation of oil and gas facilities. In 2021, BLM was directed to reevaluate the 2020 NPR-A IAP (BLM 2020a). The NPR-A IAP reevaluation resulted in the issuance of a new NPR-A IAP ROD (BLM 2022). Full text of the requirements is provided in BLM (2022).

All action alternatives would require deviations from existing LS K-1 because they would include road and pipeline crossings of one or more of the waterbodies protected in the LS. These deviations would not result in adverse impacts to cultural resources.

Areas of traditional subsistence land use are a critical cultural element in the Project area and are addressed in Section 3.16, *Subsistence and Sociocultural Systems*, of this Supplemental EIS. TLUI clearance is required by NSB to ensure avoidance of sensitive Alaska Native cultural sites before issuing a Development Permit or Administrative Approval, and the Proponent must seek TLUI clearance before receiving a permit from NSB. Potentially undocumented places that are significant to North Slope heritage but lack definitive expressions of land use are best identified and assessed through consultation with local and regional tribal and municipal governments and Alaska Native corporations, as well as other community members. BLM's efforts thus far to consult with these entities within Nuiqsut and the NSB under NEPA and Section 106 have not resulted in expressed concerns for impacts to specific cultural resources within the Project area.

1.5.1 Direct Impacts*

Two cultural resources (HAR-00173 and TES-00043) have been identified within the Project footprint. Project components (temporary and/or permanent) would overlap these identified historic properties but would do so in ways that avoid degrading aspects of integrity related to physical form (e.g., location, materials, design, and workmanship) or surroundings (e.g., setting, feeling, or association) that contribute to their significance, while maintaining an association between modern and historic functions at these places. Therefore, direct impacts to cultural resources would be unlikely to occur.

Under All Action Alternatives, CPAI would construct new pipeline and VSMs along the existing pipeline between the GMT2 and Kuparuk CPF2 pads. Like the existing pipeline, new pipeline and VSMs pads would bisect HAR-000173 (the Colville #1 Peat Road). CPAI would cross the pipeline over the historic property, suspending it several meters above the road with VSMs (which are spaced 55 feet apart on average) placed as far away from the structure as possible. In so doing, CPAI would avoid direct physical impacts to the peat road. Although the existing and new pipeline would cross HAR-00173, the overall character-defining features (raised height and peat as a construction material) would remain intact and evident. During consultation conducted for the Nanushuk Project in 2017 and 2018, SHPO concurred that, although a road or pipeline bisecting the HAR-00173 would likely disturb those locations, the resulting impacts would be minor compared to the overall length of the feature (Oil Search 2018). Similarly, given that that an existing pipeline currently passes over HAR-000173, and that the new pipeline would similarly pass over a short (<10 meter) length of the 46-mile-long road within approximately 100 meters of the existing pipeline, the proposed additional pipeline would not cause adverse impacts to HAR-00173. Moreover, HAR-00173 has a historic association with oil development in Arctic Alaska, and the modern oil pipelines that either already or would potentially pass over it are consistent with the property's historic function for supporting oil and gas development.

Module Delivery Option 2 would use the existing gravel infrastructure (TES-00043) at Point Lonely to stage modules prior to transport via ice road to the Project area. CPAI would stage the modules in winter and would not modify the Point Lonely gravel infrastructure, and then transport the modules in winter, primarily relying on land-based ice road. The gravel pads' proposed use to stage and transport heavy equipment is consistent with its historical function, especially when considering POW-1's role in supporting oil and gas exploration in the NPR-A in the 1970s. While ice roads and pads in the NPR-A generally result in temporary, observable changes to the tundra due to the scuffing, crushing, or compression of the underlying tussocks, the visibility and type of changes due to ice compaction vary depending on local water saturation, which also influences recovery time (Guyer and Keating 2005; Pullman, Jorgenson et al. 2005; Yokel, Huebner et al. 2007).

1.5.2 Indirect Impacts*

Indirect impacts to cultural resources would also be unlikely. With the exception of HAR-00173 and TES-00043, the Proponent would opt to route all Project components at least 500 feet from all other recorded cultural sites and would avoid the Prince Creek Formation when constructing the ice road crossing of the Colville River near Ocean Point. To ensure appropriate treatment of inadvertent discoveries, the Proponent would maintain a Fossil and Artifact Finds Standard Operating Procedure.

Of the 37 intact cultural sites located outside of the Project footprint but within 2.5 miles of permanent Willow Project, six AHRS and four TLUI sites are within one mile of permanent or long-term temporary infrastructure (HAR-00156/TLUIHAR82, TES-00044, TES-00045, TES-00120, XBP-00039, XBP-00058, TLUIHAR059, TLUIHAR103, and TLUITES218). While it is possible that the proposed permanent Project infrastructure may

result in some perceptible visual, audible, or olfactory change within any of these ten sites' settings for the life of the Project, such changes are unlikely to result in adverse impacts to the sites' physical form or surroundings.

Sites located near the proposed pipeline (HAR-00156/TLUIHAR82, TLUIHAR059, TLUIHAR103) would be avoided by a minimum of 500 feet. Careful placement of the pipeline and VSMs roughly parallel to those of the existing pipeline will avoid impacts to traditional land use activities associated with TLUIHAR059. Use of existing gravel infrastructure sites (TES-00044 and TES-00045) to stage and transport heavy equipment for Module Delivery Option 2 is consistent with these sites' historical function. Two graves (TES-00120) located amidst the former DEW Line site are nearly one mile away from Project components associated with Module Delivery Option 2. No archaeological remnants could be located at TLUITES218, which is nearly one-half mile away from proposed temporary Project infrastructure. Likewise, staging and transport of heavy equipment is unlikely to impact any potential traditional land use activities that may be associated with this site. Road widening required for Module Delivery Option 3 would occur near gravel infrastructure of the DEW Line Station boundary (XBP-00039) and Oliktok LRRS Road System (XBP-00058). These sites remain in use to support oil and gas operations at Oliktok; Project infrastructure is therefore unlikely to impact these sites.

There are 17 AHRS and 10 TLUI sites located within one mile of temporary ice infrastructure (Table F.1.2). Regarding temporary ice infrastructure, CPAI would temporarily rely on ice roads and pads over several years, limited to the Project construction phase. Constructed if and when needed, CPAI's ice roads and pads would last through individual winter seasons and melt the following summer. While ice roads and pads in the NPR-A generally result in temporary, observable changes to the tundra, these become less conspicuous with each passing year (Guyer and Keating 2005, Yokel et al. 2007), and when visible, are mostly discernable from the air and difficult to observe from ground level. As such, ice infrastructure would not result in lasting visual, audible, or olfactory changes to the landscapes observable from sites in the APE outside the Project footprint—especially changes of a scale that could diminish aspects of integrity related to cultural properties' surroundings (e.g., setting, feeling, or association). CPAI's proposed temporary ice road/pad and MTI infrastructure are therefore unlikely to result in permanent or long-term visual, audible, or olfactory changes to any of these sites.

1.5.3 Cumulative Effects*

Section 3.20, *Cumulative Effects*, of this Supplemental EIS addresses the potential for Project impacts to accumulate with those associated with past, present, and RFFAs, and what those effects might be. While increasing oil and gas and transportation projects relating to the Project can potentially adversely affect historic properties, the majority of lands or coastal regions on or along the North Slope are managed or owned by either Federal agencies or the State of Alaska. Future activities connected to the Project within Federally managed areas or on State of Alaska lands would be subject to Section 106 of the NHPA or the Alaska Historic Preservation Act, respectively. Similarly, any future actions connected to the Project that occur outside state of Federal lands, but with a federal nexus (including rights-of-way) would be subject to Section 106 of the NHPA. Therefore, RFFAs resulting from the Project are not expected to result in cumulative effects to historic properties, cultural resources, or paleontological sites.

Climate change associated with the cumulative effects of past, present, and future oil and gas development could adversely affect cultural and paleontological resources, although the degree to which this might happen remains unclear. Deepening active layers and the near-surface permafrost thaw can cause mass wasting (French 2007; Washburn 1980), resulting in partial or total destruction of the cultural and paleontological sites as the landforms on which they are located erode; these circumstances are also greatly exacerbated by increased moisture. Arctic warming has also been linked to changes in sea ice dynamics and increased and rapid erosion along the Arctic coast (Frederick, Thomas et al. 2016; Gibbs and Richmond 2015; Gibbs, Snyder et al. 2019). A warming environment and permanent or seasonal permafrost thaw can enhance degradation of organic remains, vertical and horizontal spatial relationships between objects, and the information they may yield (BLM 2012, 382; French 2007; Washburn 1980; Wood and Johnson 1978).

However, any potential effects attributable to climate change are not expected to be universal or predictable across the APE, as myriad factors influence the degree to which climate change can affect a specific location, region, habitat, or ecosystem. Climate Change may affect some locales substantially, while others may not be affected at all (BLM 2012, 183). According to the Willow MDP SEIS evaluation of cumulative impacts to soils and permafrost (Section 3.20.8 Cumulative Impacts to Soils, Permafrost, and Gravel Resources), the Project

would impact soils and permafrost similar to past and present actions, and are expected to be localized, occurring within 100 meters of infrastructure. While the Willow MDP is expected to contribute to cumulative effects to soils and permafrost overall, it is not currently possible to predict where impacts from the Project would occur, to what extent they would occur, or if those effects would adversely affect historic properties.

Although improving access to cultural resource locations (such as through road construction into otherwise remote areas) correlates strongly with increased instances of vandalism and looting of cultural resources sites (Hedquist, Ellison et al. 2014; Spangler, Arnold et al. 2006), these impacts are improbable due to CPAI's operation procedures, conditions specific to the Project area, and the Project timing. CPAI would control access to Project infrastructure and limit public access and would require its staff to undergo cultural awareness training prior to deployment per ROP I-1 (Table F.1.3). Cultural awareness training would inform personnel on how to identify and avoid disturbing archaeological materials, thereby reducing the risk of inadvertent disturbance of culturally significant sites. Of those sites situated near proposed Project infrastructure, most are either located near temporary ice infrastructure or already accessible by existing permanent infrastructure; very few sites are located near proposed new permanent infrastructure. Improved access to sites by ice infrastructure would occur temporarily over the span of several years during the Project construction phase. Ice road access would also only occur during winter seasons in which frozen and snow-covered conditions would hinder surface visibility and soil erodibility and penetrability, thus limiting the likelihood of illegal collection, subsidence, and erosion due to increased access to an area. While permanent gravel roads could improve access to sites year-round to some degree, environmental conditions and required offroad travel would still promote site preservation. As with ice road access, winter conditions would hinder surface visibility and freeze the underlying sediments, limiting the likelihood of illegal collection, subsidence, and erosion. The surrounding terrain complicates any improved access during summer months, as the tundra during this season is uneven, frequently inundated, and spongy, thereby making off-road travel in the Project area during summer months is suboptimal by foot or vehicle.

1.6 Conclusion

The protections afforded by the placement of Project components relative to documented cultural and paleontological sites (Table F.1.2), the LSs and ROPs (particularly site avoidance and staff training; Table F.1.3), the seasonal timing of project components, and accessibility difficulties during winter and summer conditions are suitable to avoid impacts to cultural and paleontological resources by the range of activities or potential activities connected to the proposed undertaking. It is, thus, unlikely that the proposed Project would result in direct or indirect adverse impacts to cultural or paleontological resources

Table F.1.1. List of Cultural and Paleontological Sites in the Analysis Area According to the Alaska Heritage Resource Survey and the Traditional Land Use Inventory Data*

AHRS No.	TLUI No.	Site Name/Description	Site Type	Determination of NRHP Eligibility	Condition
HAR-00002	—	HAR-00002	Prehistoric	Not Eligible	Destroyed
HAR-00005	—	Sod House and Boat on Fish Creek	Historic (Iñupiaq)	No Determination	Intact
HAR-00010	—	Kikkaq	Historic (Iñupiaq)	No Determination	Intact
HAR-00011	TLUIHAR011	Sikulik (Grave location)	Historic, Modern (Iñupiaq)	No Determination	Intact
HAR-00014	—	HAR-00014 Reindeer Corral	Historic (Iñupiaq)	Eligible	Partially Destroyed
HAR-00018	—	Ahsogeak Site	Historic (Iñupiaq)	Eligible	Excavated
HAR-00021	—	Niglivik 1 (original anticipated location for Niglivik based on original TLUI, later determined to be HAR-00080)	Historic (Iñupiaq)	No Determination	No Site: Erroneous Location in AHRS
HAR-00025	TLUIHAR060	Tikigaqmiut/Tikibaq (Cemetery)	Historic (Iñupiaq)	No Determination	Unconfirmed
HAR-00026	TLUIHAR091	Atigaru Point/Atibruk (Sod house ruin; gravesite; fishing, trapping, hunting, and camping area)	Historic (Iñupiaq)	No Determination	Destroyed
HAR-00027	TLUIHAR038	Kanigluq/Kangiqluk (Sod house ruin; fishing and hunting area)	Historic (Iñupiaq)	Eligible	Threatened
HAR-00029	TLUIHAR089	Ikkalipik (Sod house ruin; fishing and trapping area)	Historic (Iñupiaq)	No Determination	Destroyed
HAR-00032	—	Pa, D306t	Paleontological	NA	Intact
HAR-00033	—	Pa, 34571 Observation Point (Blm Ak-83-V)	Paleontological	NA	Intact
HAR-00034	—	Pa, Ocean Point	Paleontological	NA	Intact
HAR-00035	—	Pa, Ocean Point	Paleontological	NA	Intact
HAR-00036	—	Pa, D306, Loc. 1	Paleontological	NA	Intact
HAR-00038	—	PA, Carter Et Al. 1978 Site A	Paleontological	NA	Intact
HAR-00040	—	Pa, 7	Paleontological	NA	Intact
HAR-00045	—	Old Campsite	Historic (Iñupiaq)	No Determination	Partially Destroyed
HAR-00046	—	Leavitt Family Campsite	Historic (Iñupiaq)	No Determination	Partially Destroyed
HAR-00048	—	HAR-00048	Historic (Iñupiaq)	No Determination	Intact
HAR-00049	—	HAR-00049	Historic (Iñupiaq)	No Determination	Intact
HAR-00055	—	Caribou Bone	Modern (Faunal)	No Determination	Destroyed
HAR-00057	—	Pa, Mammoth Femur Sticking Vertically from Ground	Paleontological	NA	Excavated
HAR-00060	—	Pa, Old Bone Beach	Paleontological	NA	Intact
HAR-00061	—	Pa, Liscomb Bed	Paleontological	NA	Intact
HAR-00067	—	HAR-00067	Paleontological	NA	Excavated

AHRS No.	TLUI No.	Site Name/Description	Site Type	Determination of NRHP Eligibility	Condition
HAR-00073	—	HAR-00073	Prehistoric (Denbigh, ASTt)	No Determination	Intact
HAR-00075	—	Metatarsal Bar	Paleontological	NA	Disturbed
HAR-00080	TLUIHAR030	Niglivik/Niblivik (Fishing and hunting area)	Historic (Iñupiaq)	No Determination	Intact
HAR-00081	—	Reindeer Corral, Uqalium Kanigana, Uqalik Corral	Historic (Iñupiaq)	No Determination	Intact
HAR-00089	TLUIHAR081	Nappaun (Napaun) (Sod house ruin)	Historic (Iñupiaq)	No Determination	Destroyed
HAR-00090	—	Niglivigauraq Creek 1	Historic (Iñupiaq)	No Determination	Intact
HAR-00091	—	Niglivigauraq Creek 2	Historic (Iñupiaq)	No Determination	Intact
HAR-00098	—	SRBA 2012 C3	Prehistoric	No Determination	Intact
HAR-00100	—	HAR-00100	Prehistoric	No Determination	Intact
HAR-00101	—	HAR-00101	Prehistoric	No Determination	Intact
HAR-00105	—	Drained Lake Blowout	Prehistoric	No Determination	Could not be located (2018, 2020)
HAR-00106	—	HAR-00106	Prehistoric	No Determination	Intact
HAR-00107	—	HAR-00107	Prehistoric	No Determination	Intact
HAR-00108	—	HAR-00108	Historic, Modern (Iñupiaq)	No Determination	Intact
HAR-00109	—	Sod Feature	Prehistoric	No Determination	Intact
HAR-00110	—	Navy Seismic Camp	Historic (Euroamerican)	No Determination	Intact
HAR-00111	—	Navy Seismic Camp	Historic (Euroamerican)	No Determination	Intact
HAR-00112	—	Akulik	Historic (Iñupiaq)	No Determination	Intact
HAR-00119	—	HAR-00119	Historic (Iñupiaq)	No Determination	Intact
HAR-00120	—	HAR-00120	Historic (Iñupiaq)	No Determination	Intact
HAR-00121	—	Navy Debris	Historic (Euroamerican)	No Determination	Intact
HAR-00151	—	HAR-00151	Historic (Euroamerican)	No Determination	Intact
HAR-00154	—	Katairuaq Grave	Historic (Iñupiaq)	No Determination	Intact
HAR-00156	TLUIHAR082	Nanuq (Fishing area; bird nesting area)	Historic (Iñupiaq)	No Determination	Intact
HAR-00157	—	Niglivik 2	Historic (Iñupiaq)	No Determination	Intact
HAR-00158	—	Putu	Historic (Iñupiaq)	No Determination	Disturbed
HAR-00167	—	Kayuqtusilik	Historic (Iñupiaq)	No Determination	Intact
HAR-00168	—	Aqsiataaq Inaat	Historic (Iñupiaq)	No Determination	Intact
HAR-00170	—	Mammoth Bone	Paleontological	NA	Destroyed
HAR-00172	—	HAR-00172	Prehistoric	No Determination	Intact
HAR-00173	—	Colville #1 Peat Road	Historic (Euroamerican)	Eligible	Intact

AHRS No.	TLUI No.	Site Name/Description	Site Type	Determination of NRHP Eligibility	Condition
TES-00028	TLUITES222	Kolovik/Qalluvik (Former village site (peak population 1930s); houses, whale boats, cabin)	Historic (Iñupiaq)	Eligible	Threatened
TES-00029	—	Pa, 2	Paleontological	NA	Intact
TES-00030	—	Pa, 6	Paleontological	NA	Intact
TES-00032	—	Building 1, Dew Operations Lonely LRRS Dew Line Facilities	Historic (Euroamerican)	Eligible	Destroyed
TES-00033	—	Building 2, Maintenance Shop Lonely LRRS Dew Line Facilities	Historic (Euroamerican)	Eligible	Destroyed
TES-00034	—	Building 12, Supply and Equipment Warehouse Lonely LRRS Dew Line Facilities	Historic (Euroamerican)	Eligible	Destroyed
TES-00035	—	Building 13, Pump Station Lonely LRRS Dew Line Facilities	Historic (Euroamerican)	Eligible	Destroyed
TES-00036	—	Building 15, Pump Station Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00037	—	Building 17, Pump Station Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00038	—	Building 18, Aircraft Shelter Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00039	—	Building 19, Air Freight and Passenger Terminal Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00040	—	Building 20, Warehouse Supply and Equipment Building Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00041	—	Building 100, Radome Tower Building Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00042	—	Building 101, Electric Power Station Lonely LRRS Dew Line Facilities	Modern (Euroamerican)	Not Eligible	Destroyed
TES-00043	—	Gravel Structures Lonely SRRS Road System	Historic (Euroamerican)	Eligible	Partially Destroyed
TES-00044	—	Gravel Structures Lonely SRRS Airfield	Historic (Euroamerican)	Eligible	Intact
TES-00045	—	Gravel Structures Lonely SRRS Gravel Pad System	Historic (Euroamerican)	Eligible	Partially Destroyed
TES-00048	—	POW-1	Historic (Euroamerican)	Eligible	Destroyed
TES-00120	—	Point Lonely Graves	Historic (Iñupiaq)	No Determination	Intact
TES-00121	—	TES-00121	Historic (Iñupiaq)	No Determination	Intact
XBP-00002	—	Oliktok Point	Historic (Euroamerican)	No Determination	Intact
XBP-00033	—	Kuparuk Pingo	Prehistoric (Northern Archaic)	No Determination	Excavated

AHRS No.	TLUI No.	Site Name/Description	Site Type	Determination of NRHP Eligibility	Condition
XBP-00036	TLUIXBP016	Ugrugnavik River (Gravesite; frame and sod houses, cellar)	Historic (Iñupiaq)	No Determination	Could not be located (1996, 2005)
XBP-00037	—	Thetis Pingo	Prehistoric, Historic (Iñupiaq, Euroamerican)	No Determination	Disturbed
XBP-00039	—	Pow-2	Historic (Euroamerican)	Eligible	Intact
XBP-00050	—	Building 1, Civilian Camp Oliktok Dew Line Facilities	Historic (Euroamerican)	Eligible	Intact
XBP-00051	—	Building 2, Vehicle Maintenance Shop Oliktok Dew Line Facilities	Historic (Euroamerican)	Eligible	Intact
XBP-00052	—	Building 3, Aircraft Shelter Oliktok Dew Line Facilities	Historic (Euroamerican)	Eligible	Intact
XBP-00053	—	Building 8, Supply and Equipment Warehouse Oliktok Dew Line Facilities	Historic, Modern (Euroamerican)	Eligible	Intact
XBP-00054	—	Building 17, Fuel Pump Station Oliktok Dew Line Facilities	Historic (Euroamerican)	Eligible	Intact
XBP-00055	—	Building 18, Weather Building Oliktok Dew Line Facilities	Historic (Euroamerican)	Eligible	Intact
XBP-00057	—	Gravel Structures Oliktok LRRS Road System	Historic (Euroamerican)	Eligible	Intact
XBP-00058	—	Gravel Structures Oliktok LRRS Airfield	Historic (Euroamerican)	Eligible	Intact
XBP-00059	—	Gravel Structures Oliktok LRRS Gravel Pad System	Historic (Euroamerican)	Eligible	Intact
XBP-00119	—	Ugnuravik Pingo	Historic (Iñupiaq)	No Determination	Intact
—	TLUIHAR006	Inibruat (Ruin; hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR007	Narvabauraq (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR012	Sikulik Lake (No description available)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR015	Savikpaligauram Leitublia (Sod house ruin; fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR017	Ayuvieam Ixuvia (Gravesite and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR023	Ayuviea (Hunting area; placename derived from person)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR027	Qitiq (Hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR031	Niblivigauram Narvafi (Fishing, trapping, and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR032	Itivliqpak (Placename)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR033	Niblivigauram Narvafa (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR035	Tifmiaqpalik (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR059	Apkugaruk (Fishing area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR065	Sabviavik (Fishing area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR066	Anagguvik (Fishing and trapping area; berry and coal gathering)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR068	Tiglak (Fishing and trapping area; berry and coal gathering)	Historic (Iñupiaq)	NA	Intact

AHRS No.	TLUI No.	Site Name/Description	Site Type	Determination of NRHP Eligibility	Condition
—	TLUIHAR069	Putu (Former trading post with ruins; current hunting and camping area)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR079	Kayuqtusilik (Sod house ruin and gravesite)	Historic (Iñupiaq)	NA	Intact
—	TLUIHAR103	Sigiaruk (Fishing, hunting, and camping area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES104	Abnaqsraq (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES216	Ayagutaq (Hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES217	Nalluabruum Paafa (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES218	Sisamalik (Hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES220	Tasibaabruk (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES221	Afupqan Ieitublia (Sod house ruin, hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES225	Natibnauraq (Hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES226	Kifiefuq (Hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES227	Qiruktabiaq (Driftwood collecting area; hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES229	Igluqabvialuk (Hunting area; possible house ruins)	Historic (Iñupiaq)	NA	Intact
—	TLUITES230	Tigutaam Paafa (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES233	Kuvrabliq (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES238	Tigutaam Kuufa (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUITES244	Tigutaaq (Fishing and hunting area)	Historic (Iñupiaq)	NA	Intact
—	TLUIXBP013	Sannifaruaq (Sod house ruin; gravesites)	Historic (Iñupiaq)	NA	Intact
—	TLUIXBP014	Uuliktuq (Gravesite; old store site)	Historic (Iñupiaq)	No Determination	Partially Destroyed
—	TLUIXBP015	Ufurabvik (Ice cellars)	Historic (Iñupiaq)	NA	Intact

Notes: — (no data); AHRS (Alaska Heritage Resources Survey); NA (not applicable); No. (number); NRHP (National Registry of Historic Places); TLUI (Traditional Land Use Inventory); all destroyed, excavated, and non-locatable sites in the Area of Potential Effects are indicated by dark gray shading.

Table F.1.2 Extant Sites Relative to Proposed Project Infrastructure*

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
HAR-00005	No	—	1.15	0.46	Pipeline	Option 2 Module Haul Route Ice Road
HAR-00010	No	—	>2.50	1.25	Pipeline	Option 3 Ocean Point Crossing Ice Road
HAR-00011	No	TLUIHAR011	>2.50	2.06	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
HAR-00014	No	—	>2.50	1.79	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Route Ice Road
HAR-00025	No	TLUIHAR060	>2.50	2.17	BT4 (Alternatives B, C, D)	Option 1 Module Haul Route Ice Road
HAR-00027	No	TLUIHAR038	>2.50	1.55	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
HAR-00032	Yes	—	>2.50	0.49	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00033	Yes	—	>2.50	1.9	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00034	Yes	—	>2.50	0.93	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00035	Yes	—	>2.50	1.05	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00036	Yes	—	>2.50	0.68	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00038	Yes	—	2.38	1.92	BT2 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
HAR-00040	Yes	—	>2.50	0.84	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Route Ice Road
HAR-00045	No	—	>2.50	1.92	BT4 (Alternatives B, C, D)	Option 1 Module Haul Route Ice Road
HAR-00046	No	—	>2.50	2.15	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Route Ice Road
HAR-00048	No	—	1.21	0.67	BT4 Road (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
HAR-00049	No	—	1.35	0.82	BT4 Road (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
HAR-00060	Yes	—	>2.50	1.73	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00061	Yes	—	>2.50	2.19	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00073	No	—	>2.50	0.14	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
HAR-00075	Yes	—	>2.50	1.64	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00080	No	TLUIHAR030	>2.50	1.33	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
HAR-00081	No	—	>2.50	2.48	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
HAR-00090	No	—	>2.50	0.84	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
HAR-00091	No	—	>2.50	0.79	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
HAR-00098	No	—	2.45	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
HAR-00100	No	—	>2.50	0.21	BT4 (Alternatives B, C, D)	Option 1 Module Haul Route Ice Road
HAR-00101	No	—	>2.50	1.73	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Ice Road
HAR-00106	No	—	>2.50	1.15	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
HAR-00107	No	—	>2.50	1.06	Pipeline	Option 3 Module Haul Route Ice Road
HAR-00108	No	—	>2.50	1.19	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Ice Road
HAR-00109	No	—	1.15	1.15	BT4 (Alternatives B, C, D)	BT4 Gravel Haul Ice Road
HAR-00110	No	—	1.76	1.75	BT4 (Alternatives B, C, D)	BT4 Gravel Haul Ice Road
HAR-00111	No	—	>2.50	1.38	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Ice Road
HAR-00112	No	—	>2.50	1.66	BT4 (Alternatives B, C, D)	Option 1 Gravel Haul Ice Road
HAR-00119	No	—	>2.50	1.99	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Ice Road
HAR-00120	No	—	>2.50	2.31	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Ice Road

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
HAR-00121	No	—	1.64	1.61	BT4 (Alternatives B, C, D)	BT4 Gravel Haul Ice Road
HAR-00151	No	—	>2.50	1	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Ice Road
HAR-00154	No	—	>2.50	1.71	Mine Site 1 Berm	Option 3 Module Haul Route Ice Road
HAR-00156	No	TLUIHAR082	0.05	>2.50	Pipeline	Mine Site River Crossing Ice Road
HAR-00157	No	—	2.44	>2.50	Pipeline	Mine Site River Crossing Ice Road
HAR-00158	No	—	1.64	>2.50	HDD West Pipeline Pad	Mine Site River Crossing Ice Road
HAR-00167	No	—	>2.50	1.63	Mine Site 1 Berm	Option 3 Module Haul Route Ice Road
HAR-00168	No	—	>2.50	2.07	Mine Site Berm	Option 3 Module Haul Route Ice Road
HAR-00172	No	—	>2.50	0.8	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
HAR-00173	No	—	0	>2.50	Pipeline	Option 3 Module Haul Route Ice Road
TES-00028	No	TLUITES222	>2.50	2.46	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
TES-00029	Yes	—	>2.50	2.44	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
TES-00030	Yes	—	>2.50	0.85	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
TES-00043	No	—	>2.50	0	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
TES-00044	No	—	>2.50	0.11	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
TES-00045	No	—	>2.50	0.12	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
TES-00120	No	—	>2.50	0.1	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
TES-00121	No	—	>2.50	2.33	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
XBP-00002	No	—	1.87	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00037	No	—	>2.50	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00039	No	—	0.84	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
XBP-00050	No	—	1.34	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00051	No	—	1.25	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00052	No	—	1.2	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00053	No	—	1.33	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00054	No	—	1.44	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00055	No	—	1.29	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00057	No	—	>2.50	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00058	No	—	0.87	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00059	No	—	1.18	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
XBP-00119	No	—	>2.50	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
—	No	TLUIHAR006	>2.50	0.39	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUIHAR007	>2.50	0.61	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIHAR012	>2.50	0.81	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUIHAR015	>2.50	0.35	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIHAR017	>2.50	1.3	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUIHAR023	>2.50	1.51	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIHAR027	>2.50	0.69	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
—	No	TLUIHAR031	>2.50	1.14	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUIHAR032	>2.50	1.27	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUIHAR033	>2.50	1.51	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIHAR035	>2.50	1.96	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIHAR059	0.14	>2.50	Pipeline	Mine Site River Crossing Ice Road
—	No	TLUIHAR065	>2.50	0.32	Pipeline	Option 3 Module Haul Route Ice Road
—	No	TLUIHAR066	>2.50	2.11	Pipeline	Option 3 Module Haul Route Ice Road
—	No	TLUIHAR068	>2.50	0.68	Pipeline	Option 3 Module Haul Route Ice Road
—	No	TLUIHAR069	>2.50	2.28	Mine Site 1 Berm	Option 3 Module Haul Route Ice Road
—	No	TLUIHAR079	1.76	>2.50	Pipeline	Mine Site River Crossing Ice Road
—	No	TLUIHAR103	0.93	2	Pipeline	Mine Site River Crossing Ice Road
—	No	TLUITES104	>2.50	0.84	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUITES216	>2.50	1.23	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
—	No	TLUITES217	>2.50	2.15	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUITES218	>2.50	0.3	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUITES220	>2.50	0.5	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
—	No	TLUITES221	>2.50	1.11	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road
—	No	TLUITES225	>2.50	1.93	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUITES226	>2.50	>2.50	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUITES227	>2.50	>2.50	BT4 (Alternatives B, C, D)	Option 2 Module Offload Ice Road

AHRS No.	Paleontological Site (Yes/No)	TLUI No.	Distance: Nearest Permanent Infrastructure (miles)	Distance: Nearest Temporary Infrastructure (miles)	Nearest Permanent Project Component	Nearest Temporary Project Component
—	No	TLUITES229	>2.50	>2.50	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUITES230	>2.50	1.61	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUITES233	>2.50	1.29	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUITES238	>2.50	1.44	BT4 (Alternatives B, C, D)	Option 2 Module Haul Route Ice Road
—	No	TLUITES244	>2.50	1.05	BT4 (Alternatives B, C, D)	Option 2 Gravel Haul Route Ice Road
—	No	TLUIXBP013	>2.50	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
—	No	TLUIXBP014	1.27	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road
—	No	TLUIXBP015	1.57	>2.50	Option 3 Transport Road/Curve Widening	Option 3 Module Haul Route Ice Road

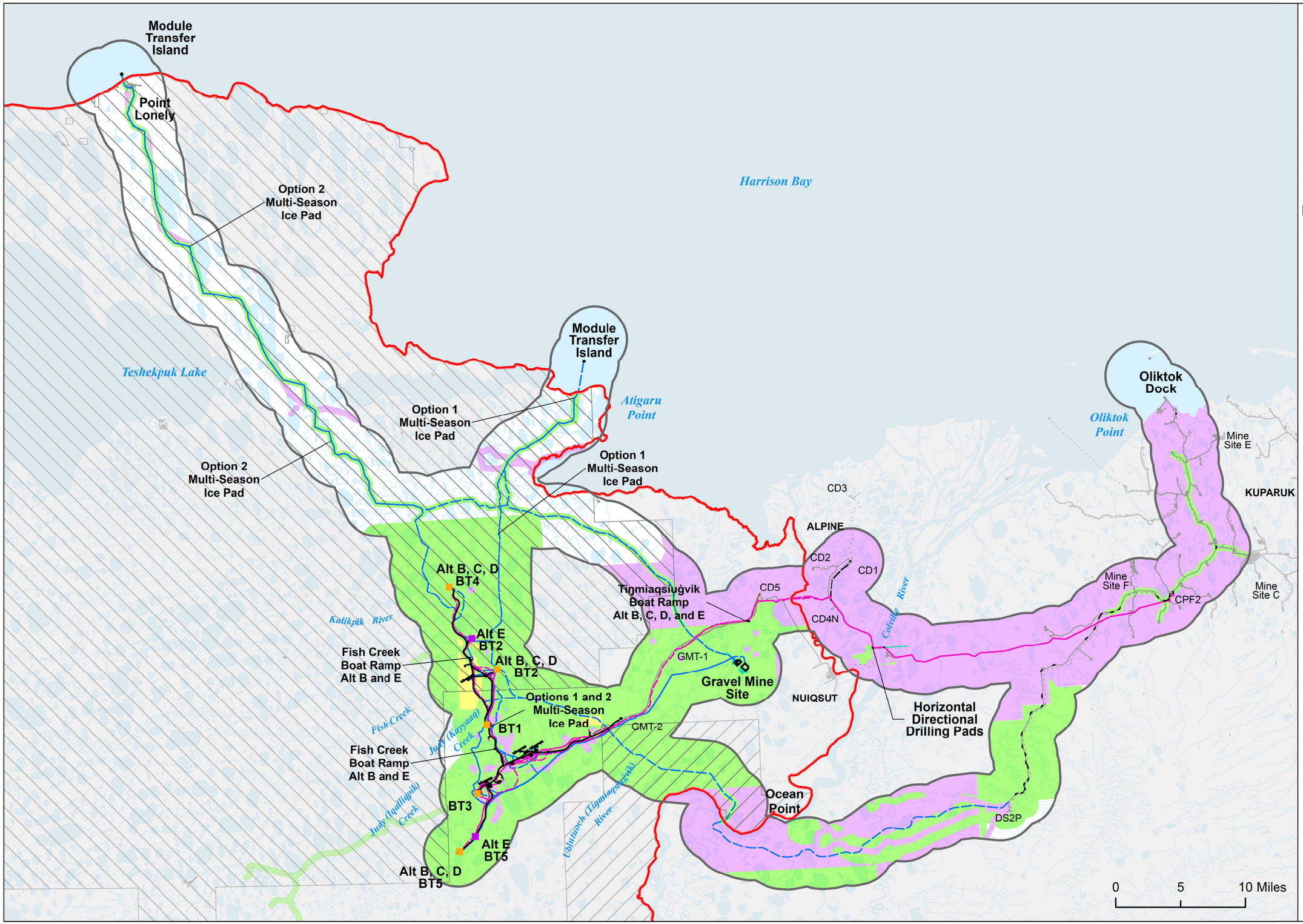
Note: — (no data); > (greater than); AHRS (Alaska Heritage Resources Survey); NA (not applicable); No. (number); TLUI (Traditional Land Use Inventory).

Table F.1.3. Summary of Applicable Lease Stipulations and Required Operating Procedures Intended to Mitigate Impacts to Cultural Resources*

LS or ROP	Description or Objective	Requirement/Standard
ROP C-2	Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.	a. Ground operations shall be allowed only when frost and snow cover are sufficient to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 15); the exact dates will be determined by the AO. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River.
ROP E-13	Protect cultural and paleontological resources.	Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity. Upon finding any potential cultural or paleontological resource, the lessee shall notify the AO and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the AO.

LS or ROP	Description or Objective	Requirement/Standard
ROP I-1	Minimize cultural and resource conflicts.	All personnel shall be provided information concerning applicable stipulations, ROPs, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. All personnel involved in permitted activities shall attend an orientation program at least once a year and the orientation program should: a. Provide sufficient detail to notify personnel of applicable stipulations and ROPs, as well as specific types of environmental, social, and traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of local community values, customs, and lifestyles. e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans. j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel. k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities.
LS K-1	*River Setbacks* Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values.	*River Setbacks* Permanent oil and gas facilities, including gravel pads, roads, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below. On a case-by case basis, essential pipeline and road crossings will be permitted through setback areas. a. Colville River: A 2-mile setback from the boundary of NPR-A where the river determines the boundary along the Colville where BLM-manages both sides of the river up through T5S, R30W, U.M. Above that point to the juncture of Thunder and Storm creeks, the setback is 0.5 mile. b. Fish Creek: A 3-mile setback from the creek downstream from the eastern edge of section 31, T11N, R1E., U.M. and a 0.5-mile setback farther upstream. c. Judy (Kayyaak) Creek: A 0.5-mile setback. d. Ublutuoch (Tiŋmiaqsiuġvik) River: a 0.5-mile setback.

Source: BLM 2022.
Note: AO (authorized officer); BLM (Bureau of Land Management); LS (lease stipulation); NPR-A (National Petroleum Reserve in Alaska); ROP (required operating procedure).



Cultural Survey
- 2021-2022
- 2016-2020
- 2010-2015
- 2004-2009

Willow Proposed Development Features
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- New Pipeline Existing VSM
- New Pipeline New VSM
- Option 3 Existing Road
- Gravel Footprint
- Analysis Area

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Land Designation
- National Petroleum Reserve in Alaska

Note:
**Where survey date ranges overlap the most recent is shown.

Data Sources:
CPAI confidential survey data

Figure F.1.1

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Willow Master Development Plan

Appendix G
Alaska National Interest Lands Conservation Act Section 810 Analysis

January 2023

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Table of Contents

List of Figures

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List of Acronyms and Abbreviations

ANILCA	Alaska National Interest Lands Conservation Act
ATV	all-terrain vehicle
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
BT1	Bear Tooth drill site 1
BT2	Bear Tooth drill site 2
BT3	Bear Tooth drill site 3
BT4	Bear Tooth drill site 4
BT5	Bear Tooth drill site 5
BTU	Bear Tooth Unit
CAA	Conflict Avoidance Agreement
CAH	Central Arctic Caribou Herd
CPAI	ConocoPhillips Alaska, Inc.
CRD	Colville River Delta
DS2P	Kuparuk drill site 2P
EIS	Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act
GMT	Greater Mooses Tooth
GMT-1	Greater Mooses Tooth 1
GMT-2	Greater Mooses Tooth 2
GMU	Game Management Unit
IAP/EIS	Integrated Activity Plan/Environmental Impact Statement
Kuukpik	Kuukpik Corporation
MTI	module transfer island
NEPA	National Environmental Policy Act
NPR-A	National Petroleum Reserve in Alaska
NPRPA	Naval Petroleum Reserves Production Act
Project	Willow MDP Project
ROD	Record of Decision
ROP	required operating procedures
SDEIS	Supplement to the Draft EIS
TCH	Teshekpuk Caribou Herd
WAH	Western Arctic Herd
Willow MDP	Willow Master Development Plan
WOC	Willow Operations Center
WPF	Willow Processing Facility

Note to Readers*

To assist readers in identifying new information in this Supplemental EIS, new or substantially revised text is highlighted in light yellow (as shown in this paragraph). Substantial revisions include changes to the text or underlying data that have changed the analysis or analysis conclusion. All sections that are new or include significant or substantial revisions include an asterisk ("*") at the end of the section header; all new or substantially revised tables and figures also include an asterisk at the end of the table or figure caption.

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ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT SECTION 810 ANALYSIS OF SUBSISTENCE IMPACTS*

This analysis of subsistence impacts is for the Willow Master Development Plan (Willow MDP) Supplemental Environmental Impact Statement (EIS). ConocoPhillips Alaska, Inc. (CPAI) is seeking approval to develop and produce oil from leases in the Bear Tooth Unit (BTU) of the National Petroleum Reserve in Alaska (NPR-A) via four or five drill sites and pipelines that would connect to the Greater Mooses Tooth 2 (GMT-2) development and existing Alpine development facilities in the Colville River Delta (CRD). The Project would include its own processing facility, an operations center, ice and gravel roads, and either one or two airstrips depending on the selected alternative. The Project would be located on the North Slope of Alaska in the northeast section of the NPR-A, west of the Colville River, CRD, and the community of Nuiqsut; however, module delivery facilities and related ice roads would also be located to the east and south of Nuiqsut, including a crossing of the Colville River. The original Willow MDP EIS was finalized in August 2020. This Supplemental EIS was prepared in response to the United States District Court of Alaska's 2021 decision remanding the Willow MDP EIS to the Bureau of Land Management (BLM) for the purpose of addressing National Environmental Policy Act (NEPA) deficiencies. A key revision of the Supplemental EIS was the addition of a fourth action alternative (Alternative E), which reduces infrastructure within the Teshekpuk Lake Special Area (TLSA) relative to the previously analyzed action alternatives.

The proposed Project drill sites and the majority of operational infrastructure would be located on federal lands in the NPR-A managed by the BLM. Some supporting infrastructure (e.g., portions of the gravel access road, temporary ice roads, and pipelines) would be located on lands owned by the Kuukpik Corporation (Kuukpik) and the State of Alaska. Conveyed and selected Native (Kuukpik) lands would include portions of Project pipelines, roads, and Colville River pipeline crossing pads. State of Alaska lands would include portions of Project pipelines. Three of the four Willow MDP Supplemental EIS alternatives analyzed include a gravel road connection from the GMT-2 drill site to the Project area. All of the action alternatives include a pipeline that would connect Project drill sites to existing pipeline infrastructure to the east.

The Willow MDP Supplemental EIS considers four alternatives and three module delivery options, in addition to a No Action Alternative (Alternative A). While the Willow MDP Supplemental EIS analysis provides an evaluation for the four Willow MDP EIS action alternatives and three module delivery options separately, any final subsistence determinations should consider the implementation of alternatives in combination with each of the module delivery options because one of the three options would occur under any action alternative. The four Willow MDP action alternatives include the Proponent's Project (Alternative B), which includes a gravel access road connecting the Project to the existing GMT-2 and Alpine developments; Disconnected Infield Roads (Alternative C), which reduces the gravel footprint but maintains a year-round gravel road connection to the existing GMT-2 and Alpine developments; Disconnected Access (Alternative D), which does not include a year-round gravel access road connection to the existing GMT-2 and Alpine developments; and Three-Pad Alternative, Fourth Pad Deferred (Alternative E), which eliminates drill site BT4 and moves drill site BT2 north. The three module delivery option alternatives include the Atigaru Point Module Transfer Island (MTI) (Option 1); the Point Lonely Module Transfer Island (Option 2); and the Colville River Crossing (Option 3). Each of these options would construct ice road connections to the Project area, and two of the options (Options 1 and 2) would construct a man-made island to support gravel hauling and module transport. Either MTI would be located in State of Alaska waters, while other associated infrastructure (e.g., ice roads, ice pads) would be located on federal lands in the NPR-A.

Chapter 3.0, *Affected Environment and Environmental Consequences*, of the Willow MDP Supplemental EIS describes the current environmental status of the Project area and potential effects of the alternative development scenarios to the physical, biological, and social environment. In particular, Section 3.16, *Subsistence and Sociocultural Systems*, addresses the affected environment and environmental consequences for subsistence, traditional use, and sociocultural systems. Other relevant sections include Section 3.10, *Fish*; Section 3.11, *Birds*; Section 3.12, *Terrestrial Mammals*; Section 3.13, *Marine Mammals*; and Section 3.18, *Public Health*. This analysis uses that information to evaluate potential impacts to subsistence uses and needs pursuant to Section 810(a) of the Alaska National Interest Lands Conservation Act (ANILCA). This analysis is organized to inform BLM's findings of significance based on the factors listed below (Section A). While the Willow MDP Supplemental EIS provides both a description of the affected environment and an analysis of the environmental

consequences of the Project, this document provides an evaluation of the potential impacts of the Project on subsistence uses and needs, followed by BLM's findings of significance for each Project alternative and the cumulative case.

A. SUBSISTENCE EVALUATION FACTORS*

Section 810(a) of ANILCA, 16 USC 3120(a), requires that an evaluation of subsistence uses and needs must be completed for any federal determination to "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." All of the Project's proposed drill sites, Willow Processing Facility (WPF), Willow Operations Center (WOC), gravel roads, air strip(s), and sections of associated pipelines and ice roads would be located on BLM-managed public lands under all action alternatives. Thus, an evaluation of potential impacts to subsistence under ANILCA Section 810(a) must be completed for the Willow MDP Supplemental EIS. All impacts to subsistence uses and needs are evaluated herein regardless of land status.

ANILCA requires that this evaluation include findings on three specific issues:

1. The effect of use, occupancy, or disposition on subsistence uses and needs.
2. The availability of other lands for the purposes sought to be achieved.
3. Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 USC Section 3120(a)).

In this analysis, four factors are considered when determining if a significant restriction of subsistence uses and needs may result from the proposed action and alternatives, or in the cumulative case:

1. A reduction in the abundance of harvestable resources.
2. A reduction in the availability of resources used for subsistence purposes caused by alteration in their distribution, migration, or location.
3. A limitation on the access of subsistence users to harvestable resources.
4. An increase in competition from non-federally qualified users, resulting in a disruption to the continuation of subsistence uses.

Willow MDP Supplemental EIS Section 3.16.1, *Affected Environment*, and Appendix E.16, *Subsistence and Sociocultural Systems Technical Appendix*, provide information on areas and resources important for subsistence use, and the degree of dependence of Nuiqsut and Utqiaġvik (Barrow) on different subsistence populations. The Willow MDP Supplemental EIS Section 3.16.2, *Environmental Consequences*, provides data on subsistence resource availability and limitations that each action alternative would place on access and is used to determine whether the action alternatives may cause a significant restriction to subsistence uses.

A finding that the proposed action may significantly restrict subsistence uses imposes requirements to notify the State of Alaska and appropriate regional and local subsistence committees, hold hearings in affected communities, and make the following determinations before BLM can authorize the use of public lands:

- Such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the use of the public lands.
- The proposed activity would involve the minimal amount of public lands necessary to accomplish the purposes of the use, occupancy, or other disposition.
- Reasonable steps would be taken to minimize adverse effects upon subsistence uses and resources resulting from such actions (16 USC 3120(a)).

A proposed action or alternative would be considered to significantly restrict subsistence uses if, after consideration of stipulations or protection measures (e.g., lease stipulations and required operating procedures [ROPs]) included as a part of each alternative, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources. Substantial reductions in the opportunity to continue subsistence uses generally are 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.

When analyzing the effects of Project alternatives, particular attention is paid to Nuiqsut, the community that has the potential to be most directly impacted by the Project. Nuiqsut is located on the Niġliq Channel of the Colville River, and the Project area lies within a substantial portion of the community's subsistence use area (Willow MDP Supplemental EIS Section 3.16, *Subsistence and Sociocultural Systems*, Figure 3.16.1). Additionally, the

analysis considers potential effects to Utqiaġvik because the Project would be in the eastern portion of the community's subsistence use area and some components would be close to Teshekpuk Lake, a key traditional use area for the community. The cumulative analysis expands the evaluation of potential impacts to consider areas beyond the Project area in which past activities have impacted North Slope subsistence uses, in which current activities are impacting North Slope subsistence uses, or in which future activities could occur that could impact Nuiqsut, Utqiaġvik, or other North Slope communities' subsistence uses or the subsistence resources that rely upon the habitats affected.

In addition to ANILCA, Environmental Justice, as defined in Executive Order 12898, also calls for an analysis of the effects of federal actions on minority populations with regard to subsistence. Specifically, Environmental Justice is:

> *The fair treatment and meaningful involvement of all people regardless of race, color, national 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 a racial, ethnic, or socioeconomic group 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.*

Section 4-4 of the Executive Order on Environmental Justice, regarding the Subsistence Consumption of Fish and Wildlife, requires federal agencies to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish or wildlife for subsistence, and to communicate to the public any risks associated with those consumption patterns. To this end, the action alternatives subsistence analyses, located in Section 3.16 of the Willow MDP Supplemental EIS, have been reviewed and found to comply with Executive Order 12898.

B. ANILCA SECTION 810(A) EVALUATIONS AND FINDINGS FOR ALL ALTERNATIVES AND THE CUMULATIVE CASE

Evaluations and findings for Alternatives A, B, C, D, and E, module delivery Options 1, 2, and 3, and the cumulative case are presented individually in the following sections. ROPs established by the 2022 NPR-A Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) Record of Decision (ROD) (BLM 2022) would apply to all Project alternatives. CPAI's leases in the BTU are subject to lease stipulations established in the 2008 Northeast NPR-A Supplemental IAP ROD (BLM 2008). The mitigating effects of these ROPs and lease stipulations are accounted for in the following evaluations and findings.

1. Evaluation and Finding for Alternative A (No Action)

The No Action Alternative of the Willow MDP Supplemental EIS precludes the currently proposed development in the BTU, and no oil from the BTU field would be produced. Under this alternative, no new roads, airstrips, pipelines, or other oil and gas facilities would be constructed pursuant to CPAI's proposal for development in the BTU.

Activities that are currently allowed pursuant to the 2022 NPR-A IAP/EIS ROD would continue. These activities include seismic exploration, exploratory drilling of test wells, and the construction of ice roads and pads to support these operations.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

No additional impacts to subsistence uses and needs would be expected under the No Action Alternative. Impacts in the Project area would be expected from those actions associated with scientific research during the summer and oil and gas exploration during the winter. Numerous studies are conducted on a year-round basis on the North Slope. Aerial surveys are conducted by fixed-wing aircraft or helicopter, and ground surveys are conducted on foot, snow machine, or by all-terrain vehicle (ATV); these activities have the potential to disturb wildlife. However, the effects of these activities on species used by subsistence users are expected to be local and short-term and would have no regional population effects.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation for Willow MDP Supplemental EIS Alternative A (No Action) regarding the availability of other lands is not applicable because Alternative A does not propose the disposition or use of public lands.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Alternative A (No Action) would eliminate the use of public lands needed for subsistence purposes. The Willow MDP Supplemental EIS Appendix D.1, *Alternatives Development*, Section 3.5.3 (*Alternative Components Considered but Eliminated from Further Analysis*) discusses other alternatives that were considered but eliminated from detailed analysis due to economic or technological feasibility or practicability, or because they did not meet the purpose of the proposed action.

d. Findings

The effects of the No Action Alternative fall below the level of possibly significantly restricting subsistence uses and needs. The impacts to subsistence resources and access discussed above would be minimal. This finding applies to the entire Project study area.

2. Evaluation and Finding for Alternative B (Proponent's Project)

Development of oil reserves in the BTU would occur under Alternative B, the Proponent's Project. Infrastructure would include five drill sites (BT1, BT2, BT3, BT4, and BT5), WPF, WOC, an all-season gravel road connection extending from the GMT-2 drill site southwest to the WPF, an airstrip, infield and export pipelines, gravel roads (including eight turnouts with subsistence/tundra access ramps and seven associated bridges) connecting the five drill sites to the WPF, and a water source access road near BT5. Gravel roads would cross both the Judy (Iqalliqpik and Kayyaaq) and Fish creeks. The Proponent would also construct up to three boat ramps for subsistence uses. One of the boat ramps, common to all action alternatives, would provide access to the Ublutuoch (Tiŋmiaqsiuġvik) River along the existing gravel road between Alpine CD5 and Greater Mooses Tooth 1 (GMT-1). Up to two additional boat ramps would be constructed along Judy (Iqalliqpik) Creek and/or Fish Creek pending further community input (and the selected alternative). All three boat ramps would be accessed via short roads connected to Project roads near Project bridges. During construction, the Project would also develop the Tiŋmiaqsiuġvik gravel mine site (with two distinct mine pits), a module delivery option (see Sections B.5, *Evaluation and Findings for Module Delivery Option 1: Atigaru Point Module Transfer Island;* B.6, *Evaluation and Findings for Module Delivery Option 2: Point Lonely Module Transfer Island; and Option 3: Colville River Crossing*), and associated ice roads for gravel haul and/or module transport. All action alternatives would use Oliktok Dock for the delivery of Project materials.

In the Willow MDP Supplemental EIS, BLM analyzed potential direct impacts on subsistence based on a 2.5-mile buffer of permanent and temporary (e.g., ice roads) infrastructure associated with Alternatives B, C, D, and E, in addition to the gravel mine site, ice roads, and Oliktok Dock (Figure 1). Because the 2.5-mile buffer of the first three action alternatives is nearly identical, it was not necessary to provide a separate analysis area for each action alternative. The Alternative E 2.5-mile buffer yielded slightly different results in the subsistence analysis for one subsistence resource, and those results were provided separately. Thus, while the footprint of development infrastructure and activity is similar under all action alternatives, differences in infrastructure design, infrastructure placement, and operational details determine how and to what level subsistence uses would be affected. These differences are discussed qualitatively. The alternatives analysis area includes both permanent infrastructure and temporary infrastructure (e.g., ice roads, ice pads) that would only be present during the construction phase. The difference in impacts between the construction and operations phases are discussed qualitatively. In addition, the alternatives analysis area does not include upgrades to infrastructure or new infrastructure that would occur within the footprint of existing development areas (e.g., new pipelines that would colocate with existing pipelines and roads east of GMT-2), nor does it include all areas where development-related activity, such as air traffic, would occur. These indirect effects are discussed where applicable. While each action alternative would also include a module delivery option and associated ice roads because there is more than one module delivery option, the three options and associated ice infrastructure are analyzed separately using a separate 2.5-mile buffer (Sections B.5, B.6, and B.7).

The alternatives analysis area allows for more detailed analysis of the area where subsistence users are most likely to experience direct impacts from the Project. Additional direct and indirect impacts that would occur outside the alternatives analysis area are also addressed. In addition to the alternatives analysis area, a direct effects analysis area, which is defined as a 2.5-mile buffer around all action alternatives and module delivery options, is used in the Willow MDP Supplemental EIS Subsistence Appendix (Appendix E.16) to characterize the nature of subsistence uses, including timing and transportation methods, within the area of potential direct effects.

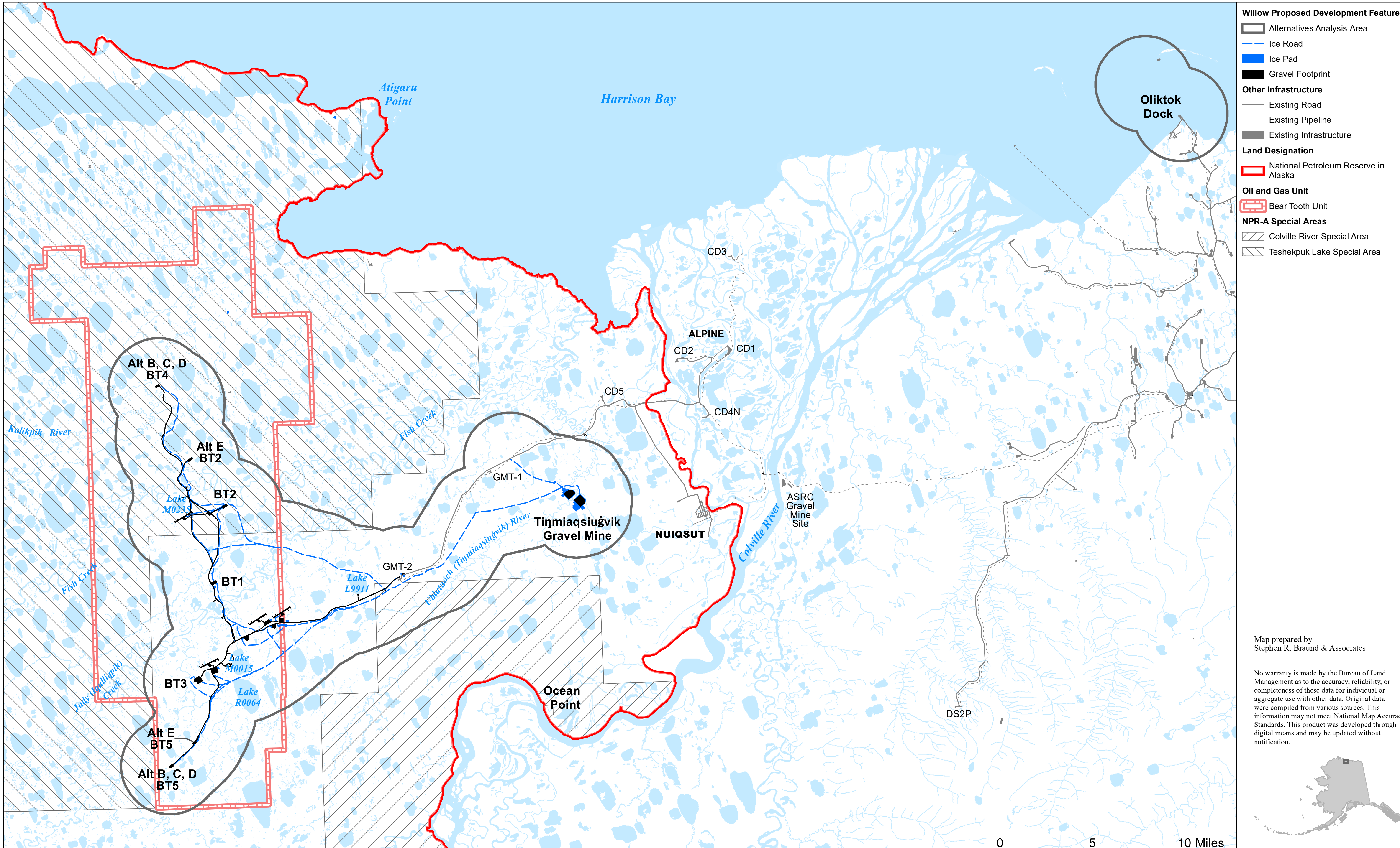
Willow Proposed Development Features
Alternatives Analysis Area
Ice Road
Ice Pad
Gravel Footprint
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Oil and Gas Unit
Bear Tooth Unit
NPR-A Special Areas
Colville River Special Area
Teshekpuk Lake Special Area
Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D BT4
Alt E BT2
BT2
Lake M0235
Kalikpik River
Fish Creek
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Ublutuoch (Tiŋmiaqsiuġvik) River
GMT-2
Lake L9911
BT1
Lake M0015
BT3
Judy (Iqalliqpik) Creek
Lake R0064
Alt E BT5
Alt B, C, D BT5
Ocean Point
DS2P
0
5
10 Miles
Map prepared by
Stephen R. Braund & Associates
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Figure 1

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a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

The Willow MDP alternatives analysis area (Figure 1) lies within areas heavily used by Nuiqsut residents for subsistence (Figure 2), particularly for harvesting of caribou and furbearers (wolf and wolverine) with some goose hunting and limited moose and eider hunting also occurring within the alternatives analysis area. The Oliktok Dock portion of the alternatives analysis area overlaps with Nuiqsut offshore seal and eider use areas in addition to coastal caribou hunting areas. The alternatives analysis area lies within the eastern periphery of Utqiaġvik subsistence use areas for wolf, wolverine, and caribou (Figure 3). During interviews with Nuiqsut active harvesters for the 1995 through 2006 time period, 91% of harvesters reported using the alternatives analysis area for Alternatives B through D, with wolf, wolverine, and caribou being the primary targeted resources (Table 3.16.5 in the Willow MDP Supplemental EIS Section 3.16.2.3, *Alternative B: Proponent's Project*). Based on annual data for the Nuiqsut Caribou Subsistence Monitoring Project for the 2008 through 2019 time period, use of the alternatives analysis area for caribou hunting on an annual basis appears somewhat lower (between 35% and 72% of harvesters during individual study years, Table 3.16.6 in the Willow MDP Supplemental EIS Section 3.16.2.3). The percent of total caribou harvests occurring within the alternatives analysis area throughout 12 years of the Nuiqsut Caribou Subsistence Monitoring Project has ranged from 6% to 21%, with the last two study years (2018 and 2019) being on the high end at 21% and 17%, respectively. The area just east of the alternatives analysis area (defined as the area "West of Nuiqsut" in the Nuiqsut Subsistence Caribou Monitoring Project) shows even greater harvests, ranging from 14% to 65%. Recent years show an increase in harvests coming from this area (SRB&A 2021). Twelve percent of Utqiaġvik harvesters reported using the alternatives analysis area, primarily for wolf and wolverine, during the 1997 through 2006 time period.

For Nuiqsut, caribou is a resource of major importance, both culturally and as a food source, and the alternatives analysis area includes lands that are highly used for caribou hunting or lands that are directly west of areas highly used for caribou hunting (Figures 4 through 7). While furbearers generally are not a food source for the community, furbearer hunting and trapping has cultural value as it is a specialized activity, among highly active harvesters, which contributes to the local economy and provides materials for Native crafts and clothing. The alternatives analysis area is heavily used by furbearer hunters in Nuiqsut (Figures 8 and 9).

Thus, impacts to both caribou and furbearer resources are considered in this ANILCA Section 810 evaluation, in addition to indirect and cumulative impacts to other harvesting activities, such as fishing and waterfowl hunting, where applicable. Nuiqsut lies on the eastern periphery of the Teshekpuk Caribou Herd (TCH) range and the western periphery of the Central Arctic Caribou Herd (CAH) range. Estimates based on the timing and location of harvests indicate that a majority of Nuiqsut's caribou harvest is from the TCH, which is the primary herd that occurs within the alternatives analysis area (Braem, Kaleak et al. 2011). The CAH also contributes to the community's overall harvest, and caribou from this herd may cross to the west of the CRD on occasion. However, the CAH generally occurs east of the alternatives analysis area and impacts to harvests to this herd resulting from Alternative B would likely be minimal.

The alternatives analysis area is on the periphery of Utqiaġvik subsistence use areas but is directly east of the Teshekpuk Lake area, which is a key traditional use area for many Utqiaġvik residents (Figure 3). The alternatives analysis area is used during some years for hunting of wolf and wolverine and may be particularly important during years when these resources are less available elsewhere (Figures 10 and 11). Caribou may also be harvested during these furbearer hunting trips, but the alternatives analysis area is generally not used specifically for Utqiaġvik caribou hunting (SRB&A 2010b). Thus, the ANILCA Section 810 evaluation focuses on potential impacts to furbearer harvesting for Utqiaġvik, in addition to indirect or cumulative impacts to other resource harvesting activities. Like Nuiqsut, furbearer hunting is practiced by a relatively small proportion of households, but it is a culturally important and specialized activity in Utqiaġvik.

Subsistence Resource Abundance

As noted above, the TCH is the primary herd that occurs in the alternatives analysis area, with seasonal migrations occurring through the area during the spring and fall, and large numbers of caribou sometimes occurring in the area during the oestrid fly season (July through August), a peak hunting time for Nuiqsut (Willow MDP Supplemental EIS Section 3.12.1, *Affected Environment*). The alternatives analysis area occurs in areas of relatively low caribou calving density. Impacts to caribou populations could occur through direct mortality (e.g., vehicle strikes) or through decreased calf survival resulting from impacts to calving grounds or to the behavior of maternal caribou. Injuries and mortality resulting from vehicle collisions may occur but are not expected to have population-level effects (Willow MDP Supplemental EIS Section 3.12.2.3.3, *Injury or Mortality*). In addition,

while the Project may result in displacement of some calving caribou because the alternatives analysis area is located in low density calving areas for the TCH, displacement would likely not have population-level effects (Willow MDP Supplemental EIS Section 3.12.2.3.2, *Disturbance or Displacement*). Thus, the abundance of caribou available for subsistence use would not be impacted under Alternative B.

The alternatives analysis area does not have a high density of wolves or wolverines, although the area is heavily used by Nuiqsut furbearer hunters who generally cover large areas in pursuit of these resources. While wolf and wolverine would likely be displaced by infrastructure and human activity and some individual mortalities of wolverine may occur, overall population levels are not expected to be affected by the Project (Willow MDP Supplemental EIS Appendix E.12, *Terrestrial Mammals Technical Appendix*). Thus, the abundance of wolf and wolverine available for subsistence use would not be impacted under Alternative B.

While generally not harvested within the alternatives analysis area, other subsistence resources that could experience direct or indirect impacts from the Project include waterfowl and fish. Waterfowl hunting occurs to the north and east of the alternatives analysis area, while fishing of broad whitefish and other fish species occurs downriver from the alternatives analysis area in Fish Creek. Habitat loss and degradation could displace or cause individual mortalities of these resources, but the Project is not expected to cause population-level effects (Willow MDP Supplemental EIS Section 3.10, *Fish*). A large oil spill could have population-level effects but is not expected to occur (Willow MDP Supplemental EIS Sections 3.10, *Fish*, and 3.11, *Birds*).

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D BT4
Kalikpik River
Alt E BT2
BT2
Lake M0233
Fish Creek
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Tiŋmiaqsiuġvik River
GMT-2
Lake L9911
BT1
Fish Creek
Lake M0015
BT3
Judy Creek (Qalliqpiqvik)
Lake R0064
Ocean Point
Alt E BT5
Alt B, C, D BT5
DS2P
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas All Resources, 1995-2006 [a]

Willow Proposed Development Features
- Alternatives Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 2

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D BT4
Alt E BT2
BT2
Kuukpik River
Fish Creek
Lake M0233
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
Tiŋmiaqsiuġvik (Tiŋmiaqsiuġvik) River
NUIQSUT
ASRC Gravel Mine Site
Colville River
GMT-2
Lake L9911
BT1
Fish Creek
Lake M0015
BT3
Judy Ugaillipik Creek
Lake R0064
Ocean Point
DS2P
Alt E BT5
Alt B, C, D BT5
0 5 10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas All Resources, 1997-2006 [a]

Willow Proposed Development Features
- Alternatives Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

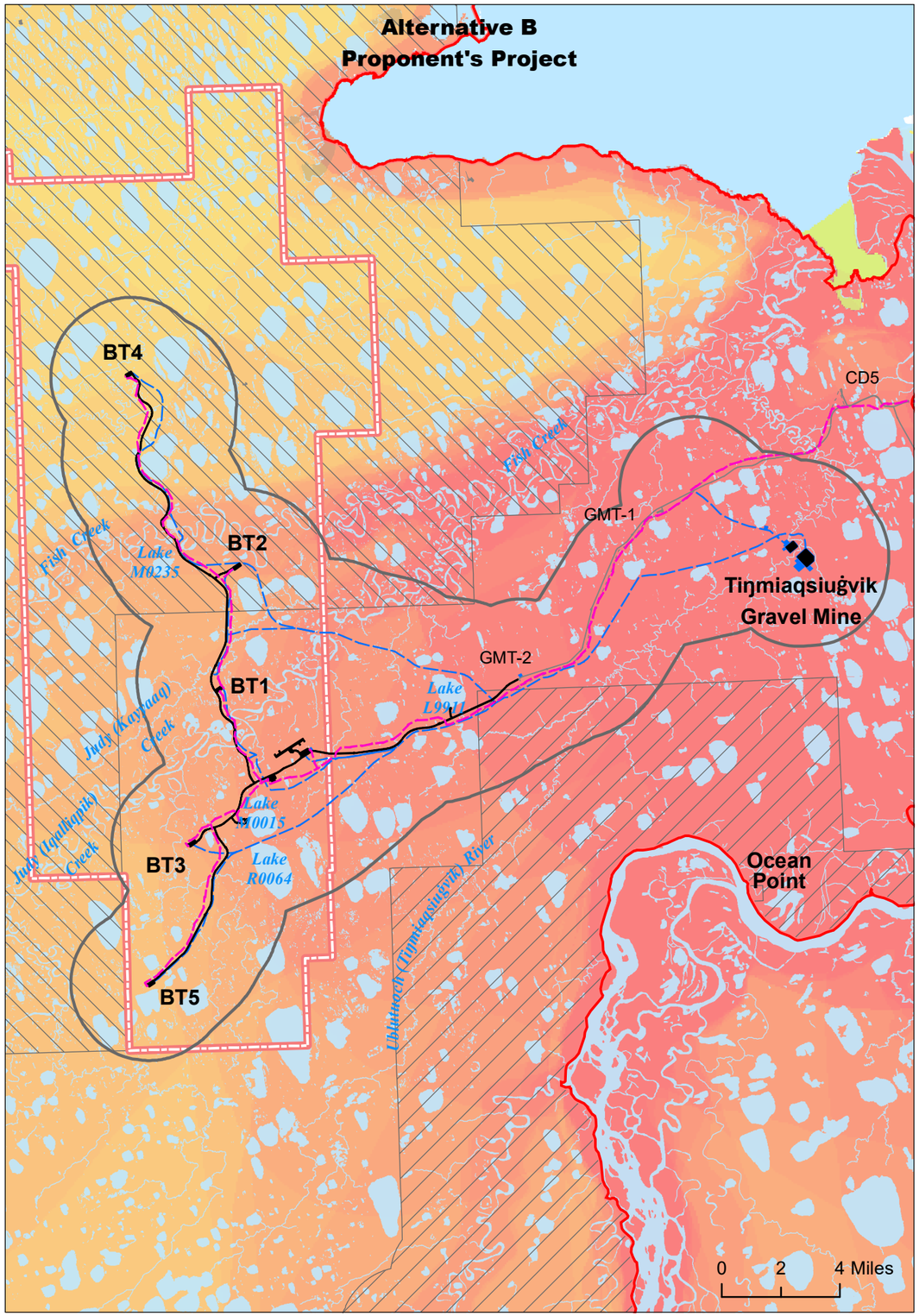
Oil and Gas Unit
- Bear Tooth Unit

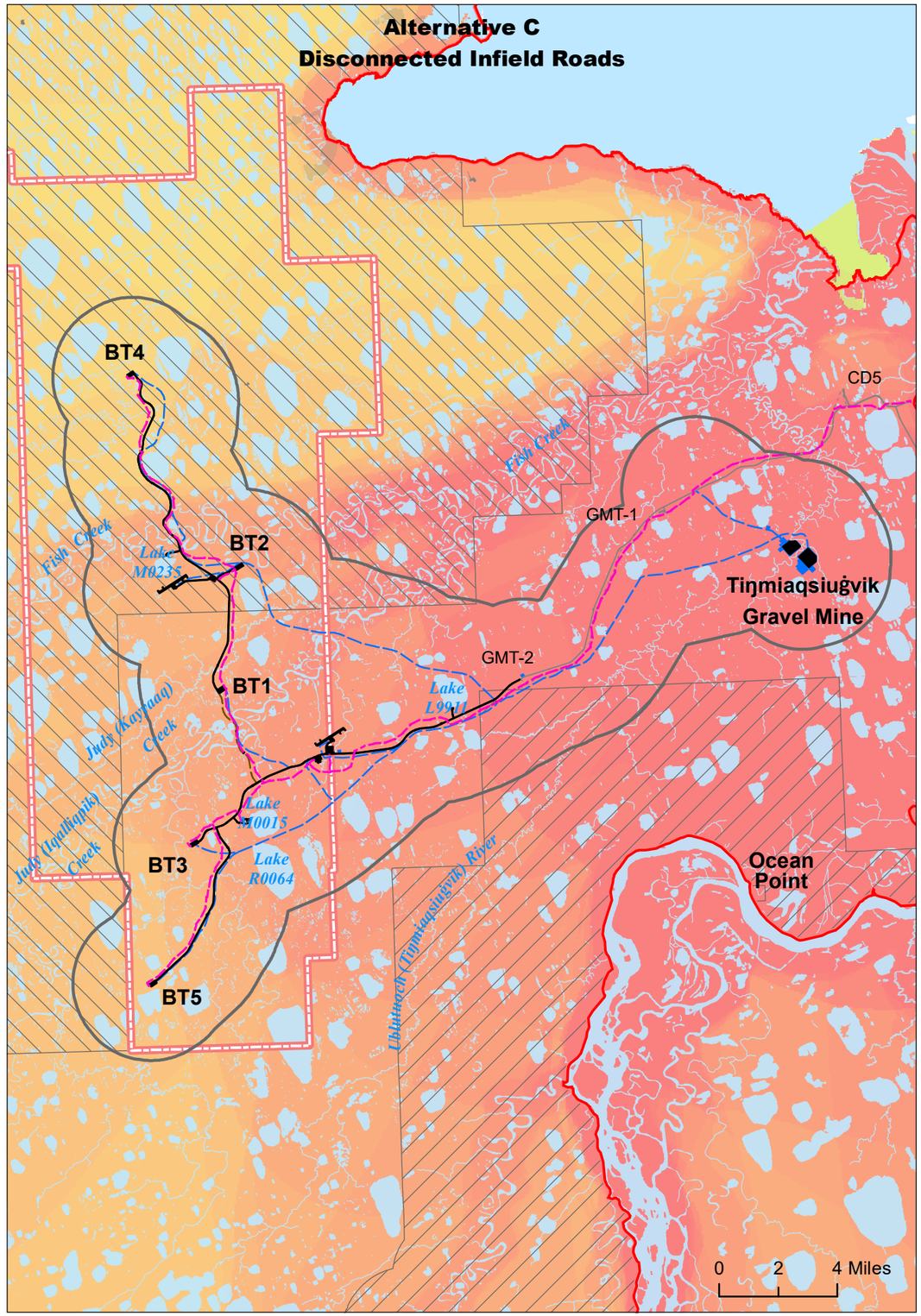
NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 3





Subsistence Data

High / Low — Overlapping Subsistence Use Areas Caribou, 1995-2006 [a]

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

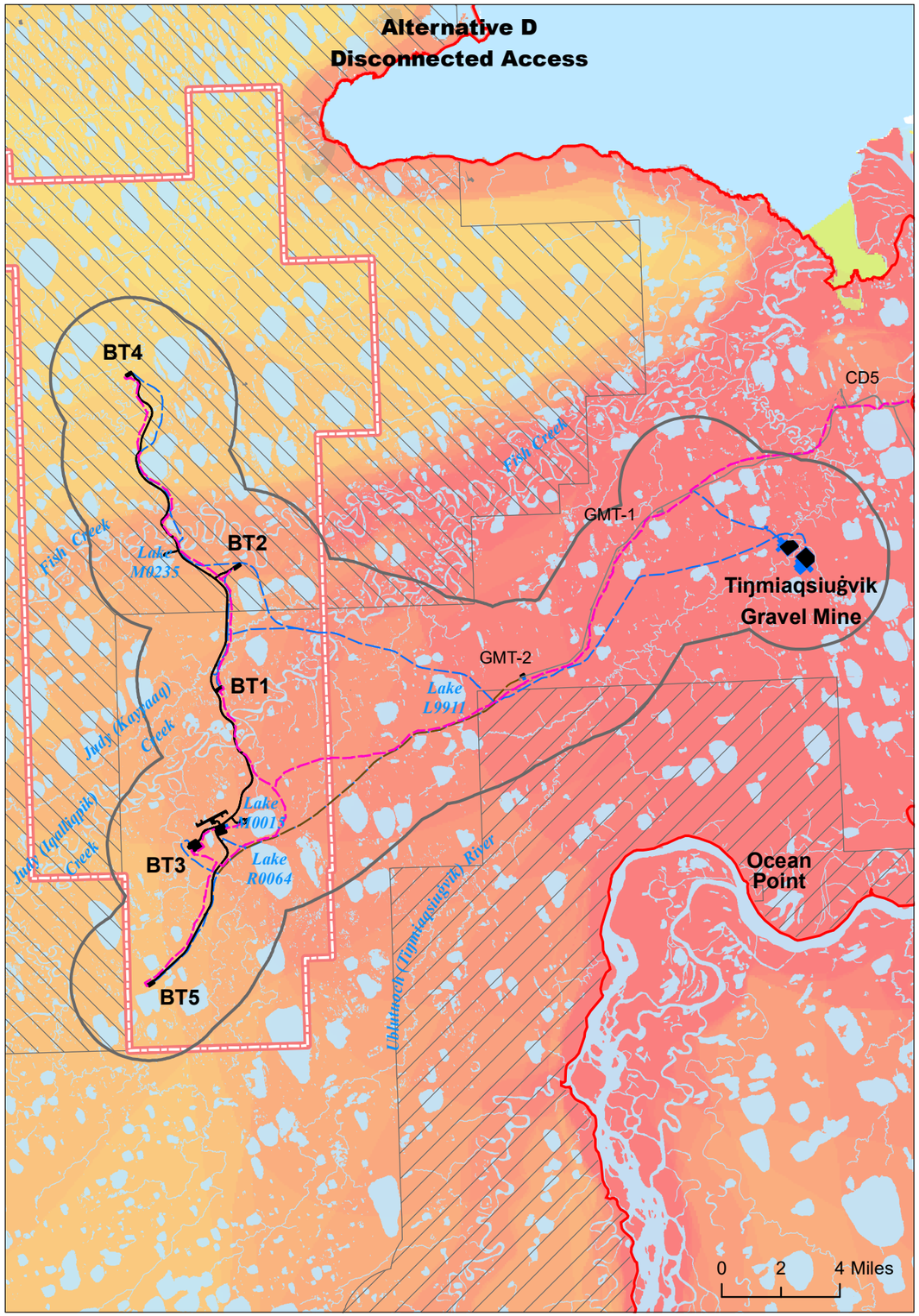
- Colville River Special Area
- Teshekpuk Lake Special Area

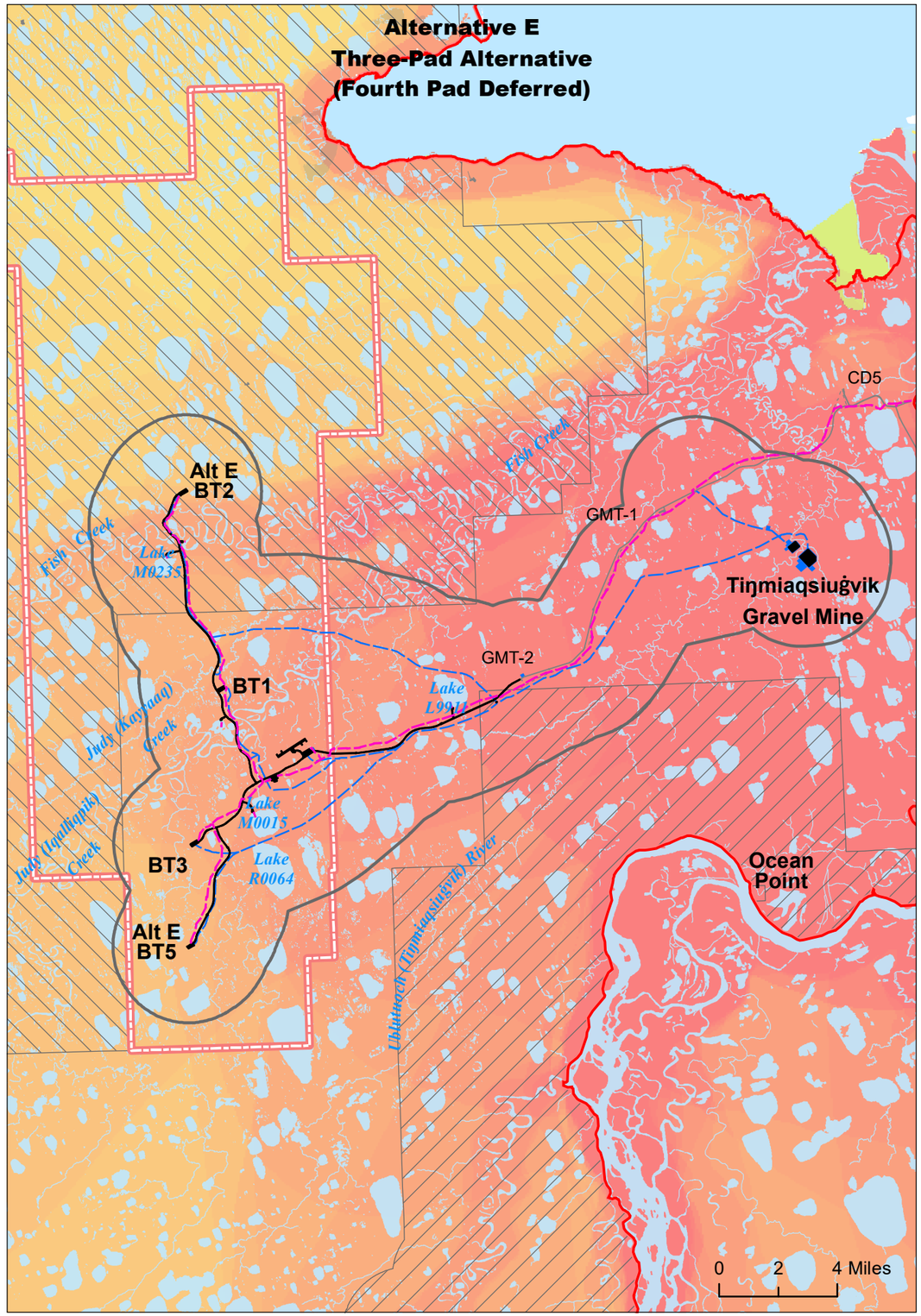
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 4





Subsistence Data

- High / Low — Overlapping Subsistence Use Areas Caribou, 1995-2006 [a]

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

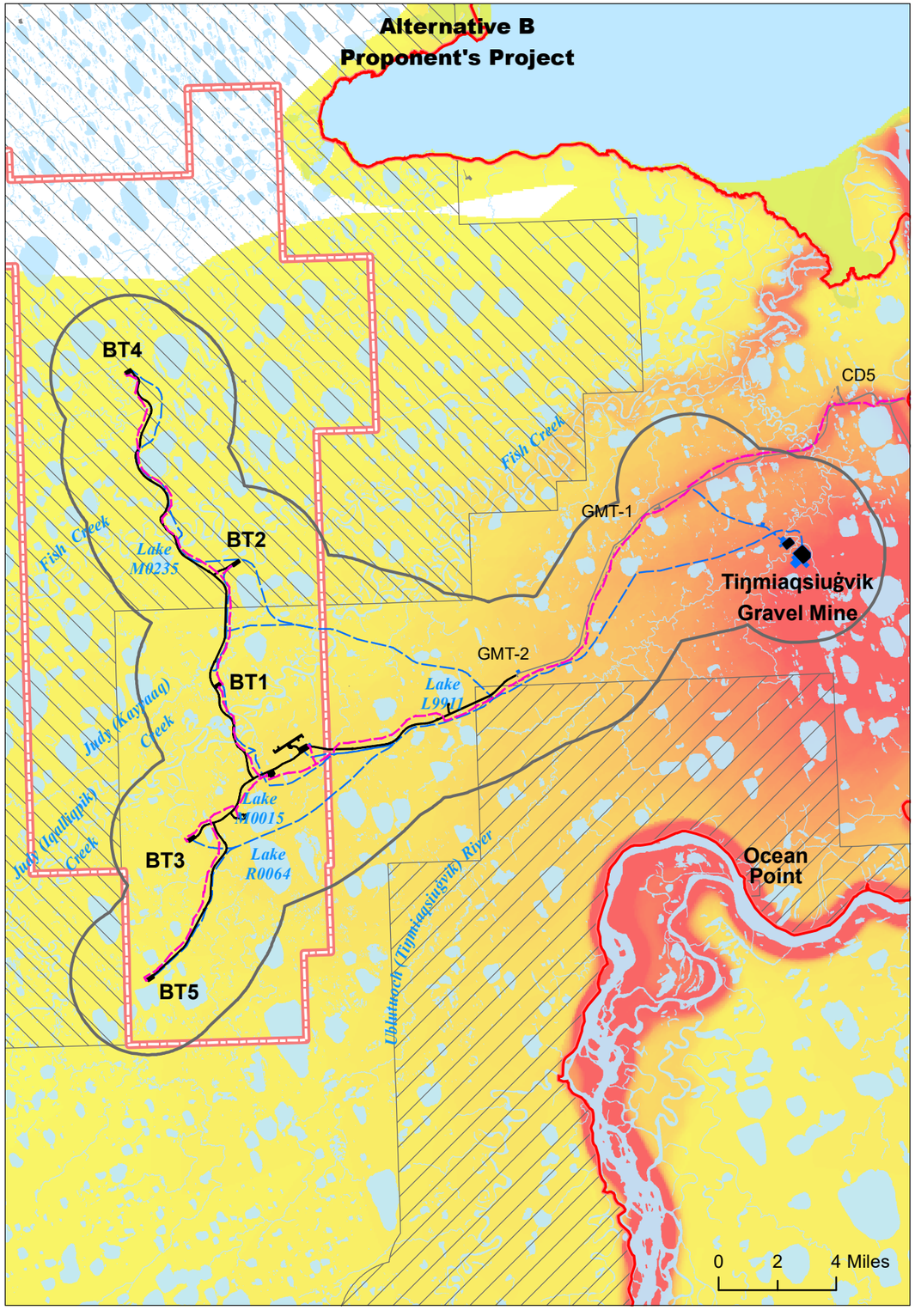
- Colville River Special Area
- Teshekpuk Lake Special Area

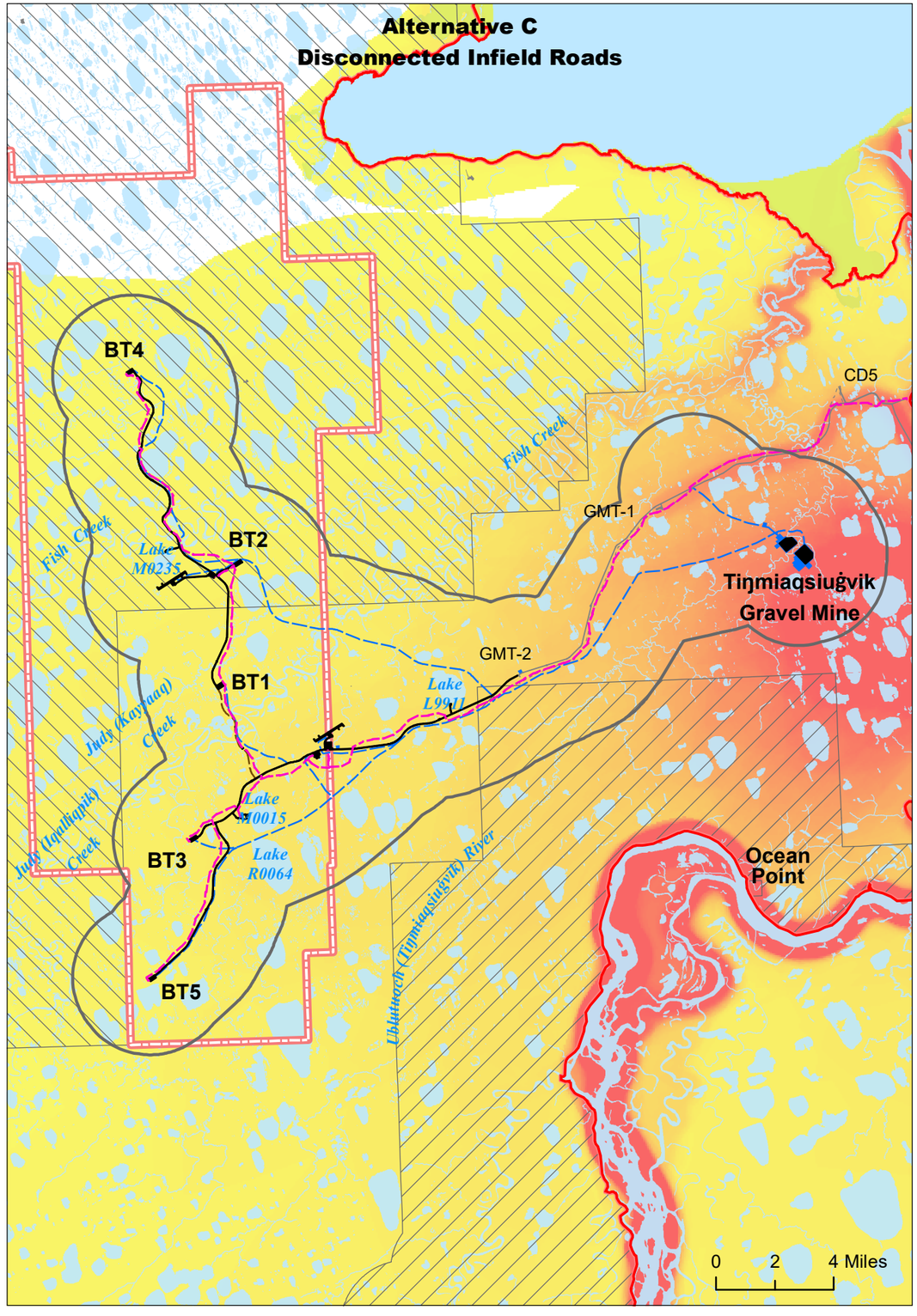
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 5





Subsistence Data

High / Low — Overlapping Subsistence Use Areas Caribou, January 2008 through December 2019 [a]

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

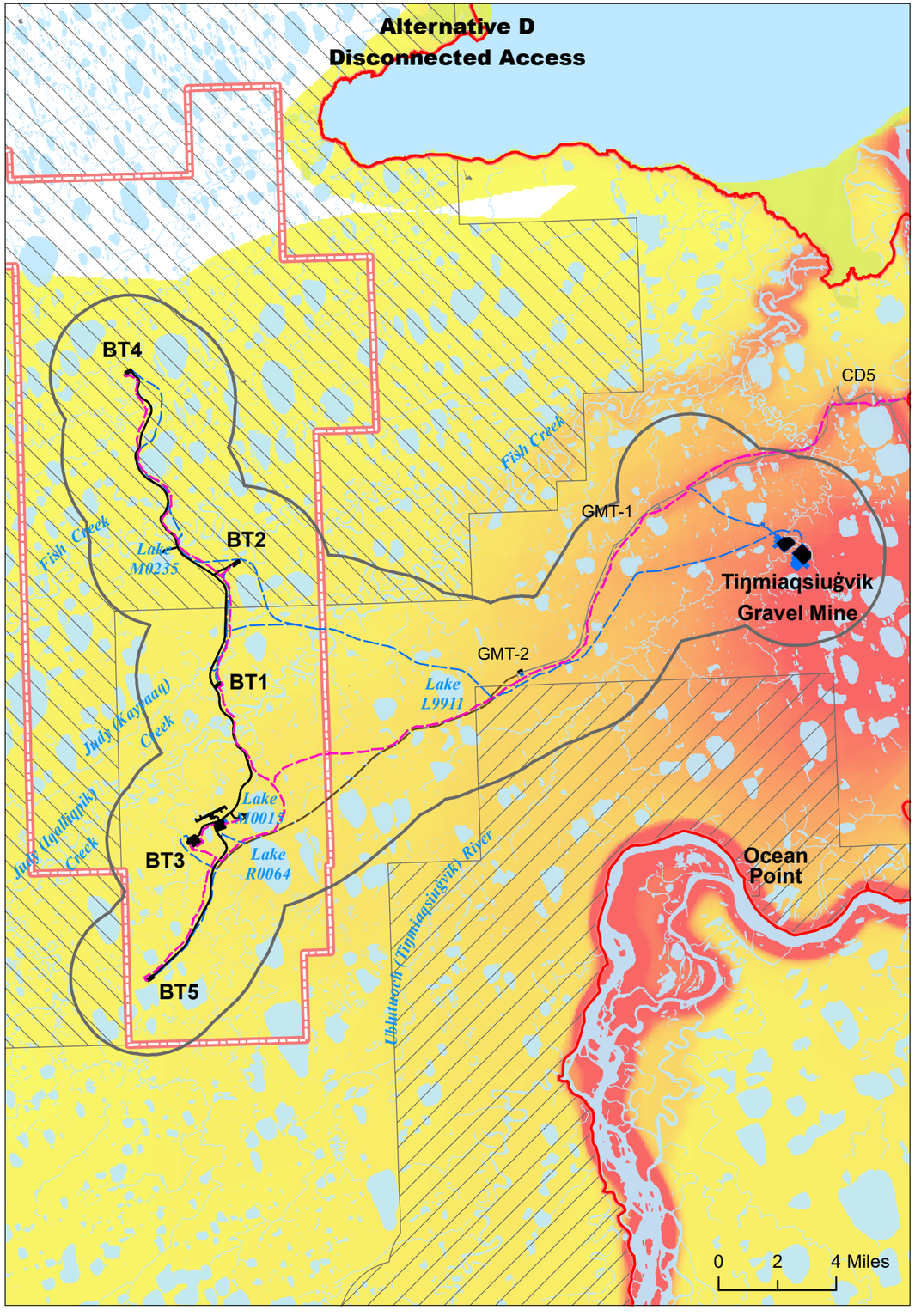
- Colville River Special Area
- Teshekpuk Lake Special Area

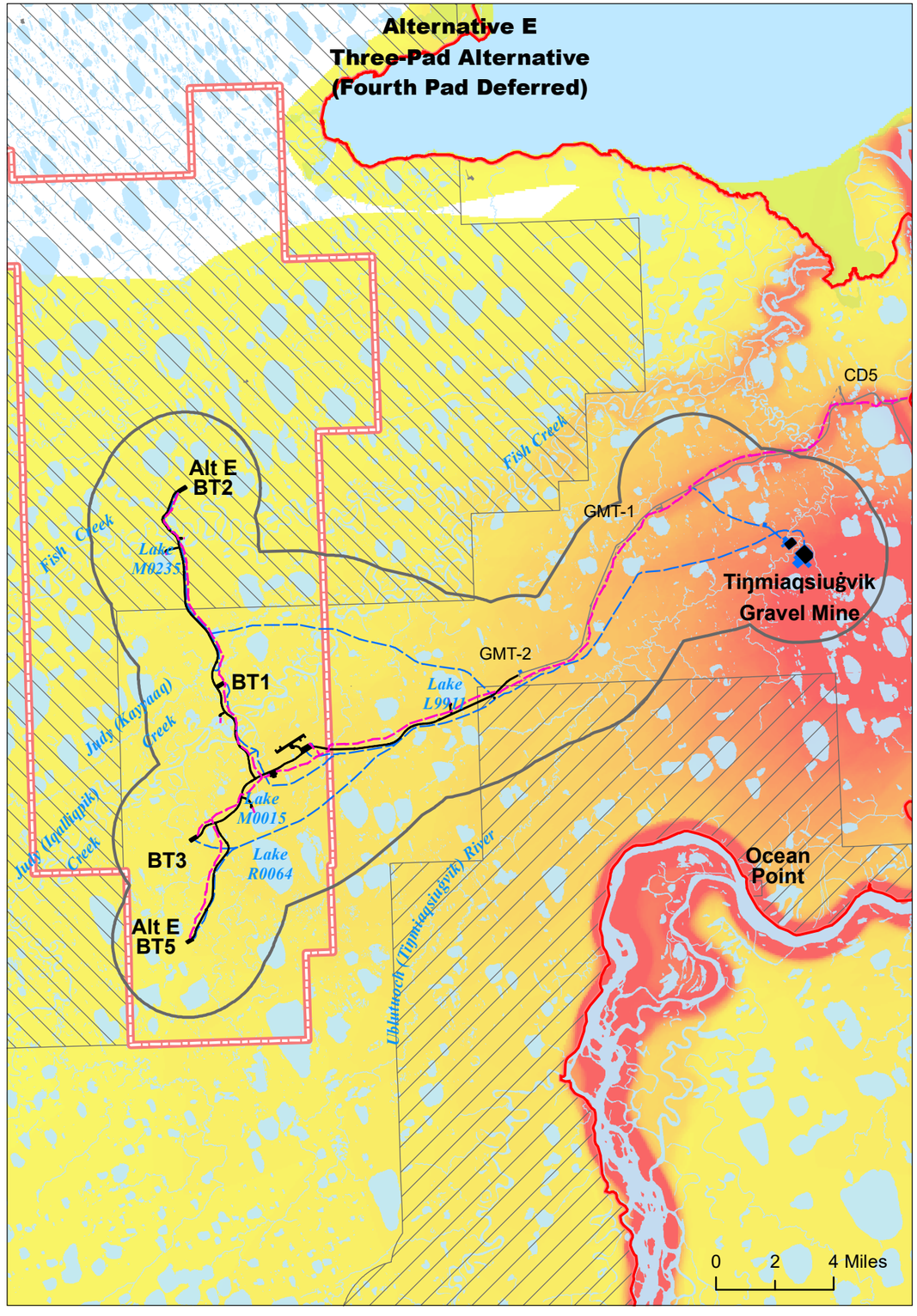
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2021

Figure 6





Subsistence Data
- High / Low — Overlapping Subsistence Use Areas Caribou, January 2008 through December 2019 [a]

Willow Proposed Development Features
- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

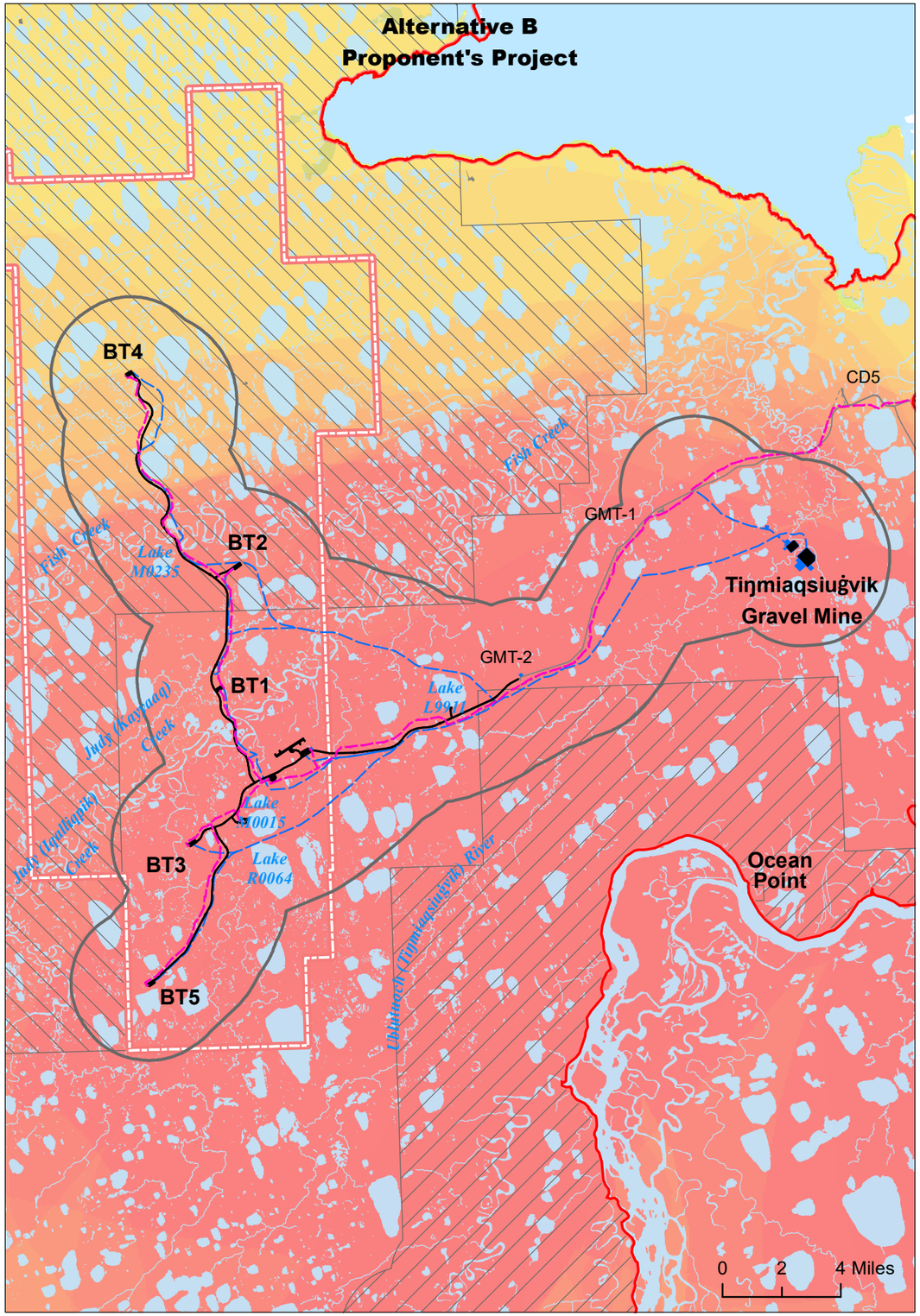
NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

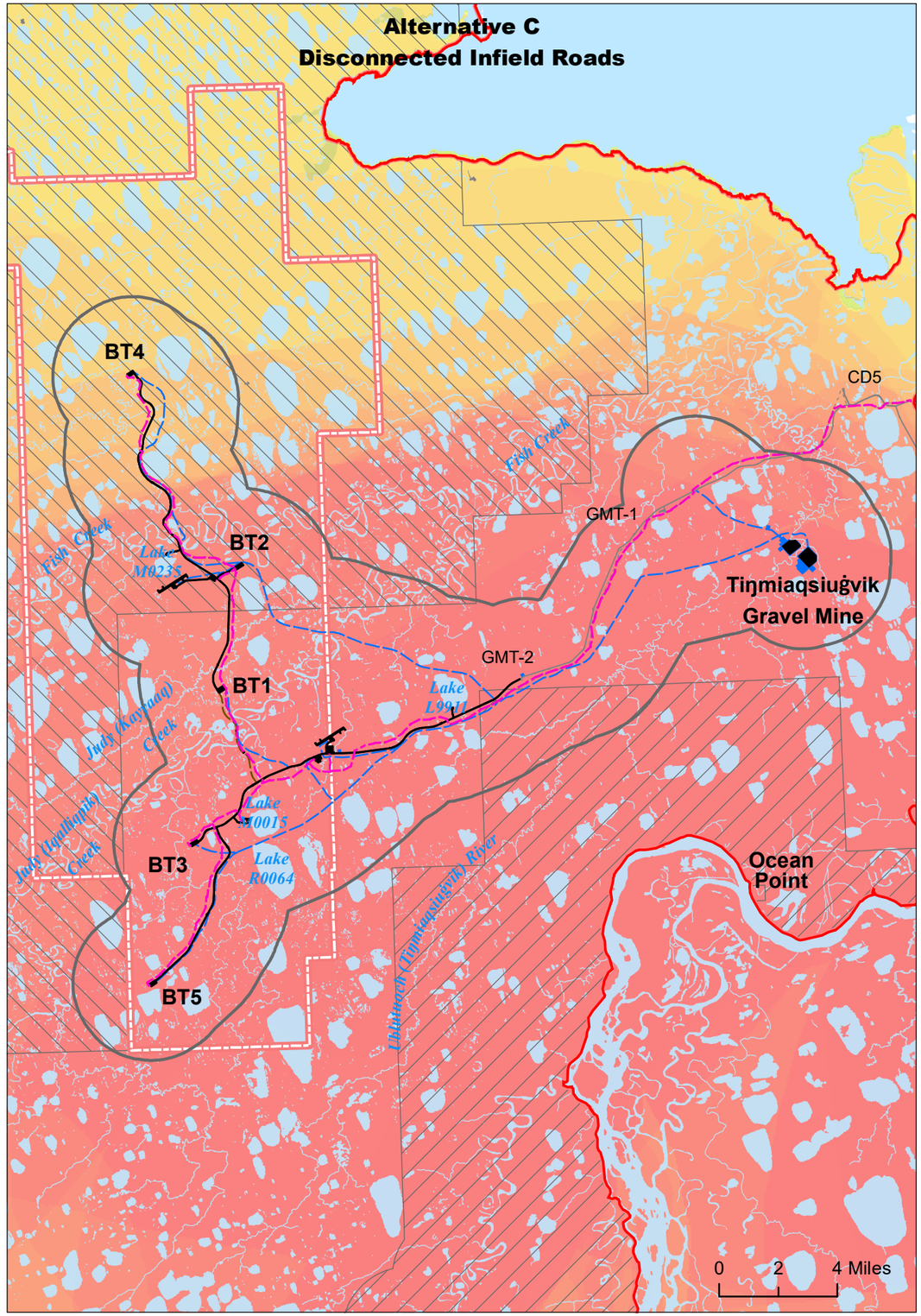
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2021

Figure 7





Subsistence Data

- High / Low — Overlapping Subsistence Use Areas Wolf and Wolverine, 1995-2006 [a]

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

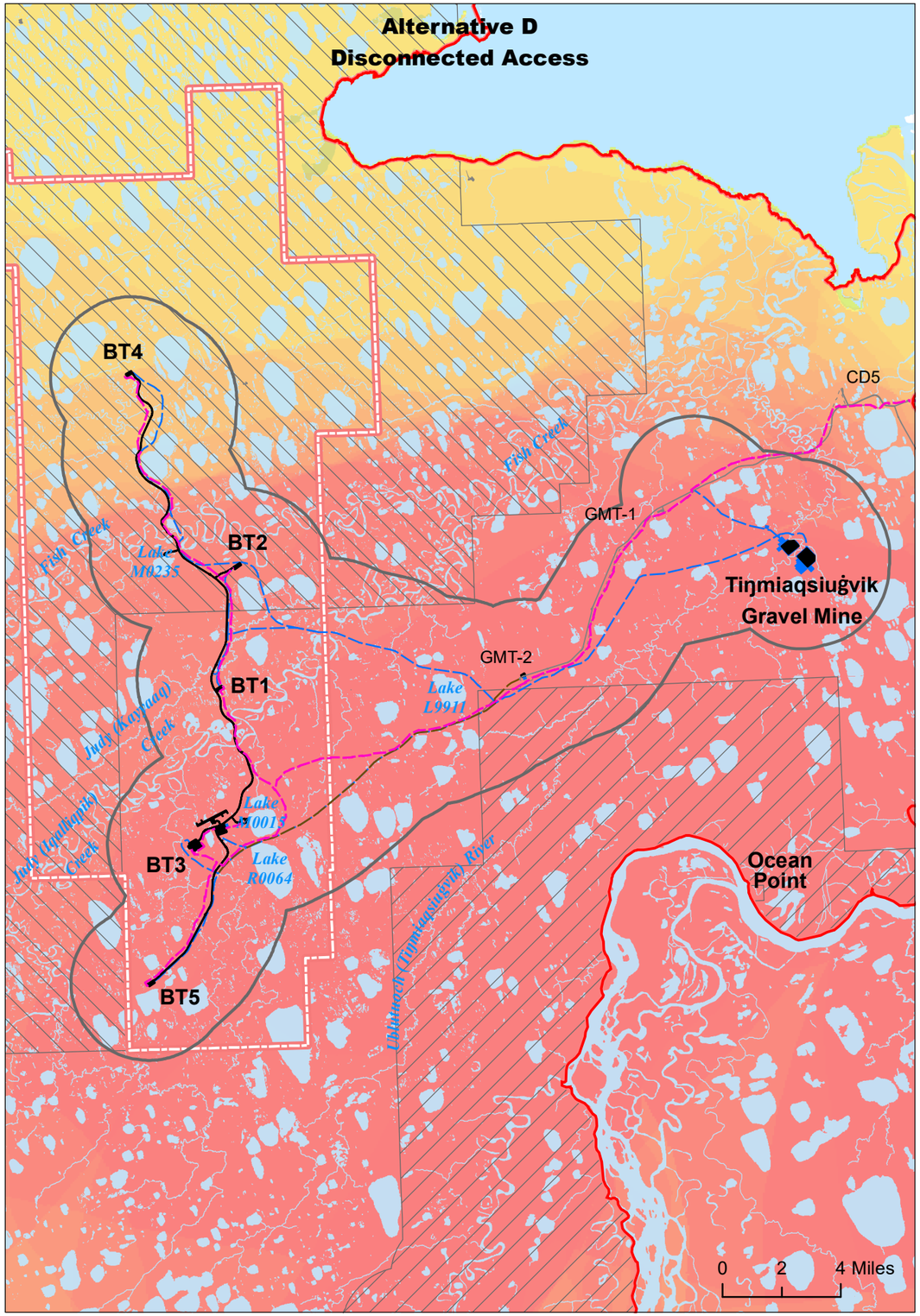
- Colville River Special Area
- Teshekpuk Lake Special Area

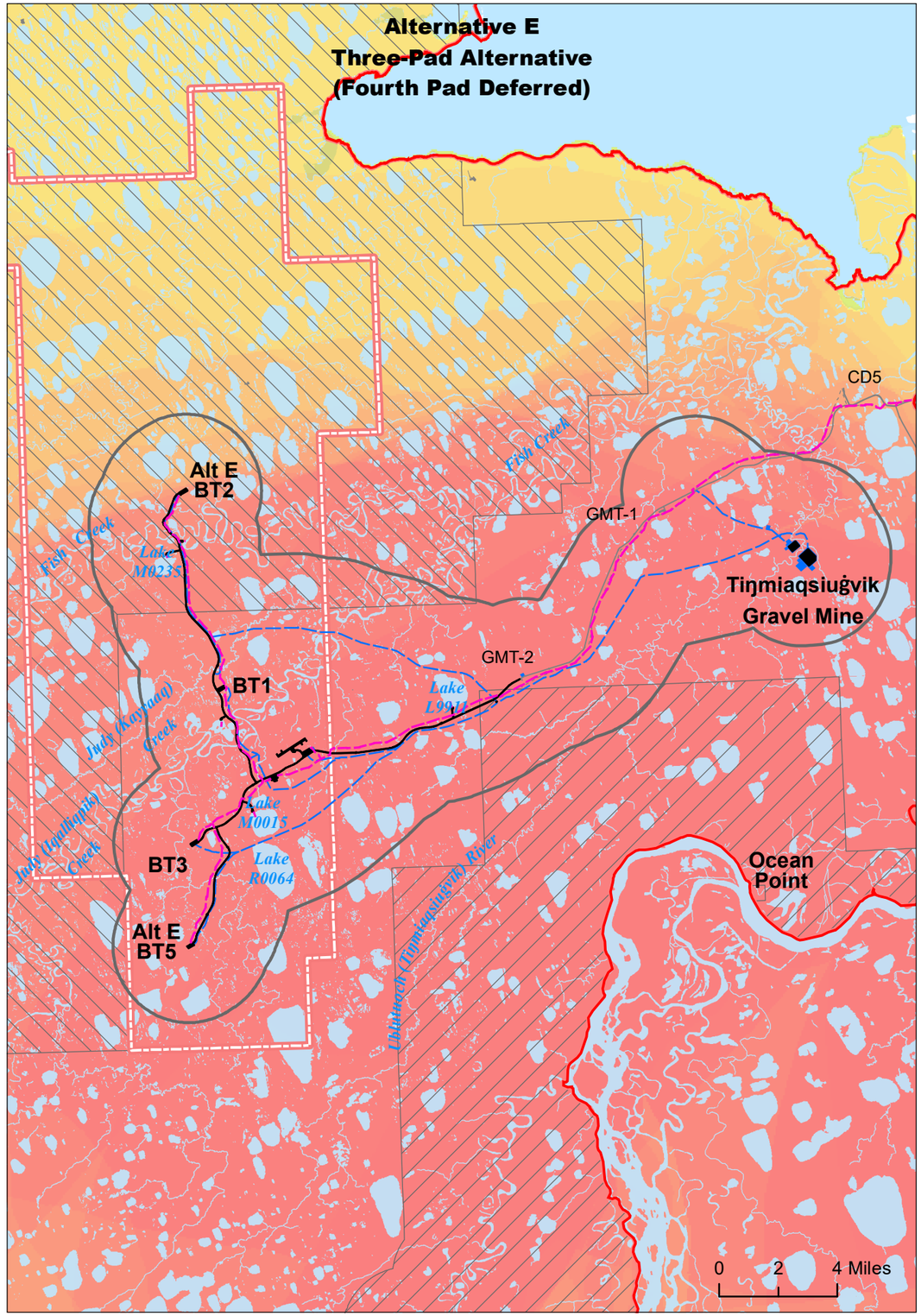
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 8





Subsistence Data

- Overlapping Subsistence Use Areas Wolf and Wolverine, 1995-2006[a] (High / Low)

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

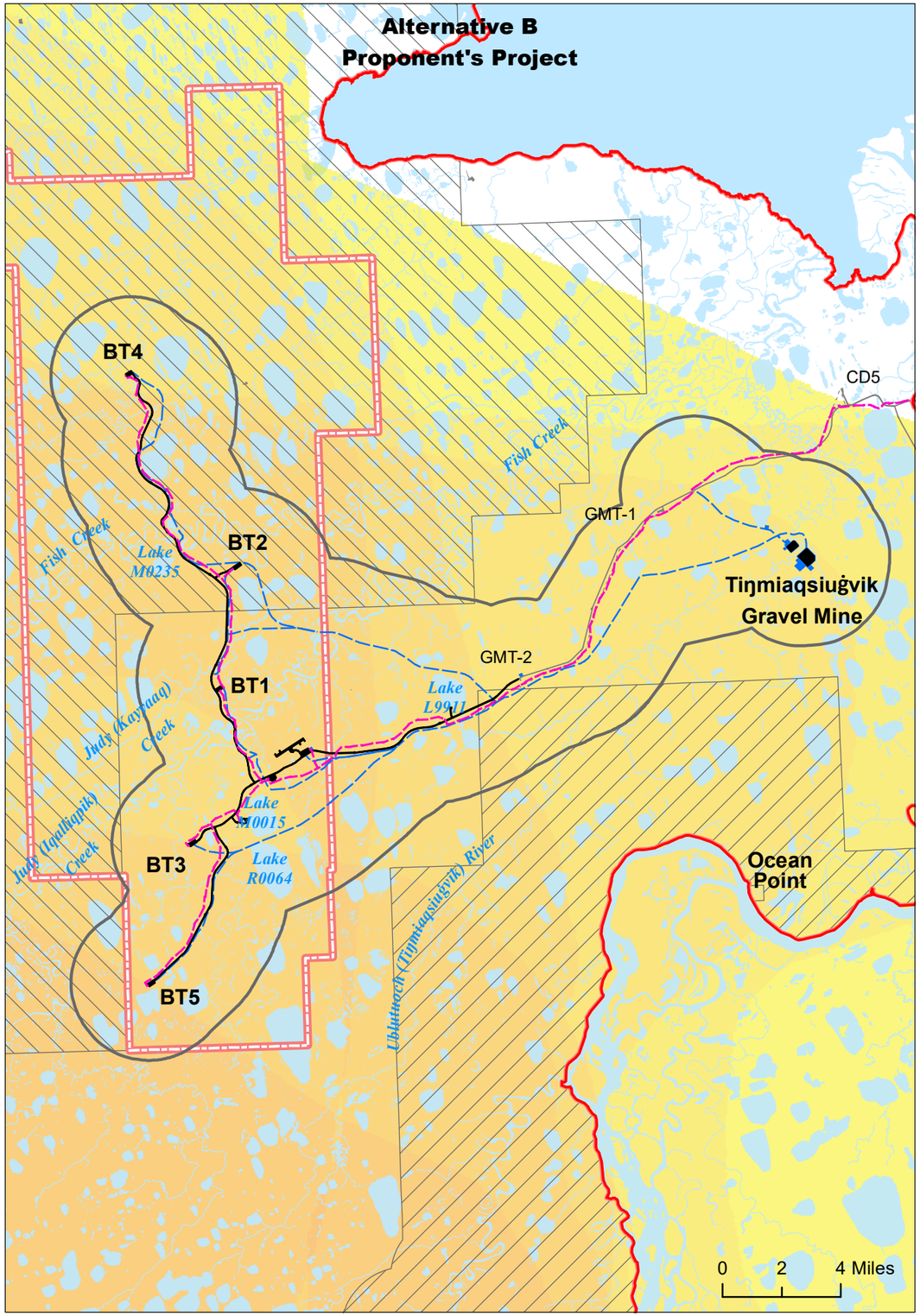
- Colville River Special Area
- Teshekpuk Lake Special Area

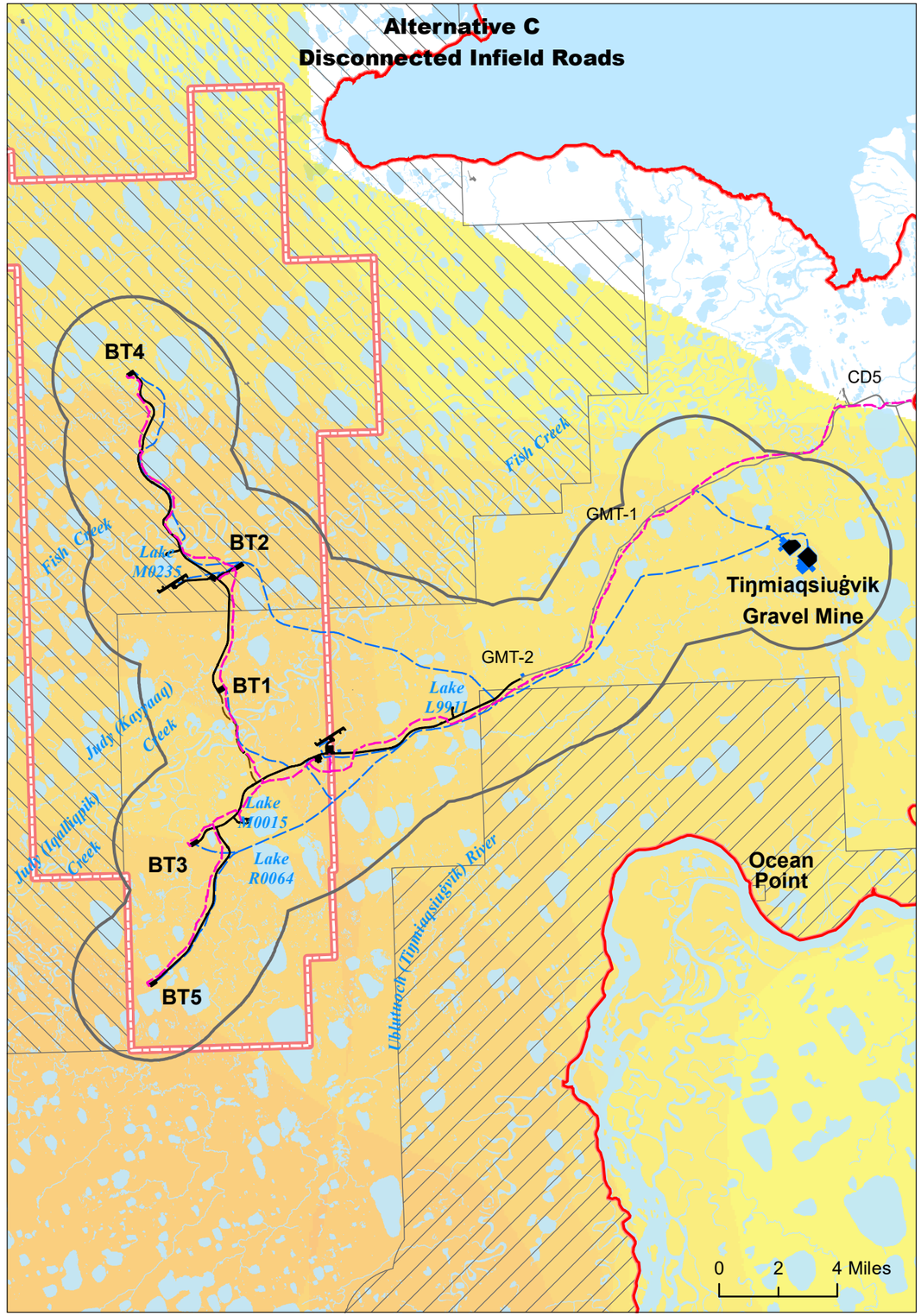
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 9





Subsistence Data

High / Low — Overlapping Subsistence Use Areas Wolf and Wolverine 1997-2006 [a]

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

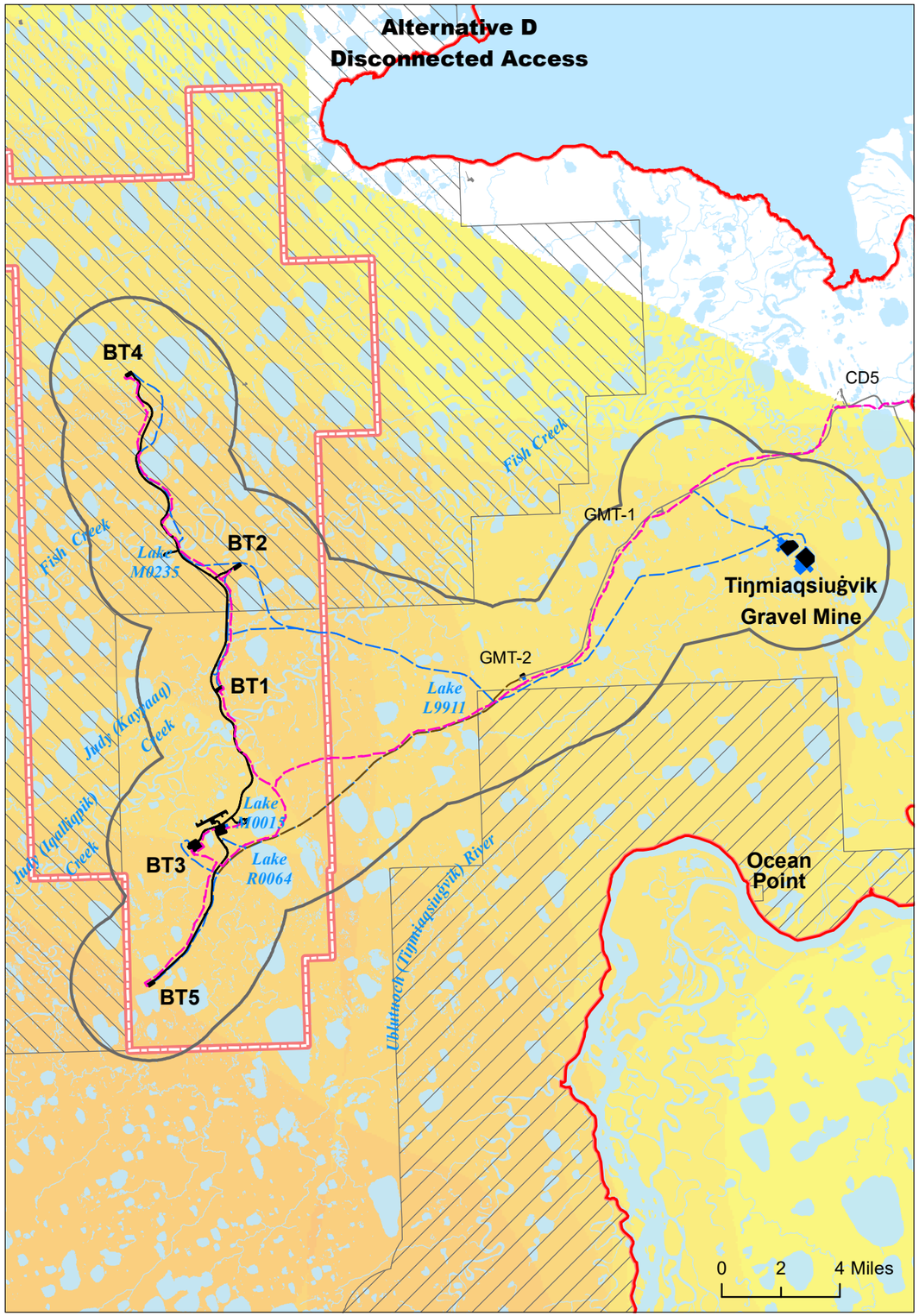
- Colville River Special Area
- Teshekpuk Lake Special Area

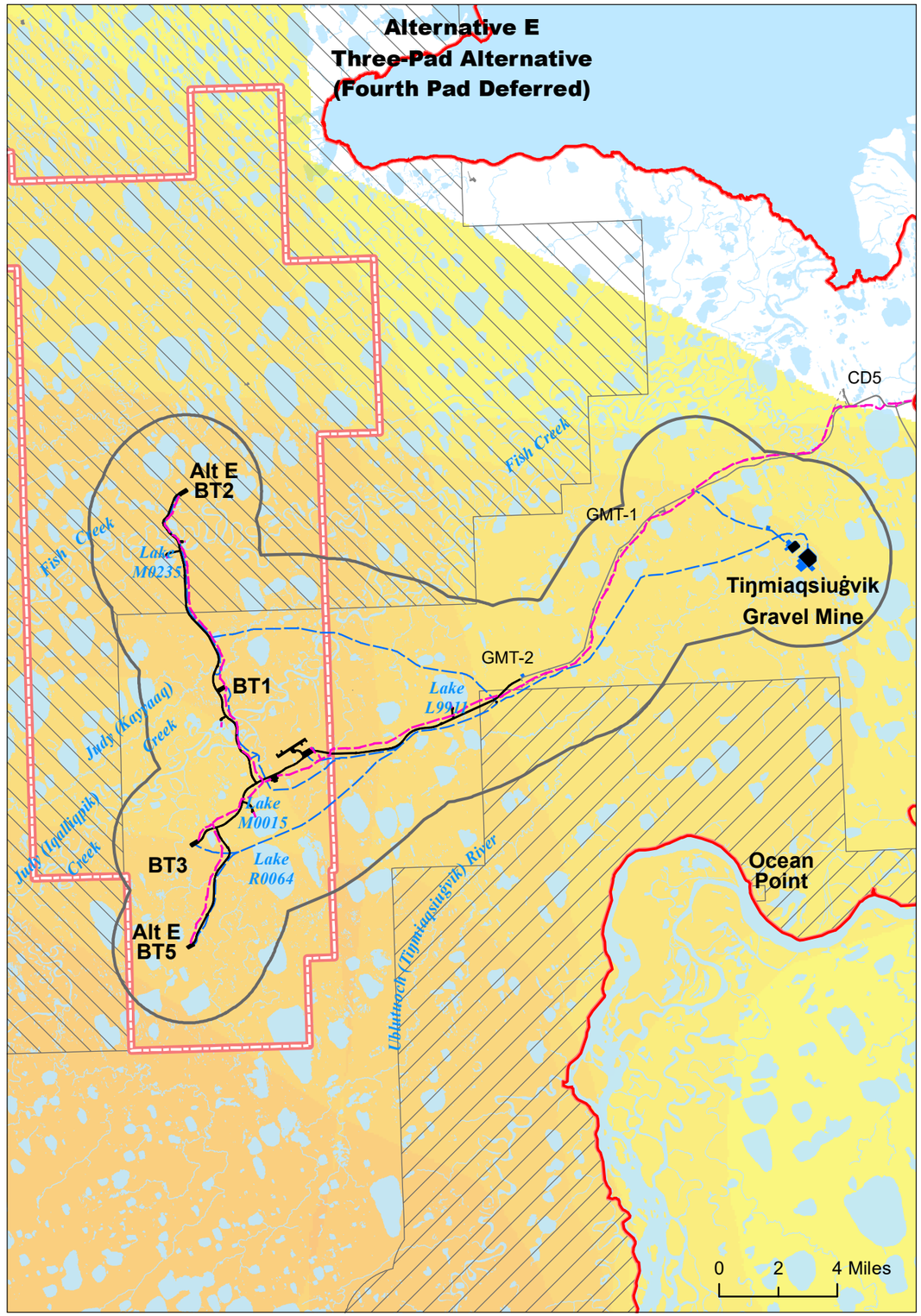
* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 10





Subsistence Data

High / Low — Overlapping Subsistence Use Areas Wolf and Wolverine 1997-2006 a

Willow Proposed Development Features

- Alternative Analysis Area *
- New Pipeline New VSM
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

- Colville River Special Area
- Teshekpuk Lake Special Area

* The alternatives analysis area also includes Oliktok Dock (see Figures 1 through 3)

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 11

Subsistence Resource Availability

A description of subsistence uses for Nuiqsut and Utqiaġvik is provided in Willow MDP Supplemental EIS Section 3.16.1, *Affected Environment*, and in Willow MDP Supplemental EIS Appendix E.16, *Subsistence and Sociocultural Systems Technical Appendix*. Nuiqsut caribou hunting primarily occurs along the Colville River drainage, including the Niġliq and East channels, as well as in overland areas to the west, southwest, and northwest of the community. While boat is the primary method of travel to caribou hunting areas along the Colville River, overland areas west of the community are primarily accessed by ATV, snow machine, and, since construction of the Kuukpik Spur, CD5, GMT-1, and GMT-2 roads, by automobile. Use of the area west of Nuiqsut for caribou hunting has increased somewhat in recent years, partially due to increased access from recently constructed gravel roads. The increase in subsistence use to the west of the community correlates with decreased use of other areas including Niġliq Channel, East Channel, and the Fish Creek drainage, which have been commonly reported as places of avoidance by local hunters due to development, environmental, and personal factors (SRB&A 2019a). Nuiqsut caribou hunting activities in the direct effects analysis area peak from July through September, as does hunting directly east and south of the alternatives analysis area (Willow MDP Supplemental EIS Appendix E.16). The majority of the use of the alternatives analysis area for caribou hunting occurs in the eastern portion of the area surrounding the proposed gravel mine and access road. Recent data from the Nuiqsut Caribou Subsistence Monitoring Project (2017–2019) have shown increasing overlapping use to the west along the GMT-1 and GMT-2 roads (SRB&A 2021). Data for the 1995 through 2006 time period shows greater use of the alternatives analysis area; recent years have seen a decrease in use of snow machines and increased use of ATVs, which may partly explain the relatively smaller overland use areas shown on Figures 6 and 7 compared to Figures 4 and 5 (SRB&A 2021). During years with adequate snow cover, use of the area may be higher. Nuiqsut caribou hunters often target caribou in the area west of the community while caribou are most available in the area during the oestrid fly season (July and August) and fall migration (August and September). During these time periods, caribou may cross through the Project and alternatives analysis area before being hunted to the west of the community. In recent years, residents have reported using roads to access caribou during these times because the caribou tend to stay near the road system rather than migrating farther south and east as they have in the past. Such deflection near the road was documented by Welch, Prichard et al. (2021) during the 2020 summer and fall migration.

Nuiqsut wolf and wolverine hunting is a winter subsistence activity that occurs in large overland areas to the west, south, and southeast of the community. For the 1995 through 2006 time period, 88% of wolverine harvesters and 87% of wolf harvesters reported using the alternatives analysis area. The majority of the alternatives analysis area is used heavily for wolf and wolverine hunting by Nuiqsut harvesters. Wolf and wolverine hunting in the area peaks from November through March and occurs by snow machine (Willow MDP Supplemental EIS Appendix E.16, *Subsistence and Sociocultural Systems Technical Appendix*).

Potential impacts to the abundance of subsistence resources are discussed above. The primary sources of potential impacts to resource availability of caribou, wolf, and wolverine to subsistence users include:

1. Displacement resulting from habitat loss (roads, pipelines, and/or other oil and gas facilities).
2. Displacement resulting from road disturbance.
3. Displacement from air traffic.
4. Displacement from other infrastructure and sources of disturbance.

These impacts are discussed in further detail below.

Displacement of Caribou Due to Habitat Loss

Impacts on caribou related to habitat loss are discussed in Willow MDP Supplemental EIS Section 3.12, *Terrestrial Mammals*. The Project area is to the east and south of the TCH primary calving grounds which, in recent years, occur with the greatest density to the southeast of Teshekpuk Lake. Alternative B would remove 615.6 acres of terrestrial mammal habitat due to gravel mining and construction of gravel infrastructure. Additional habitat loss or alteration would result from gravel spray and dust deposition. The habitats that would be affected by Alternative B are not unique, and similar habitats would be available nearby. Thus, habitat loss and alteration associated with the Project would likely cause caribou to move to similar habitats nearby and would not have overall impacts on subsistence resource availability for Nuiqsut harvesters.

Displacement of Caribou Due to Road Disturbance*

Impacts on caribou and caribou hunting resulting from road-related disturbance are discussed in Willow MDP Supplemental EIS Sections 3.16.2.3.2.1, *Resource Availability–Caribou*, and 3.12.2.3.2, *Disturbance or Displacement*. The increasing presence of roads near Nuiqsut has resulted in increased reports of impacts to hunting from roads and road traffic (SRB&A 2016, 2017a, 2018a, 2019a; SRB&A 2020a, 2021). As noted above, the Project area would be in the northeastern portion of the range of the TCH. In the spring (May and June), some TCH caribou migrate through the Project area on their way to calving grounds, with males arriving in mid- to late-June when Nuiqsut residents begin traveling by boat to hunt caribou. In the summer oestrid fly season (July and August), caribou sometimes occur in the area of proposed infrastructure in large numbers, and in the fall, large numbers of caribou may move through the Project area as they migrate south to their wintering grounds (Prichard, Macander et al. 2018).

The Alternative B Project access road would bisect a portion of the fall migration corridor and would occur in areas heavily used by TCH caribou in some years (during both the summer and winter months). Residents hunt to the west, northwest, and southwest of the community of Nuiqsut during the summer and fall by ATV, and they hunt to the north and west of the community by automobile. In addition, residents hunt caribou by boat along the Colville River to the east and southeast of the proposed road corridor in the months of July, August, and September (Willow MDP Supplemental EIS Appendix E.16). While the majority of this hunting occurs in the eastern portion of the alternatives analysis area near the proposed mine site and directly east of the proposed road, some residents also travel as far as the proposed gravel road, particularly when using the existing road system to access hunting areas. This has become increasingly common in recent years with construction of the GMT-1 and GMT-2 roads (SRB&A 2021). The most heavily used hunting areas are directly east and northeast of the proposed access road. Some caribou may remain in the Project area throughout the winter and are hunted by individuals on snow machine or, in recent years, along the road. While the number of caribou that occur within the alternatives analysis area may represent a small portion of the overall herd, they represent an important source of caribou available to the community of Nuiqsut, and harvests within the area may be increasing (Willow MDP Supplemental EIS Section 3.16.2.3.2.1). Thus, roads associated with the Project have a high potential for disturbance of caribou and Nuiqsut caribou hunting activities. While some Utqiaġvik hunters may venture into the western portion of the alternatives analysis area in some years during winter, the area is not a primary hunting area for caribou for that community. Thus, this discussion focuses on potential impacts to Nuiqsut hunters resulting from road disturbance.

Roads and road traffic are believed to cause behavioral and migratory changes in caribou that can affect hunting success. Deflections or delays of caribou movement from roads and associated ground traffic and human activity have been documented both by active harvesters (SRB&A 2010a, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a, 2018a; SRB&A 2019b, 2020b, 2021) and during behavioral studies on caribou (Welch, Prichard et al. 2021; Wilson, Parrett et al. 2016). During the Nuiqsut Caribou Subsistence Monitoring Program, reports of road-related impacts on caribou hunting have steadily increased since road construction began. Year 9 (2016) of the study was the first year where impacts related to man-made structures (e.g., roads, pipelines) were as common as impacts related to helicopter traffic (SRB&A 2018a). In Year 10 (2017) and Year 11 (2018), when constructed roads included the Spur, CD5, and GMT-1 roads, impacts from human-made structures were the most commonly reported impacts (SRB&A 2019a). In 2019, reports of direct impacts related to human-made structures decreased somewhat, although residents continue to discuss indirect impacts associated with resource availability. Residents indicate that the roads pose both a physical and visual barrier to the caribou and have observed changes in caribou distribution and behavior around roads, including decreased availability of caribou closer to the community (SRB&A 2019a). Residents also note that safety considerations around roads reduce the availability of individual caribou as residents are careful not to shoot toward infrastructure.

Avoidance of roads is particularly common for maternal caribou (displacement of between 0.6 and 3.1 miles [1 and 5 kilometers] from roads) (Willow MDP Supplemental EIS Section 3.12, *Terrestrial Mammals*). Displacement of calving caribou would likely not have direct effects on hunter success, as hunting during the spring calving season is low and the hunting that does occur focuses on males. During the mosquito and oestrid fly seasons, caribou are highly mobile due to insect harassment and regularly approach and cross pipelines; however, deflected movements and delays become common where roads and pipelines are close to one another or where traffic rates exceed 15 vehicles per hour (Willow MDP Supplemental EIS Section 3.12). Deflections or delays of several hours could have substantial impacts to harvesting success for residents hunting to the east of the road corridor, particularly hunters waiting along river corridors with no means of approaching delayed herds.

Traffic rates of over 15 vehicles per hour would be more common during construction, and therefore decreased hunting success resulting from delayed caribou crossings would be more frequent during the construction period. It is likely that caribou deflections would continue during operations but at a lower intensity and frequency than during Project construction. In addition to increased road traffic along Project roads, development of the Project would also increase road traffic along existing roads connecting the Project area to Greater Mooses Tooth (GMT) and Alpine developments. Thus, impacts related to roads would extend beyond the alternatives analysis area.

Caribou tend to follow linear infrastructure when they are placed parallel to the herd's primary movement (Willow MDP Supplemental EIS Section 3.12), though perpendicular roads can also intercept caribou and cause delayed crossing (BLM 2018; CPAI 2018). The Alternative B access road, where it intersects with infield roads near the WPF, WOC, and airstrip, could create a "pinch point" and deflect caribou away from the road during the fall migration. During the 2020 summer/fall caribou migration, caribou were delayed crossing the GMT-1 and GMT-2 roads and instead traveled parallel to the road system until they had passed all infrastructure (Welch, Prichard et al. 2021). Under Alternative B, these caribou would have to cross over one or more roads in order to continue their migration east and south and therefore delays may have been longer, possibly resulting in the herd not migrating into the area west of Nuiqsut, where residents frequently hunt them during the fall months. An overall deflection of migration could have substantial impacts to residents hunting caribou in overland areas during the fall. While residents hunting along roads would likely experience greater hunting success in these circumstances, some hunters will likely continue to prefer hunting in traditional overland areas rather than accessing them by road. In addition, if roads cause deflection rather than simply delaying caribou movement, there could be an overall reduction in success among road and overland caribou hunters. Temporary changes in distribution have not been shown to alter overall migration patterns or herd distribution (Willow MDP Supplemental EIS Section 3.12); however, small changes in caribou distribution and movement from a biological perspective can have large impacts on hunter success as residents are generally limited in how far and fast they can travel, particularly during the snow-free season. Because Nuiqsut is on the periphery of the two caribou herds which they rely upon (Prichard, Macander et al. 2018), they are particularly vulnerable to small changes in overall herd distribution or migration.

Caribou responses to roads seem to vary from year to year based on the context in which roads are encountered; thus, while Project roads may not deflect caribou during all seasons or years, in some years, deflections or delays could take place (Willow MDP Supplemental EIS Section 3.12). The likelihood of deflections would be higher during construction, when traffic levels would regularly exceed 15 vehicles per hour. Based on available data, it is not possible to predict the exact frequency or intensity at which deflections would take place. However, it is reasonable to conclude that caribou would be deflected from Project roads in some years, resource availability would be affected as a result of such deflections, and subsistence hunters may experience decreased hunting success during those times. Project roads would be built under CPAI's new Insulation Implementation Plan (see Appendix D.1, *Alternatives Development*). Under this plan, CPAI would use insulated embankments along approximately 18 miles of the 22 total miles of gravel road length. The insulated embankments would help reduce impacts to caribou availability by reducing the height and visual barriers of the gravel roads and pads, and by reducing gravel mining requirements (thus reducing associated noise and traffic impacts). Nuiqsut harvesters have reported difficulties spotting for caribou in certain areas where terrain conditions and road height result in blocking long-distance views. In addition, residents have reported difficulties crossing over roads in certain areas with steep embankments. The insulated embankments would lower the overall height of the roads, thus reducing these incidences.

According to CPAI (2018), the TCH may be less habituated to development activity than the CAH due to the relative lack of infrastructure within its range. Thus, TCH caribou may be more prone to disturbance than the CAH (Willow MDP Supplemental EIS Section 3.12). Impacts on resource availability would most likely occur during the summer and fall months when caribou hunting activity in overland areas and along the Colville River is highest (Table E.16.7 in the Supplemental EIS Appendix E.16). During the oestrid fly season, groups of caribou could gather on gravel pads and gravel roads for insect relief; which may result in increased availability of caribou for individuals hunting along roads but may also increase the likelihood of vehicle strikes and mortalities. Individuals not using roads to access caribou may experience reduced success closer to Nuiqsut, as the caribou are delayed or deflected from crossing roads toward the community's primary hunting area west of the community or along the Colville River toward Ocean Point. Increased hunting along the road corridor could also reduce the availability of caribou for hunters along river corridors or to the east of the road corridor and create increased competition among hunters if road use becomes more common.

Overall caribou harvests for the community of Nuiqsut as a whole have remained stable over time (during study years spanning the 1980s through 2019) (SRB&A 2021). Residents have reported that access to roads has offset some of the impacts of increased infrastructure and activity on resource availability by providing hunting access to areas farther from the community, although some report avoiding the roads altogether. Use of roads, and use of trucks to hunt for caribou, increased substantially after the Kuukpik Spur Road was built. While the first few years of road use did not show an increase in harvests along the road system, in 2018 and 2019, the percentage of caribou harvested within 2.5 miles of new infrastructure increased by approximately 10 percentage points from previous years. This suggests that the increasing use of roads has translated to increased harvests in the area west of Nuiqsut (SRB&A 2021).These conclusions are based on 6 years of post–road construction data, and hunting patterns will likely continue to change and adapt to the increasing presence of roads. Consequently, it is difficult to draw conclusions at this time regarding the magnitude of impacts of the CD5, GMT-1, and GMT-2 roads based on existing data. Impacts of roads on resource availability will vary from year to year and will depend on multiple factors including traffic rates, environmental factors affecting caribou movement, and hunter adaptation to changes.

Displacement of Caribou Due to Air Traffic Disturbance

During construction, fixed-wing airplanes would be the primary source of air traffic, with helicopters used to support ice road construction, surveying, and monitoring (CPAI 2018). Once the airstrip is constructed, air traffic to the Project area would likely increase to multiple daily flights throughout the life of the Project, although at slightly lower levels during the drilling and operations phases. Helicopter traffic would occur on a periodic basis throughout the life of the Project.

Caribou responses to air traffic disturbance and related impacts on caribou hunters are discussed in Willow MDP Supplemental EIS Sections 3.12, *Terrestrial Mammals*, and 3.16, *Subsistence and Sociocultural Systems*. Until recently, air traffic, particularly helicopter traffic, has been the most commonly reported impact on caribou hunting to the Nuiqsut Caribou Subsistence Monitoring Project (CPAI 2018; SRB&A 2018a; SRB&A 2019b, 2021). Air traffic could cause direct and indirect disturbances to caribou availability both within and outside of the alternatives analysis area. Nuiqsut hunters have observed that caribou behavior often changes in response to air traffic, particularly helicopter traffic and fixed-wing traffic at low altitudes. Observed behavioral responses include caribou "scattering" rather than remaining in groups where they are easier to hunt, acting skittish, and deflecting away from the source of noise or away from riversides (where hunters wait for them) (SRB&A 2010a, 2011, 2012, 2013b, 2014, 2015, 2016, 2017a, 2018a; SRB&A 2019b, 2020a, 2021). Hunters have frequently recounted experiences where a potentially successful harvest was disrupted by air traffic overhead, with caribou diverting to locations too far from riversides for hunters to access.

Increased air traffic associated with the Project would likely affect hunting activities in overland areas and along rivers, including the Niġliq Channel and the Colville River upriver toward Ocean Point. The increase in overall air traffic in the region associated with the Project would increase the frequency of disturbances experienced by Nuiqsut hunters. According to SRB&A (SRB&A 2021), the area west of Nuiqsut accounts for a substantial percentage of Nuiqsut's annual caribou harvest, and increased air traffic within that area could affect Nuiqsut harvesting success during the construction and operation phases. Impacts of air traffic to caribou resource availability would be most likely during the summer oestrid-fly season and in the fall when caribou migrate in an easterly direction, often crossing through the Project area into areas heavily used by Nuiqsut caribou hunters (Willow MDP Supplemental EIS Figures 3.16.9 through 3.16.12; Figure E.16.2 in Willow MDP FEIS Appendix E.16). However, air traffic impacts could occur year-round.

Displacement of Caribou Due to Other Infrastructure and Sources of Disturbance

Other potential sources of impacts to caribou availability include construction noise (including noise associated with gravel mining), drilling noise, general human activity, and contamination events. These potential impacts to Nuiqsut subsistence resource availability are discussed in Willow MDP Supplemental EIS Section 3.16, *Subsistence and Sociocultural Systems*. Noise associated with gravel mining (including blasting), mining equipment and machinery, and excavation, could cause caribou to avoid the mine site area or to act skittish. Blasting and excavation would occur over six construction seasons, primarily during the winter months, when caribou hunting levels are reduced. While winter is not the peak caribou hunting season for the community of Nuiqsut, harvests occur when caribou are available in the area and when households are in need of meat. Winter harvests are often an important source of food when stocks of summer and fall subsistence foods begin to run low. Winter caribou harvests have been documented occurring to the west and north of the community, including near

the proposed mine site. Access to winter ice roads may help offset some of the impacts to resource availability during this time; however, gravel haul ice roads, which would be the primary ice roads located within the community's hunting area, would be off-limits to subsistence users. Module transport ice roads would see less traffic than gravel haul ice roads and community use would be restricted only during ice road construction and active hauling of the modules. In addition to noise associated with mining, the presence of the mine pits could deflect movement of caribou year-round, resulting in localized changes in distribution. The mine pits would be allowed to fill with water following construction and would therefore no longer be suitable habitat for caribou, thus affecting availability of caribou in the immediate area.

Other disturbances associated with construction noise, general equipment operation, human presence and activity, and drilling noise could result in temporary avoidance behavior or deflection of caribou, thus affecting resource availability. Studies show that caribou, especially females with calves, avoid drilling sites, and caribou that do approach drilling sites spend less time feeding and lying down (Fancy 1983; Lawhead, Prichard et al. 2004).

Resources which are perceived as contaminated by subsistence users are often considered unavailable for subsistence use (SRB&A 2009); during a recent Bureau of Ocean Energy Management–funded study, 47% of Nuiqsut households reported avoidance in the previous year of certain subsistence foods due to concerns about contamination (SRB&A 2017b). Use and storage of hazardous materials, solid waste, and drilling waste; generation of air emissions; treatment and disposal of wastewater; and dust deposition, could result in real or perceived degradation of caribou habitat. If individuals perceive or confirm caribou to be contaminated and avoid harvesting caribou that feed near the Project, they may experience reduced caribou resource availability.

Displacement of Furbearers

Potential disturbances of wolf, wolverine, and other furbearers are discussed in Willow MDP Supplemental EIS Section 3.16, *Subsistence and Sociocultural Systems*, and in Appendix E.12, *Terrestrial Mammals Technical Appendix*. Wolf and wolverine are the primary furbearer resources harvested by Nuiqsut and Utqiaġvik subsistence users in the Alternative B analysis area. Although a higher number of overall caribou harvesters use the area, a higher percentage of wolf and wolverine harvesters—individuals who generally represent a smaller portion of the population and tend to be particularly active harvesters—use the area. During the construction phase, noise and other potential sources of impacts would be highest in winter, when most construction activities (e.g., pile driving, gravel mining, ice road operation) would occur. These activities would displace furbearers near Project activities.

Furbearer harvesters have observed reduced availability of wolf and wolverine near development and human activity, noting their sensitivity to noise and human activity, and their general tendency to avoid developed areas. Throughout the life of the Project, furbearers are likely to avoid areas with equipment and infrastructure or areas with high levels of human activity, noise, and ground traffic. Ground traffic and construction and mining noise would be highest during the winter construction months when furbearer harvesting activities are at their peak. Construction is expected to occur over a period of approximately 7 years with varying levels of intensity. Because wolf and wolverine hunting areas are generally large, accessible by snow machine, and extend in various directions from the community, residents would likely use different areas where the resources are believed to be more available, particularly during the construction phase. However, in some cases, subsistence users may have to expend more effort or go farther because the area to the west of the community is a commonly used and easily accessible area. Furbearer hunters often have specific areas where they prefer to hunt, and a temporary decrease in resource availability in those areas has been reported in recent years as a result of development activities (SRB&A 2022). Operations impacts would be similar to construction but would continue throughout the life of the Project (30 years) at somewhat lower levels. For Nuiqsut, high numbers of overlapping use areas for wolf and wolverine occur around BT1, BT2, BT3, and BT5, while low to moderate overlapping use areas occur around BT4. For Utqiaġvik, low to moderate overlapping use areas occur throughout the western portion of the alternatives analysis area, with greater intensity to the west and southwest of the analysis area.

Displacement of Other Resources*

While caribou, wolf, and wolverine are the primary resources harvested directly within the alternatives analysis area, goose hunting occurs directly to the east and north of the mine site and to the east of the proposed gravel access road along the Colville River, fishing (primarily for broad whitefish, a key resource for the community of Nuiqsut) occurs downstream from the alternatives analysis area on Fish Creek, and seal and eider hunting occurs in Harrison Bay near Oliktok Dock. Waterfowl hunting peaks during May when residents travel by snow machine to inland and riverine areas where white-fronted goose is known to be abundant (Willow MDP Supplemental EIS

Appendix E.16). While most construction activity would be complete before goose hunting begins, it is possible the ice road season would overlap with the beginning of the waterfowl hunting season in late April. Additionally, blasting at the gravel mine pits may occur into April. Thus, traffic and mining noise may result in temporary displacement or disturbance of waterfowl at the beginning of the hunting season, potentially causing a temporary decrease in harvester success. Recently, Nuiqsut harvesters reported impacts to goose hunting during the 2020 hunting season as a result of disturbance from helicopter traffic, indicating that geese left their hunting area after a helicopter flew overhead and did not return to the area for several hours (SRB&A 2022). Similar disturbances may continue to occur in association with the Project, but are not expected to cause overall impacts to resource availability for the community, as the mine site and ice roads are at a substantial distance from areas of high overlapping use for goose hunting, and activities would likely cease before the primary goose hunting season began (Willow MDP Supplemental EIS Sections 3.11, *Birds*, and 3.16, *Subsistence and Sociocultural Systems*).

While the Colville River and CRD are the primary fishing areas for the community of Nuiqsut, a number of families travel to Fish Creek and stay at fish camps to set nets for broad whitefish during the summer (July and August) and fall (September and October) months (SRB&A 2010b). Other fish resources harvested along Fish Creek, although in lesser quantities than broad whitefish, include burbot (in winter), Dolly Varden, and Arctic grayling (SRB&A 2010b). While construction activities, noise, and infrastructure (e.g., ice roads) may temporarily block or displace fish upstream and downstream, these impacts would be relatively localized and would not be likely to affect harvesting activities that generally occur a substantial distance downstream along Fish Creek (Willow MDP Supplemental EIS Section 3.10, *Fish*). In addition, ice infrastructure over stream channels would be removed, breached, or slotted before spring breakup to minimize blocked fish passage (Willow MDP Supplemental EIS Section 3.10). Water withdrawals to support ice infrastructure construction could alter fish habitat in some freshwater lakes, but these alterations would be temporary and are not expected to affect fish populations in Fish Creek (Willow MDP Supplemental EIS Section 3.10). Use of lakes in the alternatives analysis area for fishing is limited (see Willow MDP Supplemental EIS Appendix E.16). The primary potential impacts to fish resource availability would be related to real or perceived contamination of the Fish Creek drainage. If a spill occurs or if residents perceive that activities upstream from their fish camps are contaminating the water, they may perceive that the fish are unsafe to eat and reduce harvesting activities in the area (Willow MDP Supplemental EIS Section 3.16). Although unlikely, a larger oil spill could affect residents' fish harvesting in the Fish Creek drainage in the long term. The Wetlands Compensatory Mitigation Plan (Appendix I.4 of the Willow MDP Supplemental EIS) includes establishment of the Cape Halkett Preservation Area, which would preserve 800 acres that are privately held and available for development located between Nuiqsut and Utqiaġvik. Preservation of areas around Cape Halkett would reduce potential long-term impacts in the area.

Oliktok Dock would be used under all action alternatives for the delivery of Project construction materials. Nuiqsut harvesters use the offshore area near Oliktok Dock to hunt bearded seal (41% of harvesters), ringed seal (35%), and eiders (39%). Increased barge and vessel activity would occur in an area of low to moderate offshore Nuiqsut subsistence use for these resources, with areas of high overlapping use occurring directly west of the dock area in Harrison Bay. Increased barge and vessel traffic in the vicinity of Oliktok Dock, in addition to noise associated with screeding and lightering, could displace eiders and seals in the vicinity of these activities. During those years, some residents may periodically experience decreased seal harvest success due to the increase in overall traffic near Harrison Bay. However, activities at Oliktok Dock would occur in areas of existing industrial disturbance and would not involve the construction of new infrastructure; therefore, these activities would be additive rather than introduce impacts into previously undeveloped areas.

In addition to an increase in barge and vessel traffic in Harrison Bay and near Oliktok Dock, barges and vessels associated with the Project may also traverse through whaling grounds for other North Slope communities, including Utqiaġvik and Wainwright. Barge and vessel traffic would be additive to existing marine traffic but could result in periodic disturbances if they traverse through a community's whaling grounds during their whaling season. Such disturbances could have large effects on a community if whales are displaced and affect harvester success. However, permittees proposing barging activities are required, in accordance with ROP H-1, to coordinate with the Alaska Eskimo Whaling Commission, community whaling captains' associations, and the NSB. Such coordination often involves participation in Conflict Avoidance Agreements which are highly effective at minimizing impacts to whaling crews (SRB&A 2013a) (Willow MDP Supplemental EIS Section 3.16.2.3.2.5). Barge and vessel traffic associated with the Project are not likely to affect Nuiqsut whaling activities, as crews hunt whales from Cross Island, east of the Project, during their east to west migration.

Several other resource uses have been documented in and around the alternatives analysis area but are not regularly documented and not considered to be primary uses of the area. These include moose hunting and vegetation harvesting along Fish Creek. Moose are rare within the Project area, and eider hunting occurs primarily in offshore and nearshore areas of Harrison Bay. Vegetation harvesting has been documented along Fish Creek; however, it is unlikely that impacts to vegetation resulting from dust deposition would extend to harvesting areas downstream from the Project.

*Access to Subsistence Resources**

Potential impacts to harvester access are discussed in Willow MDP Supplemental EIS Section 3.16. A 1,000-foot safety radius around all Willow facilities would be in place and would prohibit the discharge of firearms within those areas; additionally, CPAI asks hunters not to shoot in the direction of work areas, human activity, and infrastructure. In certain areas, the presence of infrastructure and human activity, and associated safety considerations, could reduce the area in which residents can hunt by up to 2.5 miles, depending on the firearm being used (Willow MDP Supplemental EIS Section 3.16). Thus, a portion of traditional harvesting areas would be inaccessible to subsistence users from construction through the life of the Project. However, Nuiqsut subsistence users would be permitted to use most roads to access subsistence harvesting areas as long as they follow established security protocols, and hunters do use areas and harvest resources within 2.5 miles of existing roads. Gravel haul ice roads would generally be off limits to Nuiqsut harvesters due to heavy traffic levels. Module transport ice roads would see less traffic than gravel haul ice roads; these roads would be restricted from local use during ice road construction and the active hauling of the modules, with some potential for periods of local use. Thus, while much of the Project footprint would be legally accessible to subsistence users throughout the life of the Project, certain areas, particularly during construction activities, would be inaccessible to local residents and may result in residents having to divert around infrastructure to access subsistence harvesting areas, or may act as a physical barrier or obstruction to harvester access. Additionally, the presence of humans and infrastructure would affect subsistence harvesting patterns in and around the development area due to safety concerns, thus rendering some areas unusable for subsistence purposes under certain conditions.

During much of construction, access to the Project area would be limited to overland travel or via ice roads during winter, which would be open from February to April, but would be limited to ice roads not used for gravel hauling or module transport activities. Some residents—particularly those without snow machines—may use ice roads to access caribou herds farther from the community if they are not available closer by. However, the gravel haul ice roads, which are close to the community's hunting areas, would be off limit to subsistence users, and individuals traveling by snow machine may have difficulty crossing over these ice roads safely due to high traffic volumes. While the winter is not a primary hunting time for caribou, residents do hunt this resource, particularly in February and March (SRB&A 2021) to supplement their diet as needed throughout the winter. It is unlikely that furbearer hunters would use ice roads for wolf and wolverine hunting, as most individuals would begin snow machine hunting trips directly from the community and are not expected to hunt for these resources near human activity and infrastructure. If wolf and wolverine hunters want to cross over gravel haul and module transport ice roads to access areas farther from the community, they may experience difficulties due to the high traffic volumes and access restrictions. As gravel roads are gradually constructed, year-round access to the Project area via road automobile would increase. Gravel roads would extend the current area accessible by automobile for local residents and would likely be used, to some extent, for summer and fall caribou hunting, as well as during the winter. Use of roads would be particularly likely for residents who do not have access to alternate modes of transportation (e.g., boats, snow machines, ATVs), who have limited time to engage in subsistence activities, or who have health or other issues that make overland travel difficult.

In addition to Project roads, under Alternative B (Proponent's Project), CPAI would construct up to three boat ramps specifically for subsistence use. One of the boat ramps (common to all action alternatives) would provide access to the Ublutuoch (Tiŋmiaqsiuġvik) River along the existing gravel road between Alpine CD5 and GMT-1. Up to two additional boat ramps would be constructed along Judy (Iqalliqpik) Creek and/or Fish Creek pending further community input. The boat ramps would be accessible from existing Project roads with the addition of short access roads. Subsistence mapping data indicate limited travel along the Ublutuoch (Tiŋmiaqsiuġvik) River by boat; however, if it is possible for individuals to access Fish (Iqalliqpik) Creek via the Ublutuoch (Tiŋmiaqsiuġvik) River using boats (Figure 3.8.3 in Appendix A, *Figures*), the boat ramps could have substantial benefits to some users. Use of Fish (Iqalliqpik) Creek for subsistence purposes has declined in recent years with residents citing fuel costs and difficult travel and navigation conditions (e.g., shallower waters near the mouth of Fish [Iqalliqpik] Creek) for the decline in use. A boat ramp that facilitates access to Fish (Iqalliqpik) Creek could

increase use of this traditionally important subsistence harvesting area. Of the three proposed boat ramps, residents would be most likely to use the boat ramp closest to the community (on the Ublutuoch [Tiŋmiaqsiuġvik] River), as it would require less travel and would provide more immediate access to the lower, most heavily used portions of Fish (Iqalliqpik) Creek where most traditional camps are located. However, the boat ramps farther upriver on Fish and Judy (Iqalliqpik) creeks would also provide a benefit to the community, particularly in the event that the Project reduces the availability of certain resources, such as caribou, near the community. Accessing the upriver areas of Fish and Judy (Iqalliqpik) creeks would allow residents to access areas that are currently not frequently used due to the long boat ride from the community, high costs associated with such travel, and reported difficulties in recent years navigating into the mouth of Fish (Iqalliqpik) Creek by boat. Access to these areas may result in a shift to the community's boat hunting areas, but it could also provide access to new areas with greater concentrations of caribou in areas that are considered less affected by development (e.g., to the west of the current Prudhoe Bay/Kuparuk/Alpine development complex).

Recent data from Nuiqsut households indicate that the percentage of households using roads decreases somewhat with distance from the community, or in areas with high concentrations of drill sites. For example, while 53% of households reported using the Spur Road extending north from the community in 2019, 44% reported using the road between CD5 and GMT-1, and 31% reported using the road between GMT-1 and GMT-2. In addition, only 11% used the roads crossing east of the Niġliq Channel toward the CD1 and CD4 developments (Willow MDP Supplemental EIS Section 3.16). Data are not available at this time to determine why road use declines with distance from the community, but reasons could include lack of time (residents report using roads due to the ease of access during times when they are unable to take longer trip), lack of money or fuel to take longer trips, or successful harvests closer to the community. Decreased use of roads to the east of Niġliq Channel could be due to a relatively lower abundance of resources in that area, or due to heightened concerns about safety due to the greater concentration of infrastructure and human activity. Thus, because of the greater distance of Project roads from the community and the relatively higher density of infield roads and drill pads (compared to the GMT and Alpine developments), particularly near the junction of the access and infield roads where the airstrip, WPF, and WOC would be located, use of Project roads may be somewhat lower than other industry roads closer to Nuiqsut. Once Project roads and infrastructure are complete, they may introduce additional concerns for residents hunting along existing roads, particularly between GMT-1 and GMT-2, as there would be fewer directions in which to shoot without consideration of human safety.

Roads would act as a physical impediment to those traveling overland, or to those traveling on or off roads to access use areas. Tundra access ramps and road pullouts at regular distances would reduce issues with off-road travel. However, some Nuiqsut hunters report difficulty crossing onto or over existing roads, even using existing tundra access ramps, particularly when hauling a heavy sled (SRB&A 2018a; SRB&A 2021). Recent upgrades to these ramps, consisting of a more gradual slope, ramps on both sides of the road, and the inclusion of a landing area at the top of each ramp, have increased the usability and safety of the ramps according to caribou harvesters. Some concerns remain regarding the placement of the ramps in low areas where spotting for caribou is difficult (SRB&A 2022). While tundra access ramps would reduce impacts to access, residents may have to travel extra distances to access crossing areas if they are traversing overland. Project roads would be built under CPAI's Insulation Implementation Plan (see Appendix D.1, *Alternatives Development)*. Under this plan, CPAI would use insulated embankments along approximately 80% of gravel road length. Nuiqsut harvesters have reported difficulties both crossing over roads in areas with steep embankments, and spotting caribou in areas where roads block long-distance views. The insulated embankments would lower the overall height of the road and therefore could help reduce impacts associated with crossing over gravel roads and spotting caribou. Ice roads would not include tundra access ramps but would likely have a smaller slope that would pose less of a barrier to travel; however, crossing over ice roads may be difficult due to high traffic volumes and restricted access along certain routes. The mine pits, which would be located on either side of the highly used Ublutuoch (Tiŋmiaqsiuġvik) River drainage, would also act as a physical barrier to harvesters traveling overland; residents traveling by snow machine or ATV would have to divert around the mine site during construction and in subsequent summers when the mine would fill with water. Pipelines would be placed a minimum of 7 feet above the surrounding ground surface and would generally be high enough for harvesters to cross underneath on snow machines or ATVs. CPAI's Compensatory Mitigation Plan (Appendix I.4) would include Nuiqsut Subsistence Trail Tundra Rehabilitation project, which would implement measures to rehabilitate a degraded tundra trail near Nuiqsut. In recent years, residents have reported concerns about the condition of certain ATV trails and their navigability and safety (SRB&A 2022). These trails are primarily used by ATV hunters to access areas west of the Nuiqsut. The

Nuiqsut Subsistence Trail project would install a material on the trail surface which would support the weight of ATVs while allowing vegetation growth through its open cell design. Rehabilitation of local trails would improve access and safety for ATV hunters, particularly those who do not use roads to hunt or when caribou are available closer to the community and farther from Project roads. CPAI would implement a similar project in Anaktuvuk Pass.

*Competition with Non-Federally Qualified Users**

Subsistence harvesters on the North Slope have increasingly reported impacts related to competition from non-federally qualified users, often referred to as sport hunters by local residents. Alternative B will likely not result in a direct increase in competition from non-federally qualified users, as the permittee would prohibit hunting and trapping by employees, agents, and contractors while on "work status" (see Willow MDP Supplemental EIS Table 3.16.4, ROP H-3). Competition with non-federally qualified users may occur under the cumulative case and is discussed in Section B.9.a.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The Naval Petroleum Reserves Production Act of 1976, as amended, instructs the Secretary of the Interior to conduct oil and gas leasing in the NPR-A. Congress authorized petroleum production in 1980 and directed the Secretary of the Interior to undertake a program of competitive leasing of potential oil and gas tracts in the Reserve. In 2012, the NPR-A IAP/EIS analyzed impacts of future development in and around the Alpine development, including potential development in the BTU. In 2018, BLM completed an analysis of the potential impacts of development of the GMT-2 site, including a road connecting the GMT-2 site to the existing GMT-1 site located to the northwest of Nuiqsut. The Section 810 analysis for the GMT-2 project also considered development of the BTU in its Evaluation and Findings for the Cumulative Case. The purpose of the Willow MDP EIS is to analyze impacts specific to the Willow MDP alternatives to aid in differentiation of impacts between the alternatives and to provide information to agencies and other stakeholders so that they can make informed decisions regarding the Project's development. The Project was designed to develop oil from a delineated reservoir on valid leases within the NPR-A. Other lands managed by BLM are too distant to access the BTU reservoir using current drilling technologies.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

Alternative A (No Action) would reduce the use of public lands needed for subsistence purposes. The Willow MDP Supplemental EIS Appendix D, Section 3.1.3, *Alternative Components Considered but Eliminated from Further Analysis*, discusses other alternatives (or alternative components) that were considered but eliminated from detailed analysis due to economic, or technological feasibility or practicability, or because they did not meet the purpose of the proposed action to produce the oil discovered on CPAI's leases.

d. Findings

1. Reductions in the availability of subsistence resources described above for Alternative B may significantly restrict subsistence uses for the community of Nuiqsut.

2. Limitations on subsistence user access described above for Alternative B may significantly restrict subsistence uses for the community of Nuiqsut.

This evaluation concludes that development of Willow MDP EIS Alternative B (Proponent's Project) is not expected to result in a large reduction in the abundance (population level) of caribou or any other subsistence resource. Neither is there any expectation that there will be a major increase in the harvest of caribou by non-subsistence users. Therefore, this finding of "may significantly restrict" is only triggered by two other primary factors that must be considered:

1. Reduction in the availability of resources caused by alteration of their distribution
2. Limitation of access by subsistence harvesters

The rationale for these findings and the determination of significance are summarized below.

1. Rationale for the Finding of Reductions in the Availability of Subsistence Resources Under Alternative B

The Project is likely to deflect TCH caribou from areas where Nuiqsut hunters harvest them. Caribou are a resource of major importance for Nuiqsut. The majority of caribou hunting in the Project area occurs in the

eastern portion of the area surrounding the proposed gravel mine site and access road. Caribou would have to cross through the Project area before being hunted in overland areas west of the community and along the Niġliq Channel and Colville River. Deflection would likely occur due to reduced habitat, roads, road traffic, aircraft traffic (overhead flights and take offs and landings), construction noise (including mining activity), drilling noise, and general human activity.

Project roads have a high potential to disturb TCH caribou. Under Alternative B, the gravel access road would bisect the fall migration corridor for a portion of the herd and would be located in an area heavily used by TCH caribou in some years, both summer and winter. According to Nuiqsut residents, roads pose both physical and visual barriers to caribou and it has been observed that changes in caribou distribution and behavior around roads results in decreased availability of caribou closer to the community. Additionally, when caribou are near roads and pads, the availability of these animals is diminished due to safety considerations as residents do not shoot toward infrastructure or areas of human activity.

Impacts related to roads, and roads collocated with pipelines, would extend beyond the Project area. Although caribou are highly mobile during mosquito and oestrid fly seasons, deflected movements and delays are more common where roads and pipelines are close to one another. Project development would result in a second set of pipelines alongside existing pipelines from the GMT-2 drill site to the Alpine development. Deflected movement and delays would also be more common when traffic rates reach and exceed 15 vehicles per hour. Project development would also increase road traffic along existing roads connecting the Project area to the existing GMT-2, GMT-1, CD5, and Alpine developments. These traffic rates would be more common during construction, but it is likely that caribou deflections would continue at a lower intensity during the operations phase.

The Alternative B access road would create a pinch point where it intersects with infield roads, which could deflect some caribou away from the road during the fall migration. What could be small changes in caribou distribution from a biological perspective could have large impacts on hunter success because hunters are generally limited in how far and how fast they can travel, particularly during the snow-free season. Impacts on the availability of TCH caribou would most likely occur during the summer and fall months, when caribou hunting in overland areas and along the Colville River is highest. Deflections or delays of several hours could have substantial impacts to harvesting success for residents hunting east of the road corridor, and particularly to hunters waiting along river corridors.

The location of the proposed gravel mine site could be particularly disruptive to both caribou and hunters. The site is directly west of Nuiqsut in an area commonly reached by hunters traveling overland. Although blasting and excavation would occur during winter when caribou hunting levels are lower, Nuiqsut hunters do harvest caribou in the area in winter and the presence of the mine could deflect caribou movement year-round, resulting in localized distribution changes. The mine site would fill with water after construction and thus would no longer provide habitat for caribou; the mine site would remain as a pond(s) directly overlapping an overland hunting area west of Nuiqsut.

Air traffic could cause direct and indirect disturbance to caribou availability both within and outside of the Project area. In addition to helicopter traffic throughout the analysis area, the Project would include a new airport with large fixed-wing aircraft taking off and landing directly west of Ocean Point, a common hunting area along the Colville River. Increased air traffic associated with the Project would likely affect hunting activities along the Niġliq Channel and the Colville River, upriver toward Ocean Point and in overland areas west of Nuiqsut. The increase in overall regional air traffic associated with the Project would increase the frequency of disturbances experienced by hunters. This type of disturbance would most likely occur during summer and fall when caribou would migrate in an easterly direction through the Project area into areas heavily used by Nuiqsut hunters.

Project activities, particularly during construction, would reduce the availability of furbearers in the vicinity. The alternatives analysis area has been reported as being used by 88% of wolverine harvesters and 87% of wolf harvesters. The highest overlapping use areas for wolf and wolverine occur around BT1, BT2, BT3, and BT5; low to moderate use occurs around BT4. Impacts to furbearers would be highest in winter when pile driving, mine site blasting and excavation, and ice road operations would occur. These activities would displace furbearers. Residents would likely use other areas where furbearers would be more available, but hunters would likely have to travel farther with greater expense, effort, and risk, because the area west of the community is commonly used and easily accessible. While furbearers generally are not a food source for the community, furbearer hunting and trapping is a specialized activity with special importance to Nuiqsut.

BLM anticipates that altered distributions of the TCH caribou and furbearers would occur during construction and operation of the Project. As described above, this altered distribution could have large impacts to hunter success due to how far and fast hunters can travel and because there would be deflections or delays in caribou movement for residents to the east of the road corridor and along the Colville River, which is a high subsistence use area. BLM concludes that this would cause a major redistribution of resources that would affect the existing availability of these resources for Nuiqsut hunters.

2. Rationale for Finding of Limitations on Subsistence User Access Under Alternative B

A portion of traditional harvest areas would be inaccessible to residents during all Project phases, including land permanently overlain by infrastructure. Much of the Project area would be legally accessible, but infrastructure may act as a physical barrier or obstruction to harvester access. Subsistence users would be prohibited from discharging firearms within safety areas (1,000-foot radii surrounding oil and gas exploration, development, and transportation facilities other than roads) (CPAI 2019a, 2019b). Security protocols prohibit shooting toward infrastructure, people, work crews, equipment, and pipelines. The presence of humans and infrastructure would affect subsistence harvesting patterns in and around the Project area due to safety concerns, rendering some areas unusable for subsistence purposes (the range common to hunting with rifles is 0.5 to 3 miles).

Ice roads used for gravel hauling would be off limits for any other use. These roads would only be present during winter construction, which is not a primary caribou hunting period. However, residents do traditionally harvest caribou in winter along overland areas on the west side of Nuiqsut, particularly in February and March, to supplement their diet.

Access to the gravel mine area may be restricted during the construction phase. The mine site would be a physical barrier to harvesters traveling overland either by snow machine in winter or ATV in summer and fall. After construction, the mine site would be allowed to fill with water, and this would make the area inaccessible for overland travel in summer and fall.

Residents may use non-gravel haul ice roads and permanent gravel roads, once completed, to access subsistence areas. This facilitated access might provide a countervailing effect; however, use of roads declines with distance from the community. The use of Project roads may be lower than the use of roads closer to Nuiqsut (e.g., CD5, GMT-1) due to both the greater distance of Project roads from the community and the relatively high density of Project infield roads and drill sites. Industry road use is subject to standard safety rules, some of which would restrict use for some residents (e.g., no unaccompanied minors). During road construction, residents would not be able to use gravel roads and it may be difficult or impossible to cross them. Once road construction is completed, roads could be a physical impediment to overland travel; gravel roads may also prove to be difficult to gain access to or depart from to access subsistence use areas. Some Nuiqsut hunters have reported difficulty crossing existing gravel roads, even when using specifically constructed tundra/subsistence access ramps, particularly when hauling a heavy sled and in early spring when areas around roads and ramps thaw earlier than the surrounding tundra. Recent ramp upgrades have lessened but not eliminated these concerns. Crossing ice roads may be restricted due to heavy traffic and other roads may have periods of overall restricted access.

The totality of limitations on subsistence access associated with the Project, particularly during the 7-year construction phase but lasting through the life of the Project, would constitute a substantial restriction on subsistence access for Nuiqsut residents.

None of these impacts is expected to affect all subsistence hunters equally, and many of these impacts are uncertain. Caribou movement is highly variable; over time, some caribou may tolerate certain sources of disturbance (Willow MDP Supplemental EIS Section 3.12.2.3.2, *Disturbance or Displacement*), and harvesters may adapt to changes in resource availability to some extent. However, given the importance of caribou availability and access to traditional hunting areas to Nuiqsut hunters, BLM expects that limitations to subsistence access and the reduced resource availability anticipated to occur over the 30-year Project life, directly and indirectly attributable to Project development, would result in an extensive interference with Nuiqsut hunter access.

Nuiqsut residents have experienced limited access to their traditional subsistence lands and resources in large areas to the east, north, and west due to previous oil and gas infrastructure development, and they currently face substantial increasing development in those areas. As a result, their subsistence use areas have shifted away from developed areas. These impacts affect the relative value of remaining undeveloped land, including land that would

be overlain by Project infrastructure and lands adjacent to the Project where subsistence value would decrease due to Project development.

3. Evaluation and Finding for Alternative C (Disconnected Infield Roads)

The footprint for Alternative C (Disconnected Infield Roads) is similar to that of Alternative B (Proponent's Project), except there would be no gravel road between the WPF and BT1/BT2/BT4, and therefore no road and bridge crossing Judy (Iqalliqpik) Creek. This alternative would eliminate the perpendicular intersection of the access and infield roads included under Alternative B. Alternative C would also locate the WPF, WOC, and primary Project airstrip (south airstrip) approximately 1 mile to the northeast compared to Alternative B, somewhat closer to the community of Nuiqsut but into areas of lower TCH density. Only one of the three subsistence use boat ramps proposed under Alternative B (the boat ramp accessing the Ublutuoch [Tiŋmiaqsiuġvik] River) would be constructed under Alternative C due to the lack of a gravel road connection to Judy (Iqalliqpik) Creek and upper Fish Creek. The mine site footprint (excavation and perimeter berms) under Alternative C would be approximately 80 acres larger than under Alternative B.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

The effects of Alternative C on subsistence would be similar to those described for Alternative B with three important differences:

1. Alternative C would reduce impacts to migrating caribou resulting from the elimination of the roadway "pinch point" between BT1 and the WPF and the relocation of the airstrip, WOC, and WPF into areas of lower TCH density.
2. Alternative C would increase the frequency and geographic extents of air traffic due to the need for additional air travel during the ice-free months and the addition of a second airstrip (north airstrip).
3. Alternative C would not include subsistence boat ramps on the upper Fish and Judy (Iqalliqpik) creeks.

Overall, Alternative C would require slightly higher levels of fixed-wing aircraft, helicopter, and ground traffic. However, ground traffic would be more concentrated in the winter months when caribou hunting activity is lower. The lack of a perpendicular road between the WPF and BT1 would decrease the potential for deflection of migrating caribou. The lack of access to the BT1/BT2/BT4 road corridor during the peak caribou hunting season would reduce ground traffic and hunting activity in that area, likely reducing deflection away from the access road and allowing caribou to move more freely along the Judy (Kayyaaq) Creek drainage. If the Project results in large-scale deflections of caribou despite the decrease in infield roads, hunters would have no summer or fall access to the BT1, BT2, and BT4 roads, nor would subsistence boat ramps on Fish and Judy (Iqalliqpik) creeks be constructed to mitigate effects by providing access to areas with heavier concentrations of caribou. Similar to Alternative B, Alternative C would construct a subsistence boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River that would be more easily accessible from the community and that could provide access to key hunting areas on the lower portion of Fish (Iqalliqpik) Creek. Because the south airstrip, WOC, and WPF would be moved slightly farther east into areas of lower caribou density, impacts from air traffic may affect fewer caribou overall and could reduce deflection of caribou migrating toward the community's primary hunting area. However, moving the airstrip, WOC, and WPF closer to the community and core hunting areas may increase the frequency of disturbances to hunters related to aircraft takeoffs and landings, in addition to increased human activity. The increase in air traffic would be likely be offset by decreased ground traffic between the WPF and BT4, and lack of gravel infrastructure and associated human activity between the WPF and BT1 during the peak caribou hunting season. The long-term differences in direct impacts between Alternatives B and C are considered minimal because both alternatives would include a year-round access road to the west of Nuiqsut's core caribou hunting grounds. While air traffic would be substantially higher under Alternative C, impacts to caribou resource availability would likely be reduced under Alternative C due to the reduction in year-round infrastructure and ground traffic during peak hunting seasons.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the Willow MDP EIS Alternative C is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the Willow MDP EIS Alternative C is identical to that provided above in Section B.2.c.

d. Findings

1. Reductions in the availability of subsistence resources described above for Alternative C may significantly restrict subsistence uses for the community of Nuiqsut.

2. Limitations on subsistence user access described above for Alternative C may significantly restrict subsistence uses for the community of Nuiqsut.

This evaluation concludes that development of Willow MDP EIS Alternative C (Disconnected Infield Roads) is not expected to result in a large reduction in the abundance (population level) of caribou or any other subsistence resource. Neither is there any expectation that there will be a major increase in the harvest of caribou by non-subsistence users. Therefore, this finding of "may significantly restrict" is only triggered by two other primary factors that must be considered:

1. Reduction in the availability of resources caused by alteration of their distribution
2. Limitation of access by subsistence harvesters

The rationale for these findings and the determination of significance are summarized below.

1. Rationale for the Finding of Reductions in the Availability of Subsistence Resources Under Alternative C

The rationale for the finding of reduced availability of subsistence resources under Alternative C is similar to that for Alternative B with a few distinct differences. Under Alternative C, the location of the WPF is an area with lower caribou densities, thus impacts to caribou from WPF-related traffic, activity, and noise would be somewhat reduced. The lack of subsistence hunter road access to infield roads between BT1 and BT4 may allow caribou to habituate to linear infrastructure more readily and allow caribou to establish a pattern of movement through (gravel) roadless corridor along Judy (Iqalliqpik) Creek. Ground traffic rates on these infield roads would likely be reduced during summer. Although increased air traffic would likely offset this to some degree, the reduced ground traffic may allow caribou to habituate to linear infrastructure. Overall, impacts to the disturbance of caribou under Alternative C could be reduced compared to Alternative B because more caribou may move north of the GMT-2-WPF access road due to the roadless corridor along Judy (Iqalliqpik) Creek. Currently, the majority of caribou hunting occurs in the eastern portion of the Project area near the proposed gravel mine and access road. Once this area is disturbed, the area north of the access road may have more caribou; however, restrictions on shooting toward pipelines would limit the actual availability of caribou hunting in the area.

Overall, despite the potential for reduced disturbance to caribou under Alternative C, BLM expects that altered distributions of TCH caribou and furbearers would occur during the Project's construction and operations phases. This altered distribution could have large impacts to hunter success due to how far and fast hunters can travel and because there would be deflections or delays in caribou movement for residents east of the road corridor and along the Colville River, which is a high subsistence use area. BLM concludes that this would cause a major redistribution of resources that would affect the existing availability of these resources for Nuiqsut hunters.

2. Rationale for the Finding of Limitations on Subsistence User Access Under Alternative C

The rationale for the determination that interference with subsistence access would be extensive under Alternative C is identical to the rationale provided for under Alternative B (Section B.2.d.2) with the exception that under Alternative C, residents of Nuiqsut would not have all-season road access to the infield roads between BT1 and BT4.

4. Evaluation and Finding for Alternative D (Disconnected Access)

The footprint for Alternative D (Disconnected Access) is similar to that of Alternative B except there would be no gravel access road connection between the Project area and the GMT-2 and Alpine developments. Under this alternative, transportation to the Project area would be exclusively by aircraft for approximately 9 months of the year (May through January) and primarily via ice road for 3 months of the year (February through April). Gravel roads would connect the WPF, which would be colocated with BT3, to the other four drill sites and Project infrastructure. The WPF, WOC, and airstrip would be located approximately 3 to 4 miles southwest of their locations under Alternative B, thus possibly increasing human-related disturbances within areas of higher caribou density. However, overall, this alternative would reduce linear infrastructure on the landscape, remove the intersection of the access and infield road, and reduce year-round ground traffic with the goal of reducing impacts to migrating caribou. Similar to Alternative C, only one of the three subsistence use boat ramps proposed under Alternative B (the boat ramp accessing the Ublutuoch [Tiŋmiaqsiuġvik] River) would be constructed under

Alternative D due to the lack of a gravel road connection to Judy (Iqalliqpik) Creek and upper Fish Creek. The mine site footprint (excavation and perimeter berms) under Alternative D would be approximately 80 acres larger than under Alternative B.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

The effects of Alternative D on subsistence would be like those described for Alternative B with one important difference: Alternative D would reduce impacts to migrating caribou resulting from the elimination of the gravel access road connecting the Project to the GMT-2 and Alpine developments. Overall, Alternative D would require higher levels of fixed-wing aircraft and helicopter traffic resulting from the lack of year-round road access to the Project. On average, the increase in air traffic would amount to one or two additional fixed-wing aircraft trips per day for the life of the Project (32 years) and one additional helicopter trip per week during the drilling and operations phases; these trips would be more concentrated during the 9 months when there would be no ice road access. The increase in air traffic could result in a greater frequency of air traffic disturbances to caribou, resulting in decreased harvest success for Nuiqsut hunters during individual hunting trips. The lack of a gravel access road running perpendicular to the fall migration route, in addition to the lack of ground traffic in that area throughout the summer and fall, would decrease the potential for deflection of caribou migrating through the Project area in the fall, or disturbance of caribou that occur in the area in the summer. While the WPF, WOC, and airstrip would be located farther west into areas of higher caribou density (therefore increasing the potential for disturbances in those areas), they would be farther from Nuiqsut's core caribou hunting grounds.

The lack of a year-round gravel access road under Alternative D means Nuiqsut residents would not have the benefit of access to the Project area via road for hunting. However, it is unclear how much residents would use the Project road system given its distance from the community and the somewhat higher concentration of drill sites; some evidence shows decreased use of roads with increased distance from the community or in more densely developed areas (Willow MDP Supplemental EIS Section 3.16, *Subsistence and Sociocultural Systems*). Residents would still be able to use the road system to reach GMT-2 and hunt from those roads by ATV or snow machine. In addition, under Alternative D, there would no subsistence boat ramps on Fish) and Judy (Iqalliqpik) creeks to mitigate larger-scale deflections of caribou if they continue to occur despite the decrease in road infrastructure. Similar to Alternative B, Alternative D would construct a subsistence boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River that would be more easily accessible from the community and that could provide access to key hunting areas on the lower portion of Fish Creek.

Per the Willow MDP Supplemental EIS, Alternative D may result in less impacts on caribou availability due to the lack of a year-round access road. While air traffic levels would be somewhat higher, air traffic generally causes localized disturbances whereas roads can cause larger effects on caribou movement and distribution, in addition to changes in caribou hunting patterns. Across the 12 years of the Nuiqsut Caribou Subsistence Monitoring Project and as development activity has increased in the vicinity of Nuiqsut, reports of air traffic impacts have remained somewhat stable, while reports of impacts related to human-made structures have increased. In addition, avoidance behavior and changes in hunting patterns have been more evident since construction of roads in the area (SRB&A 2019a; SRB&A 2021). Thus, it is likely that while the increase in air traffic would contribute to existing impacts to hunters, additional road infrastructure to the west of the community would substantially increase impacts to resource availability and hunter access. By eliminating a large portion of year-round road infrastructure to the west of the community, Alternative D would reduce deflection of caribou as they migrate toward Nuiqsut's core hunting grounds to the west of the community. Additionally, while the Project area would not be road-accessible year-round for Nuiqsut hunters, they would likely still continue to use existing roads and hunt in the area between GMT-2 and the Project area.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the Willow MDP EIS Alternative D is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the Willow MDP EIS Alternative D is identical to that provided above in Section B.2.c.

d. Findings

1. Reductions in the availability of subsistence resources described above for Alternative D may significantly restrict subsistence uses for the community of Nuiqsut.

2. Limitations on subsistence user access described above for Alternative D may significantly restrict subsistence uses for the community of Nuiqsut.

This evaluation concludes that development of Willow MDP EIS Alternative D (Disconnected Access) is not expected to result in a large reduction in the abundance (population level) of caribou or any other subsistence resource. Neither is there any expectation that there will be a major increase in the harvest of caribou by non-subsistence users. Therefore, this finding of "may significantly restrict" is only triggered by two other primary factors that must be considered:

1. Reduction in the availability of resources caused by alteration of their distribution
2. Limitation of access by subsistence harvesters

The rationale for these findings and the determination of significance are summarized below. The rationale for these findings is similar to those described above for Alternative B (Section B.2.d, *Findings*) with key differences summarized below.

1. Rationale for the Finding of Reductions in the Availability of Subsistence Resources Under Alternative D

Alternative D may result in fewer impacts on caribou availability than Alternative B due to the lack of a year-round gravel access road connecting the Project to existing development (e.g., GMT-2, Alpine); however, BLM still anticipates a major redistribution of resources would occur under this alternative. The lack of a gravel-access road alignment being perpendicular to the fall caribou migration and the lack of ground traffic in that area throughout the summer and fall would decrease the potential for deflection of caribou migrating through the area. Higher levels of fixed-wing aircraft and helicopter traffic resulting from the lack of year-round access would overlap with peak caribou hunting months, which could result in a greater frequency of air traffic disturbances to caribou, resulting in decreased harvester success for Nuiqsut hunters during individual hunting trips. The increase in air traffic would likely not be enough to outweigh the benefits of reduced deflection of caribou as they migrate toward Nuiqsut's hunting grounds to the west of the community. While air-traffic volumes would be somewhat higher, air traffic generally causes localized disturbances whereas roads can cause larger effects on caribou movement and distribution.

Many benefits of reduced deflection from the lack of an access road would be offset by the aircraft traffic (including take offs and landings of large fixed-wing aircraft) in addition to the combined effects of a linear pipeline along the route between GMT-2 and the Project, parallel pipeline racks between GMT-2 and Alpine facilities, Project infield roads, drill sites, and the WPF, the location of and activity at the gravel mine site, and other disturbances described above for Alternative B.

2. Rationale for the Finding of Limitations on Subsistence User Access Under Alternative D

The rationale for the determination that interference with subsistence access would be extensive under Alternative D is similar to the rationale provided for Alternative B with the exception that the lack of a year-round access road under Alternative D means that Nuiqsut residents would not have the potential benefit of access to the project area via road vehicle for hunting. It is unclear how much residents would use the Willow MPD road system given its distance from the community and the somewhat higher concentration of drill sites; some evidence shows decreased use of roads with distance from the community or in more densely developed areas (Willow MDP Supplemental EIS Section 3.17). Alternative D would reduce limitations on overland travel but restrict access via roads. Residents would still be able to use the road system to GMT-2 and hunt off of those roads by four-wheeler or snow machine. Limitations to access described above for Alternative B resulting from direct overlap with subsistence use areas, safety areas around sites, road use guidelines, security protocols restricting shooting, and gravel haul ice roads would be similar under Alternative D.

5. Evaluation and Finding for Alternative E (Three-Pad Alternative, Fourth Pad Deferred)*

The footprint for Alternative E (Three-Pad Alternative, Fourth Pad Deferred) is smaller than that of Alternative B because Alternative E would exclude drill site BT4 and move the BT5 drill site to the northeast. Drill site BT2

would move farther north. This alternative would reduce infrastructure within the TLSA and reduce the overall length of gravel roads compared to Alternative B. Alternative E would reduce linear infrastructure in the portion of the Project farthest from the community of Nuiqsut and least used by Nuiqsut harvesters, but closer to high-density caribou calving and preferred mosquito-relief habitat. Alternative E would include the three subsistence use boat ramps proposed under Alternative B. Construction of BT5 would be deferred to Year 7 at the earliest. This Year 7 construction scenario is considered to be the most impactful and thus is the scenario analyzed in the Willow MDP Supplemental EIS. If BT5 construction is deferred beyond Year 7, the anticipated impacts related to BT5 would be delayed, resulting in extended temporal impacts, although the severity or intensity of the impacts would be lessened due to there being less overall Project activity (i.e., other construction activity) occurring simultaneously.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs*

The effects of Alternative E on subsistence would be like those described for Alternative B with one difference: Alternative E would reduce infrastructure in the TLSA, a key habitat and migratory area for caribou. The reduction in linear infrastructure could lessen the frequency or severity of deflection of caribou migrating toward Nuiqsut subsistence harvesting areas to the west of the community. Roads and pipelines within 500 feet of one another increase the likelihood of caribou displacement and deflection; under Alternative E, there would be a 30% reduction in the amount of pipeline within 500 feet of gravel roads. In addition, Alternative E would reduce infrastructure within the TLSA by 43% and move infrastructure (including roads, pipelines, and the nearest drill site) farther from high-density calving areas and mosquito-relief habitat (Willow MDP Supplemental EIS Section 3.12). Aside from the reduction in infrastructure described above, a key feature of Alternative B would remain under Alternative E: all drill sites under Alternative E would be connected to one another and to the existing GMT-2 development by gravel road. Thus, while the reduction in linear infrastructure within the TLSA may help reduce obstructions during the summer and fall migration, many caribou would still encounter roads, including the pinch point where the access road intersects with infield roads, during their migration south.

The reduction in infrastructure under Alternative E would primarily result in a lessening of indirect impacts (e.g., impacts related to resource availability resulting from deflection of caribou). Overall, a slightly smaller percentage of Nuiqsut harvesters (88%) would be affected under Alternative E compared to Alternative B (91%), and the difference occurs specifically among goose hunters (Willow MDP Supplemental EIS Section Table 3.16.5). Alternative E will also reduce infrastructure in Utqiaġvik areas of low to moderate use for wolf and wolverine, thus somewhat reducing the area of impact for hunters from that community.

In terms of direct impacts, the reduction in infrastructure within the TLSA would occur in an area that is not heavily used by Nuiqsut harvesters relative to the entire Project area. When looking specifically at the alternative analysis area where it intersects with the TLSA, under Alternative E, 67% of Nuiqsut all resources harvesters reported use areas compared to 73% under Alternative B (Willow MDP Supplemental EIS Table 3.16.9). For caribou during the 1995–2006 time period, just over half of harvesters (56%) reported use areas in the alternative analysis area where it intersects with the TLSA. A smaller percentage of caribou harvesters have used the area in recent individual study years (2008–2019), and no caribou harvests were reported in this area for any of the action alternatives (Willow MDP Supplemental EIS Table 3.16.9). Thus, while the decrease in infrastructure within the TLSA may reduce deflection of caribou and lessen impacts on resource availability for Nuiqsut harvesters, the difference in direct impacts on caribou hunters would be minimal.

Under Alternative E, there would be a slight reduction in air, ground, and marine vessel traffic. The reduction in traffic may reduce the frequency of impacts to hunters in addition to reducing impacts to resource availability resulting from skittish behavior in caribou, furbearers, marine mammals, and birds. A decrease in ground traffic would lessen the likelihood of vehicle strikes for terrestrial mammals.

Access to Project roads for Nuiqsut residents would be similar to Alternative B but with slightly less overall road length. It is unclear how far residents will regularly travel along Project roads, as recent data show a moderate decrease in road use with distance from the community (Willow MDP Supplemental EIS Section 3.16). Similar to Alternative B, Alternative E would construct a boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River and up to two additional boat ramps on Judy (Iqalliqpik) Creek and Fish Creek. These boat ramps would be accessible along the road system from the community and could provide access to key hunting areas on the lower portion of Fish Creek. Use of these boat ramps to access areas on Judy (Iqalliqpik) and Fish creeks could help offset impacts to resource availability associated with deflection of caribou from roads.

Overall, while Alternative E would not result in a substantial reduction in direct impacts to Nuiqsut subsistence harvesters, the reduction in infrastructure within the TLSA may reduce impacts to caribou habitat and lessen the frequency and likelihood of roads deflecting caribou away from Nuiqsut caribou hunting grounds.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved*

The evaluation of the Willow MDP EIS Alternative E is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that Would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes*

The evaluation of the Willow MDP EIS Alternative E is identical to that provided above in Section B.2.c.

d. Findings*

1. Reductions in the availability of subsistence resources described above for Alternative E may significantly restrict subsistence uses for the community of Nuiqsut.

2. Limitations on subsistence user access described above for Alternative E may significantly restrict subsistence uses for the community of Nuiqsut.

This evaluation concludes that development of Willow MDP EIS Alternative E (Three-Pad Alternative, Fourth Pad Deferred) is not expected to result in a large reduction in the abundance (population level) of caribou or any other subsistence resource. Neither is there any expectation that there will be a major increase in the harvest of caribou by non-subsistence users. Therefore, this finding of "may significantly restrict" is only triggered by two other primary factors that must be considered:

1. Reduction in the availability of resources caused by alteration of their distribution
2. Limitation of access by subsistence harvesters

The rationale for these findings and the determination of significance are summarized below. The rationale for these findings is similar to those described above for Alternative B (Section B.2.d, Findings).

*1. Rationale for the Finding of Reductions in the Availability of Subsistence Resources Under Alternative E**

The reduction in infrastructure under Alternative E may reduce deflection of caribou; however, the reduction in impacts to all resources will be minimal. Overall, a slightly smaller percentage of Nuiqsut harvesters (88%) would potentially be affected under Alternative E compared to Alternative B (91%), and the difference occurs specifically among goose hunters. The Project is likely to deflect TCH caribou from areas where Nuiqsut hunters harvest them. Caribou are a resource of major importance for Nuiqsut. The majority of caribou hunting in the Project area occurs in the eastern portion of the area surrounding the proposed gravel mine site and access road. Caribou would have to cross through the Project area before being hunted in overland areas west of the community and along the Niġliq Channel and Colville River. Deflection would likely occur due to reduced habitat, roads, road traffic, aircraft traffic (overhead flights and take offs and landings), construction noise (including mining activity), drilling noise, and general human activity.

Project activities, particularly during construction, would reduce the availability of furbearers in the vicinity. Impacts to furbearers would be highest in winter when pile driving, mine site blasting and excavation, and ice road operations would occur; these activities have the potential to displace furbearers from areas where they are traditionally harvested. While furbearers generally are not a food source for the community, furbearer hunting and trapping is a specialized activity with special importance to Nuiqsut.

Although the overall road and pipeline length would be reduced under Alternative E compared to Alternative B (with corresponding reductions in Project construction activity), these reductions would not be enough to completely prevent potential redistribution of caribou and furbearers. BLM anticipates that altered distributions of the TCH caribou and furbearers would occur during construction and operation of the Project under Alternative E. As described above, this altered distribution could have large impacts to hunter success due to how far and fast hunters can travel, and because there would be deflections or delays in caribou movement for residents to the east of the road corridor and along the Colville River, which is a high subsistence use area. BLM concludes that this

would cause a major redistribution of resources that would affect the existing availability of these resources for Nuiqsut hunters. See Section B.2.d for more details.

*2. Rationale for Finding of Limitations on Subsistence User Access Under Alternative E**

A portion of traditional harvest areas would be inaccessible to residents during all Project phases, including land permanently overlain by infrastructure. Much of the Project area would be legally accessible, but infrastructure may act as a physical barrier or obstruction to harvester access. Some Nuiqsut hunters have reported difficulty crossing existing gravel roads, even when using specifically constructed tundra/subsistence access ramps, particularly when hauling a heavy sled and in early spring when areas around roads and ramps thaw earlier than the surrounding tundra. Upgrades to existing ramps have reduced but not eliminated these concerns. Crossing ice roads may be restricted due to heavy traffic, and other roads may have periods of overall restricted access. Subsistence users would be prohibited from discharging firearms within safety areas (1,000-foot radii surrounding oil and gas exploration, development, and transportation facilities other than roads) (CPAI 2019a, 2019b). Security protocols also prohibit shooting toward infrastructure, people, work crews, equipment, and pipelines.

The totality of limitations on subsistence access associated with the Project, particularly during the construction phase but lasting through the life of the Project, would constitute a substantial restriction on subsistence access for Nuiqsut residents. See Section B.2.d for more details.

6. Evaluation and Finding for Module Delivery Option 1 (Atigaru Point Module Transfer Island)

Module delivery Option 1 (Atigaru Point Module Transfer Island) would include construction of an MTI near Atigaru Point to support sealift module delivery to the Project. Module delivery by sealift barge to the MTI would occur over two summers; the modules would be stored on the MTI and then transported from the MTI to the WPF via an ice road. Gravel would be hauled from the Tiŋmiaqsiuġvik mine site via ice road to the MTI site for construction. During construction, the MTI would house facilities such as an office, break room, and helipad; a temporary 100-person work camp would be located onshore near Atigaru Point. Construction facilities and supplies would be demobilized once construction was complete.

In the Willow MDP Supplemental EIS, BLM analyzed potential direct impacts on subsistence based on a 2.5-mile buffer of permanent and temporary infrastructure, including the MTIs and associated module transport and gravel haul ice roads, for each module delivery option (module delivery option analysis area). While the MTI-associated activities would occur solely during the construction phase of the Project, the MTIs themselves would remain after module transport was complete. Differences in impacts between the construction and operation phases are discussed qualitatively. The module delivery option analysis areas do not include all areas where development-related activity (e.g., vessel traffic) or impacts would occur. The analysis area allows for more detailed analysis of the area where subsistence users are most likely to experience direct impacts from the Project. Additional direct and indirect impacts that would occur outside the analysis area are also addressed.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs*

The analysis area for module delivery Option 1 (Figure 12) lies within areas heavily used by Nuiqsut residents for subsistence. Between 1995 and 2006, a substantial proportion of Nuiqsut harvesters reported using the analysis area for harvesting of caribou, wolverine, and wolf (over 80% of harvesters each); and goose (over 50% of harvesters) (Willow MDP Supplemental EIS Table 3.16.11). These resources are harvested primarily in overland areas crossed by ice roads, particularly where the gravel haul ice road crosses Fish Creek and terminates at the mine site (Figures 13 through 16). Between 2008 and 2019, the percentage of caribou harvesters using the analysis area for Option 1 ranged from 33% to 78%; caribou harvests within the area ranged from 4% to 19% of the total harvest during individual study years (Willow MDP Supplemental EIS Table 3.16.12). Nuiqsut harvesters also use the offshore area in Harrison Bay surrounding the MTI for subsistence harvesting of bearded seal (33% of harvesters), ringed seal (26%), and eider (14%) (Willow MDP Supplemental EIS Table 3.16.11). Uses of the area directly to the east of the analysis area for these resources are higher (Figure 17). Twelve percent of Utqiaġvik harvesters reported using the Option 1 analysis area, primarily for wolf and wolverine, during the 1997 to 2006 time period (Figure 18). While the bowhead whale hunt is a culturally important subsistence activity and provides a large portion of the Nuiqsut's annual subsistence harvest, the community's whale hunting activities occur a substantial distance east of the potentially affected area, near Cross Island, and Nuiqsut whaling crews hunt whales in the fall during their east to west migration. Thus, impacts to Nuiqsut bowhead whale hunting associated with the Project are unlikely. On the other hand, whaling communities located to the west of

the Project, such as Utqiaġvik and Wainwright, could potentially encounter barges and vessels during their summer/fall whale hunting activities. While vessel traffic has the potential to disturb migrating whales and affect whaling success, the likelihood of large or frequent disturbances is low, because permittees proposing barging activities are required, in accordance with ROP H-1, to coordinate with the Alaska Eskimo Whaling Commission, community whaling captains' associations, and the NSB. Coordination with the Alaska Eskimo Whaling Commission typically involves participation in a Conflict Avoidance Agreement, which have been found to be highly effective at minimizing impacts to whaling activities (SRB&A 2013a) (Willow MDP Supplemental EIS Section 3.16.2.3.2.5).

As discussed in Section B.2.a, both caribou and wolf and wolverine are key resources to the community of Nuiqsut, and the analysis area is heavily used by both caribou and furbearer hunters in Nuiqsut. Other resources of major cultural and/or material importance harvested within the Option 1 analysis area include white-fronted goose and bearded seal (Table E.16.9 in Willow MDP Supplemental EIS Appendix E.16, *Subsistence and Sociocultural Systems Technical Appendix*). Thus, impacts to subsistence activities related to caribou, wolf, wolverine, goose, and seal are considered in the ANILCA Section 810 evaluation of module delivery Option 1. The analysis area for Option 1 is on the eastern periphery of Utqiaġvik subsistence use areas for wolf and wolverine but is directly east of the Teshekpuk Lake area, which is a key traditional use area for many Utqiaġvik residents and includes areas of moderate to high overlapping subsistence use. Moderate overlapping subsistence use also occurs to the southwest of the Project toward Ikpikpuk River, which is a key subsistence drainage for the community of Utqiaġvik (Willow MDP Supplemental EIS Figure 3.16.4). Caribou are also harvested to the west of the Project; however, the analysis area is on the eastern periphery of the herd's range and is not expected to alter caribou migration routes to the extent that they would affect Utqiaġvik harvesting activities to the west. Thus, the ANILCA Section 810 evaluation for module delivery Option 1 focuses on impacts to furbearer harvesting for Utqiaġvik. As discussed in Section B.2.a, furbearer hunting does not provide substantial amounts in terms of food but is a specialized and culturally important activity that contributes to the local economy.

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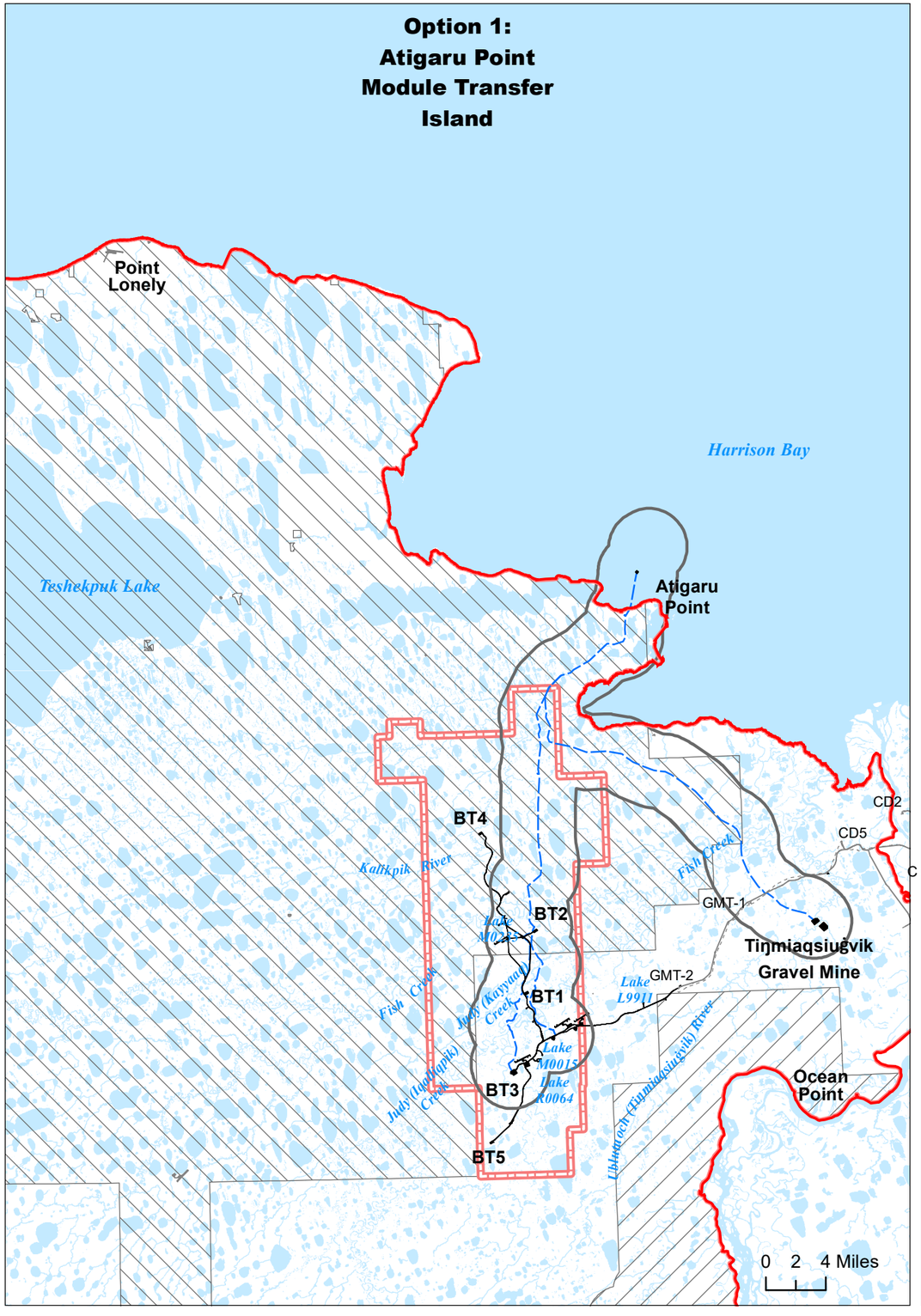
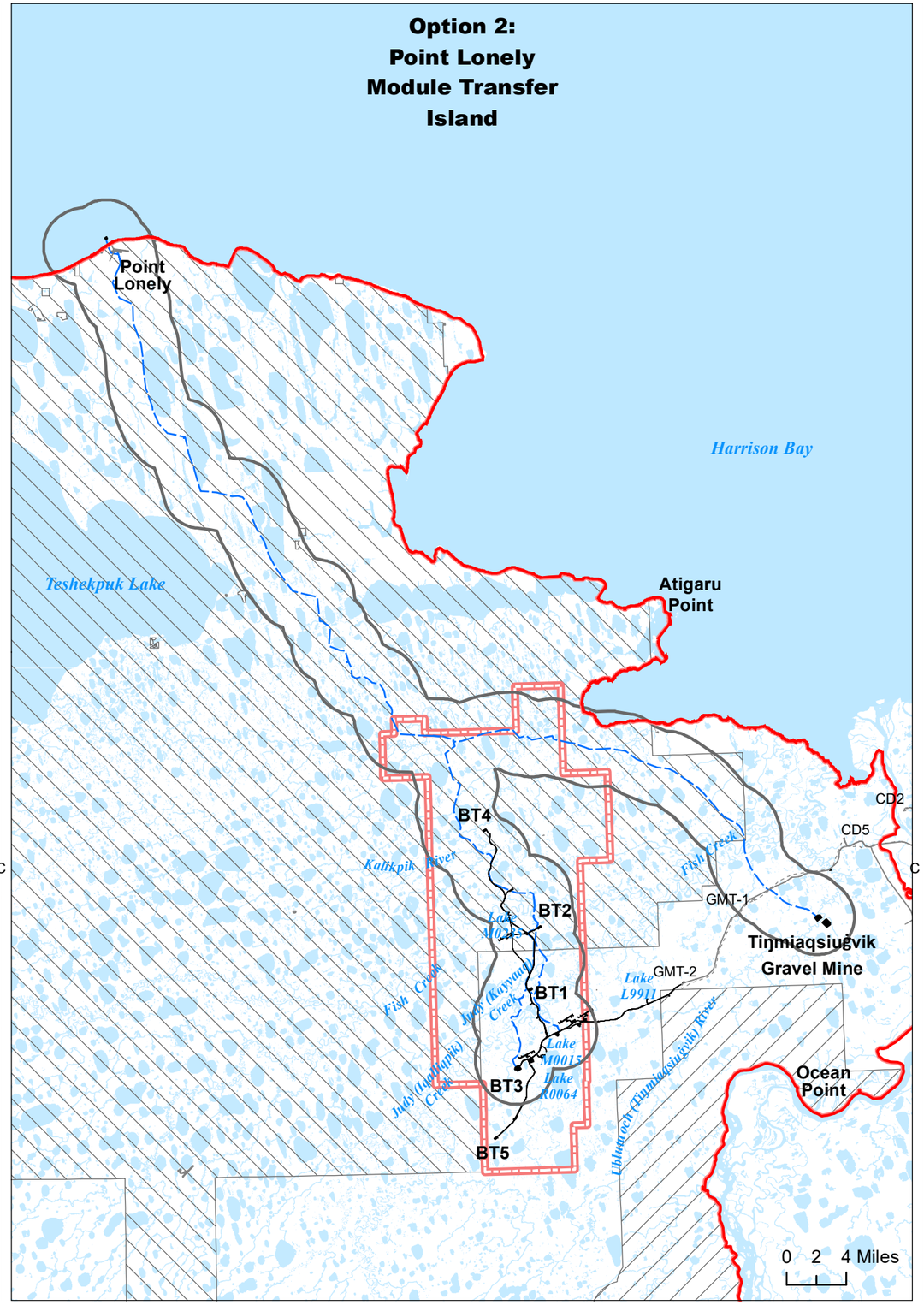
Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

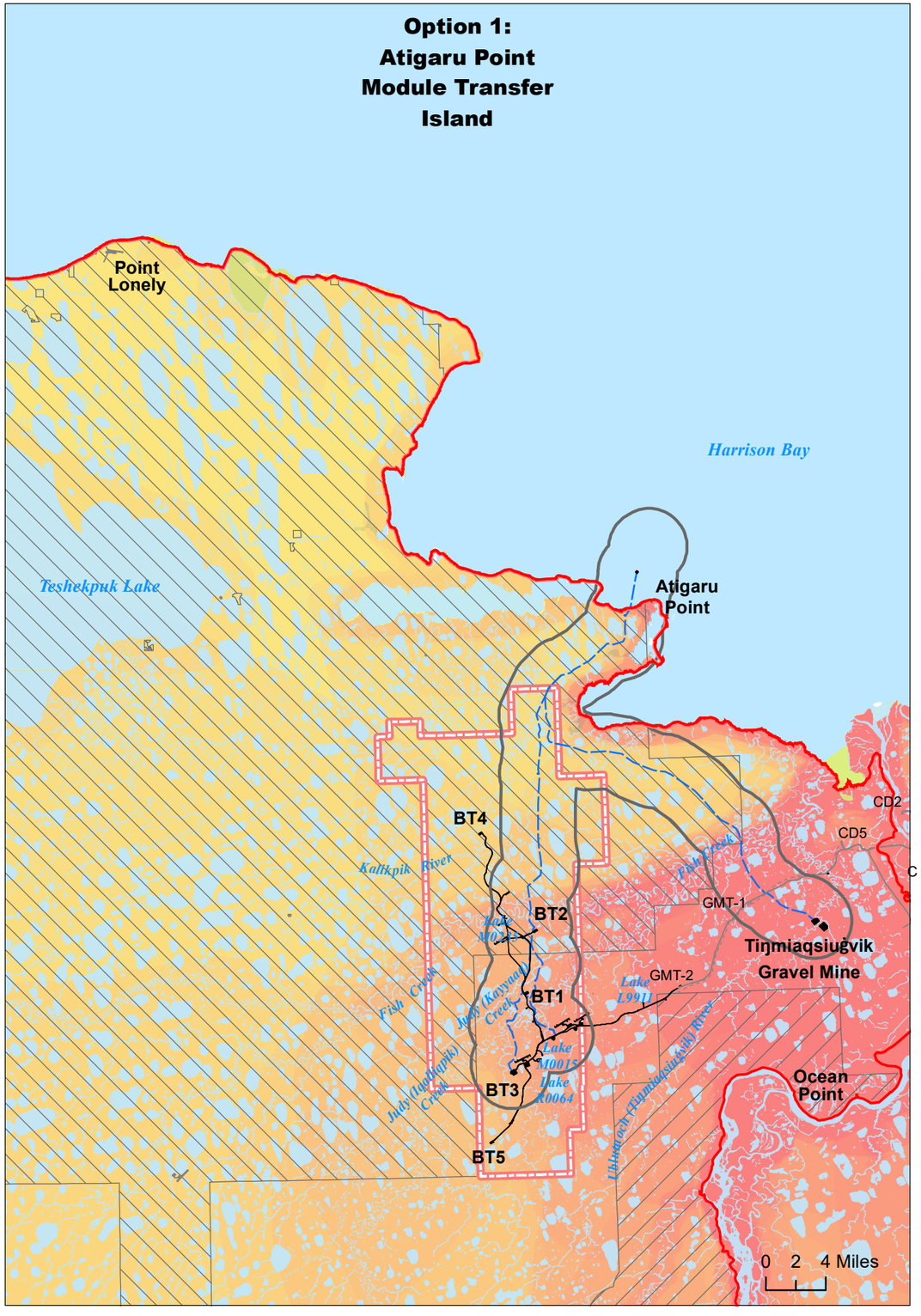
Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

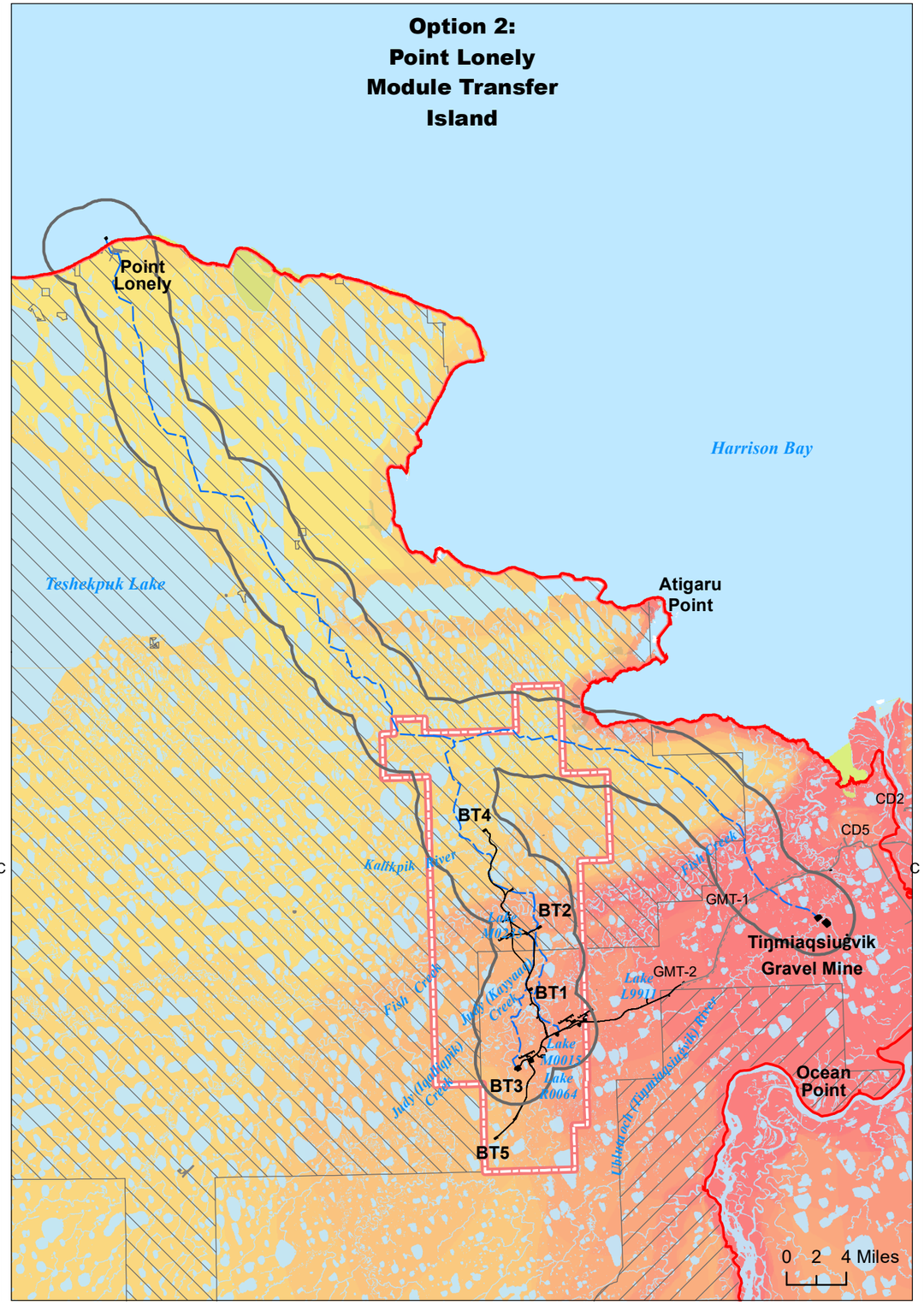
Map prepared by
Stephen R. Braund & Associates

Figure 12

Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Caribou, 1995-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

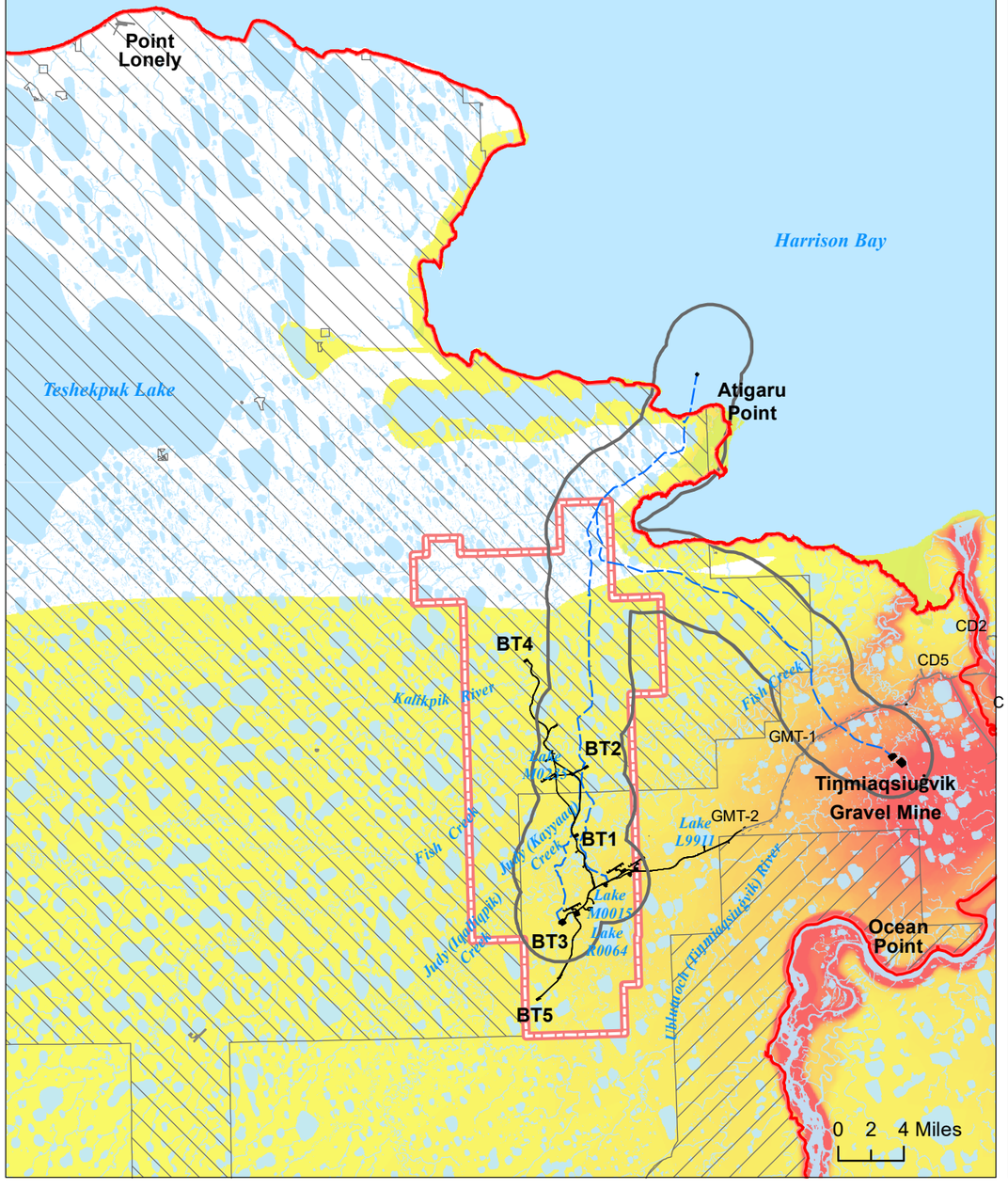
NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

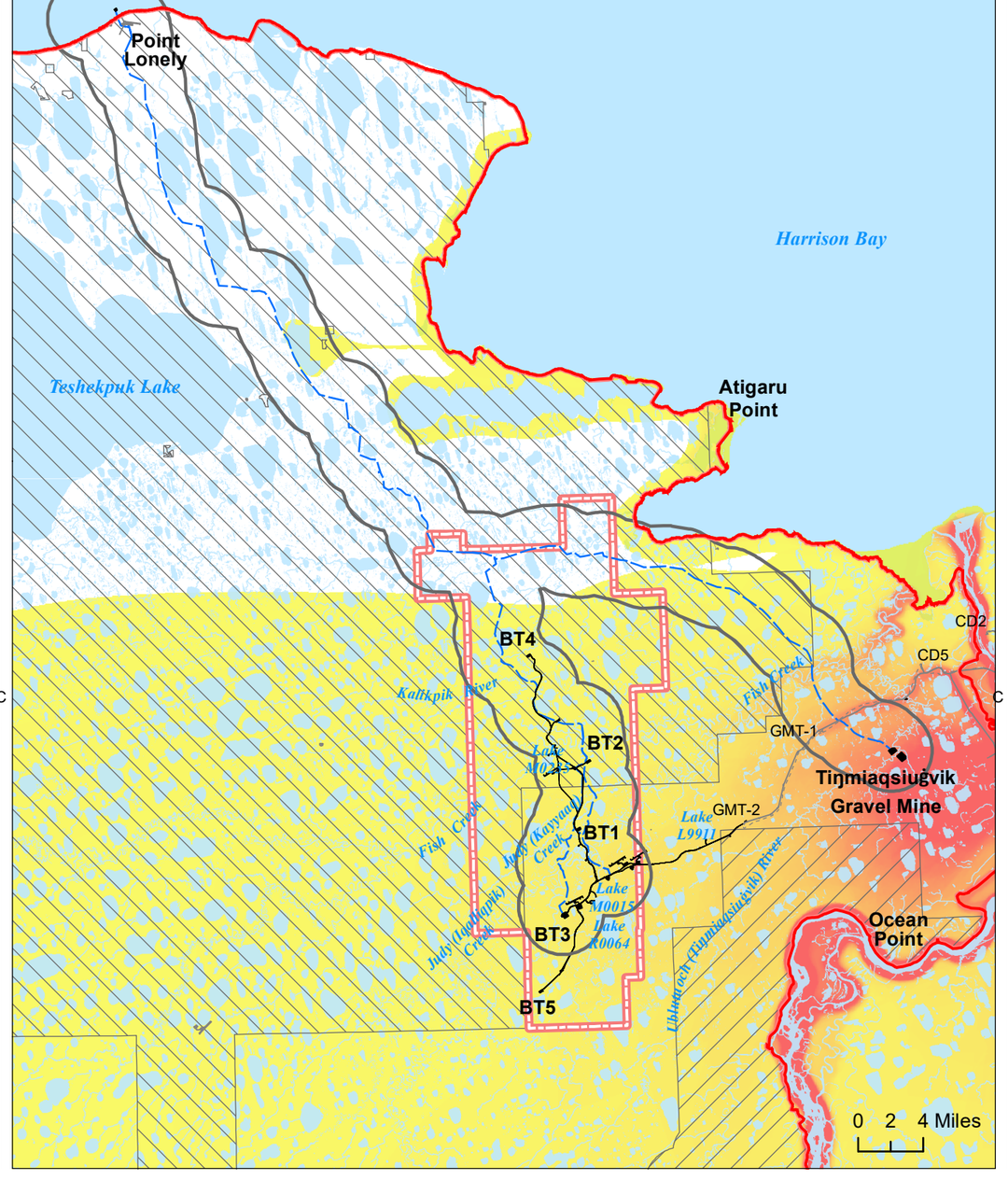
Source
a. SRB&A 2010a

Figure 13

Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Caribou, January 2008 through December 2019 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

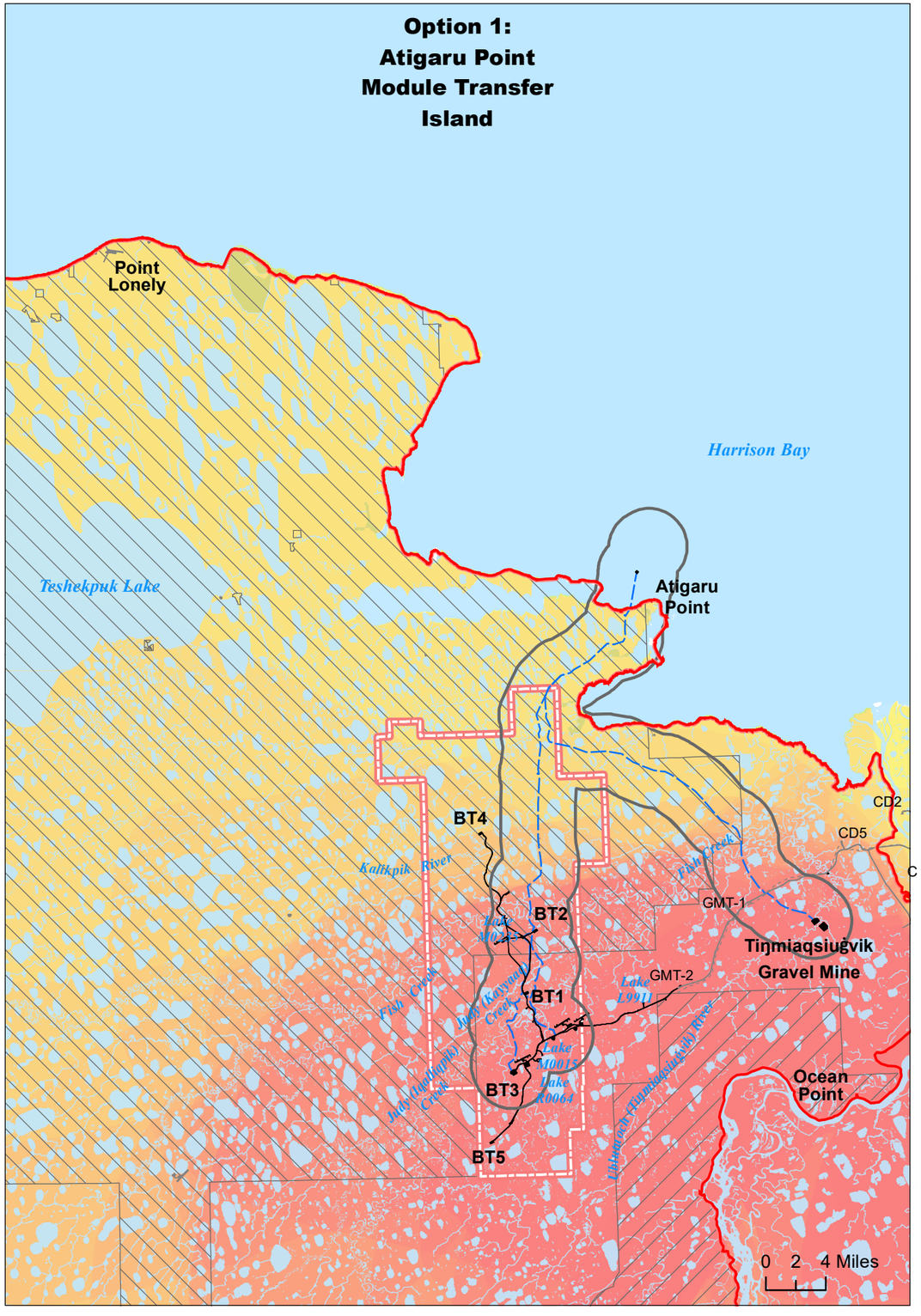
NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

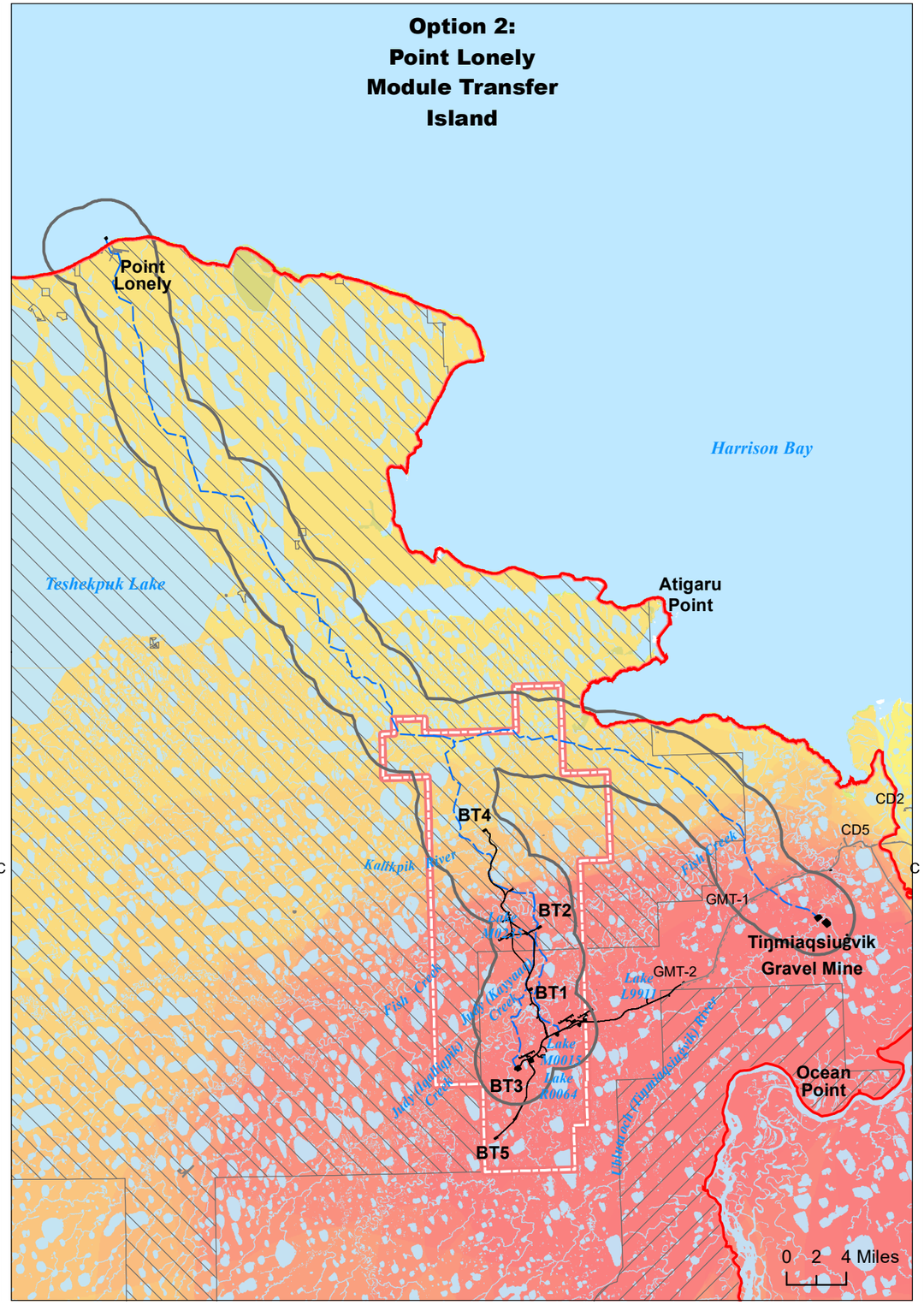
Source
a. SRB&A 2021

Figure 14

Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Subsistence Data

- Overlapping Subsistence Use Areas Wolf and Wolverine, 1995-2006[a] (High / Low)

Willow Proposed Development Features

- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

NPR-A Special Areas

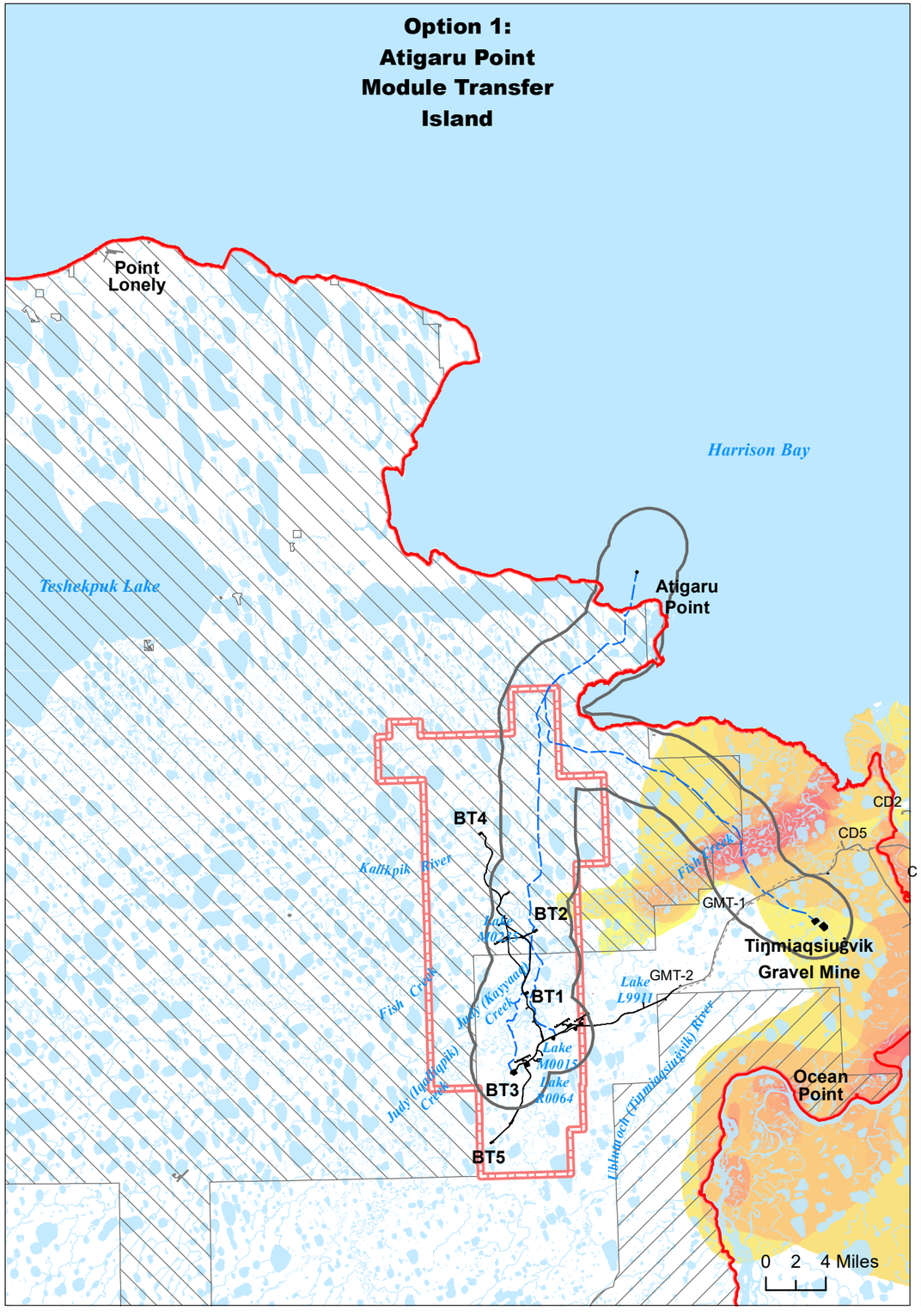
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

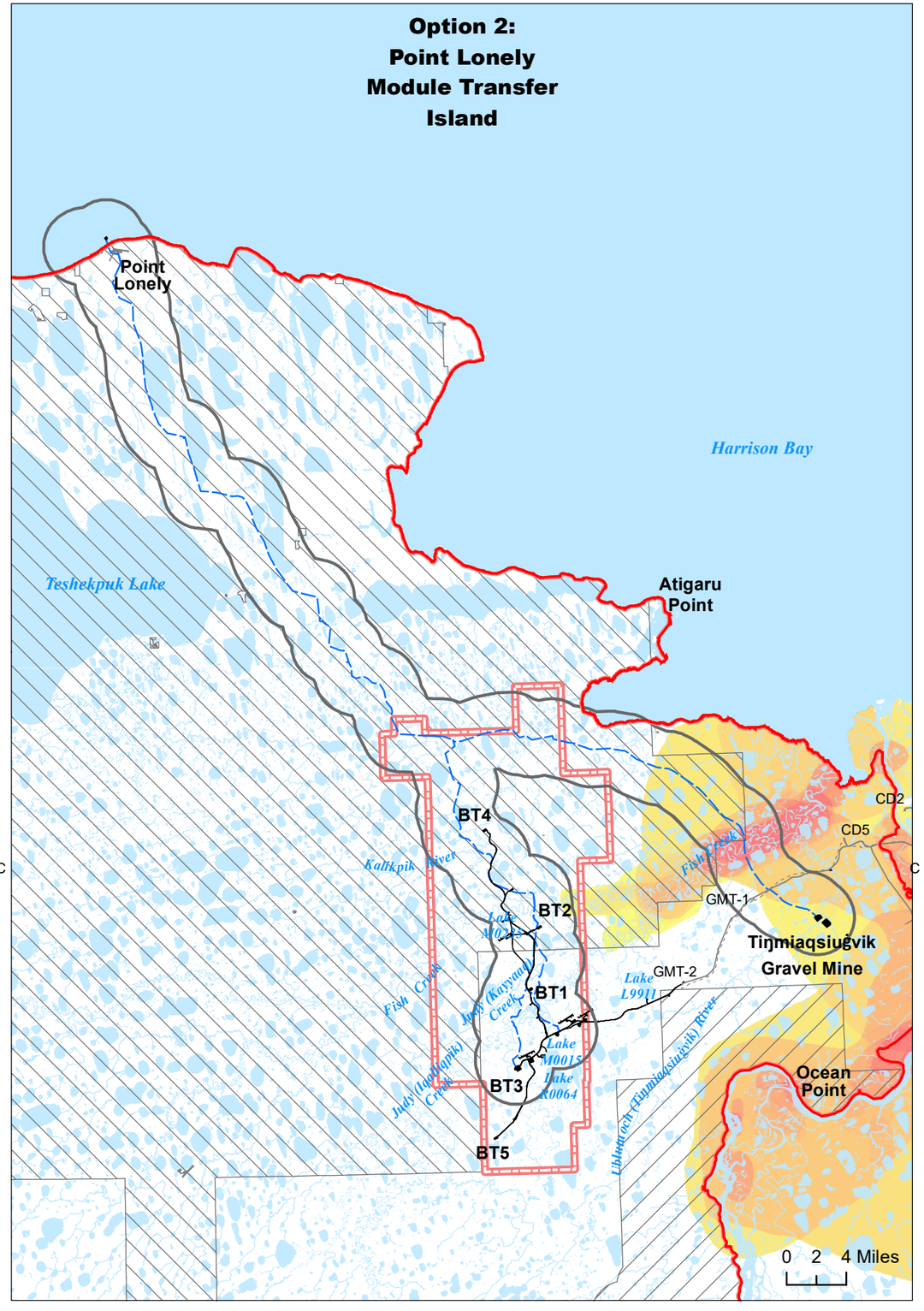
Source
a. SRB&A 2010a

Figure 15

Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Subsistence Data

- High / Low — Overlapping Subsistence Use Areas Goose, 1995-2006 [a]

Willow Proposed Development Features

- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation

- National Petroleum Reserve in Alaska

Oil and Gas Unit

- Bear Tooth Unit

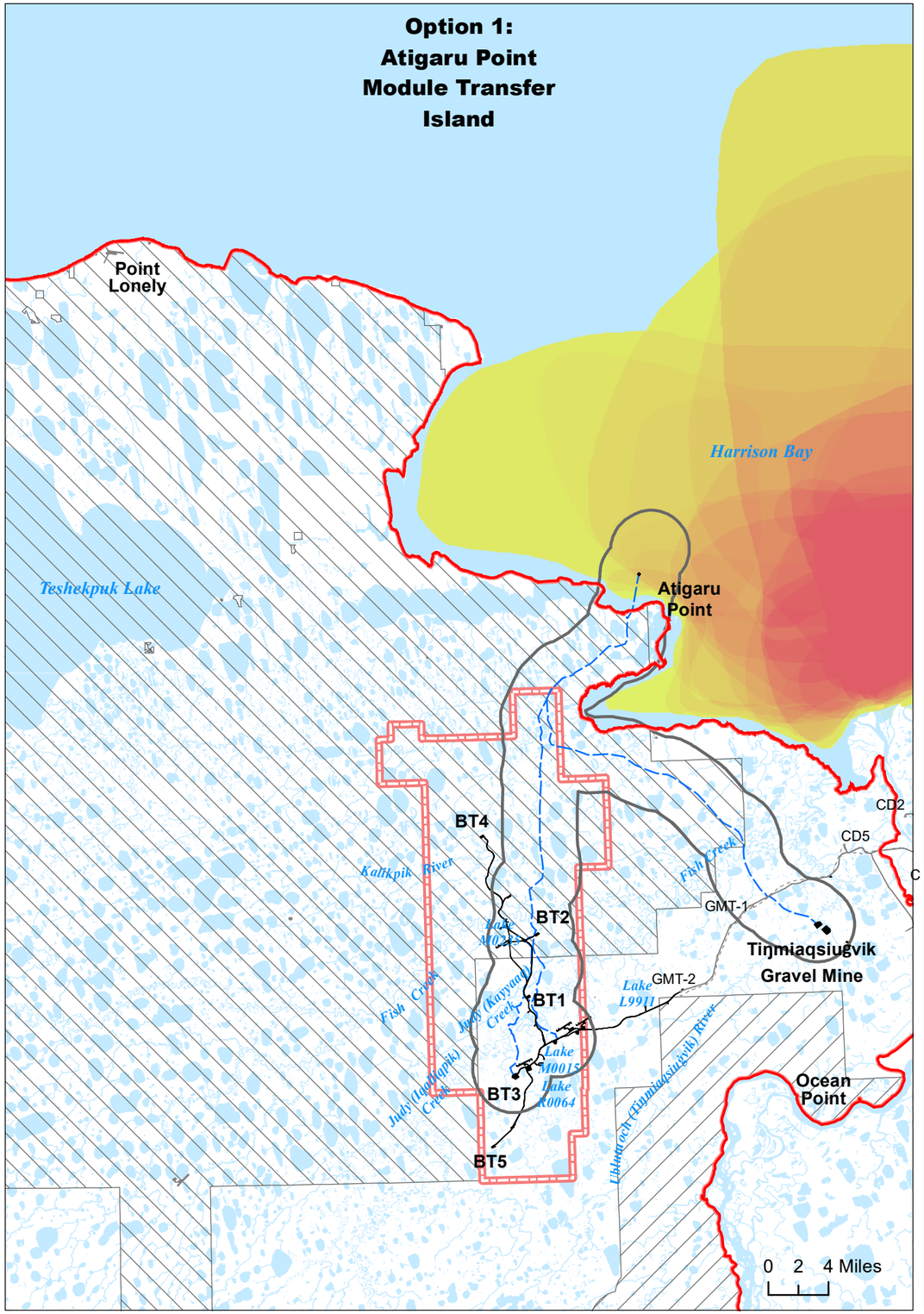
NPR-A Special Areas

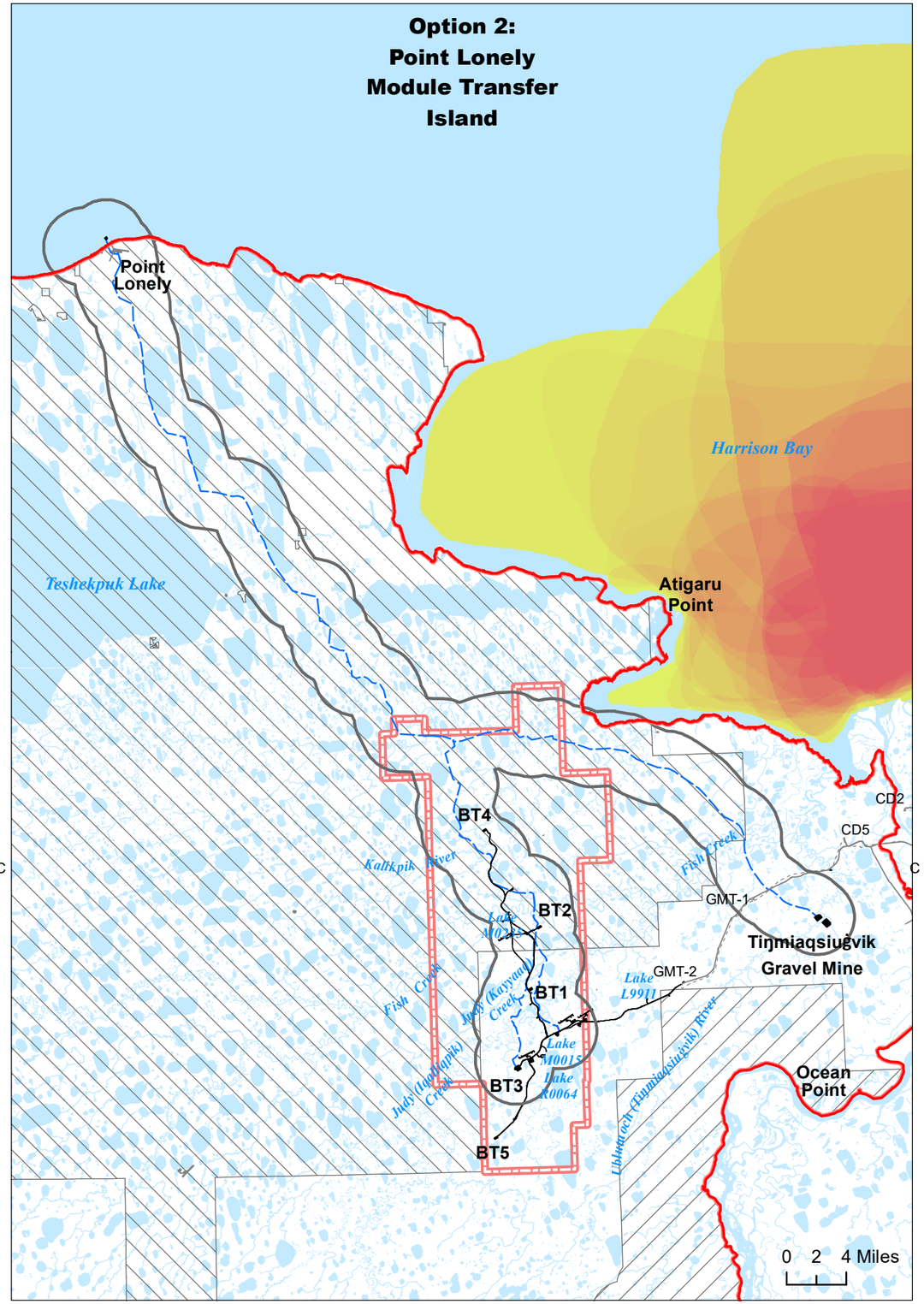
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 16





Subsistence Data
- High / Low — Overlapping Subsistence Use Areas Seal, 1995-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

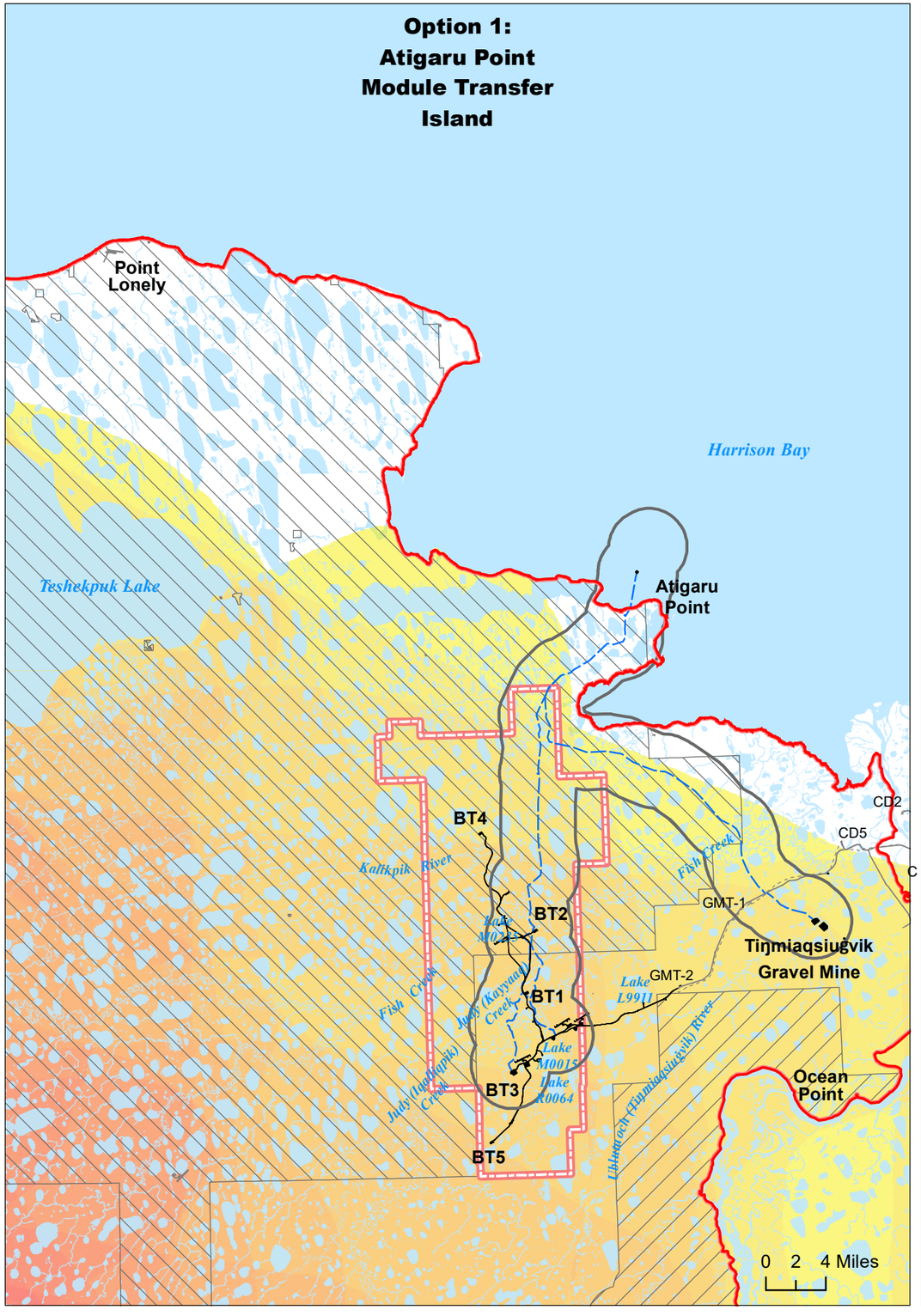
NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

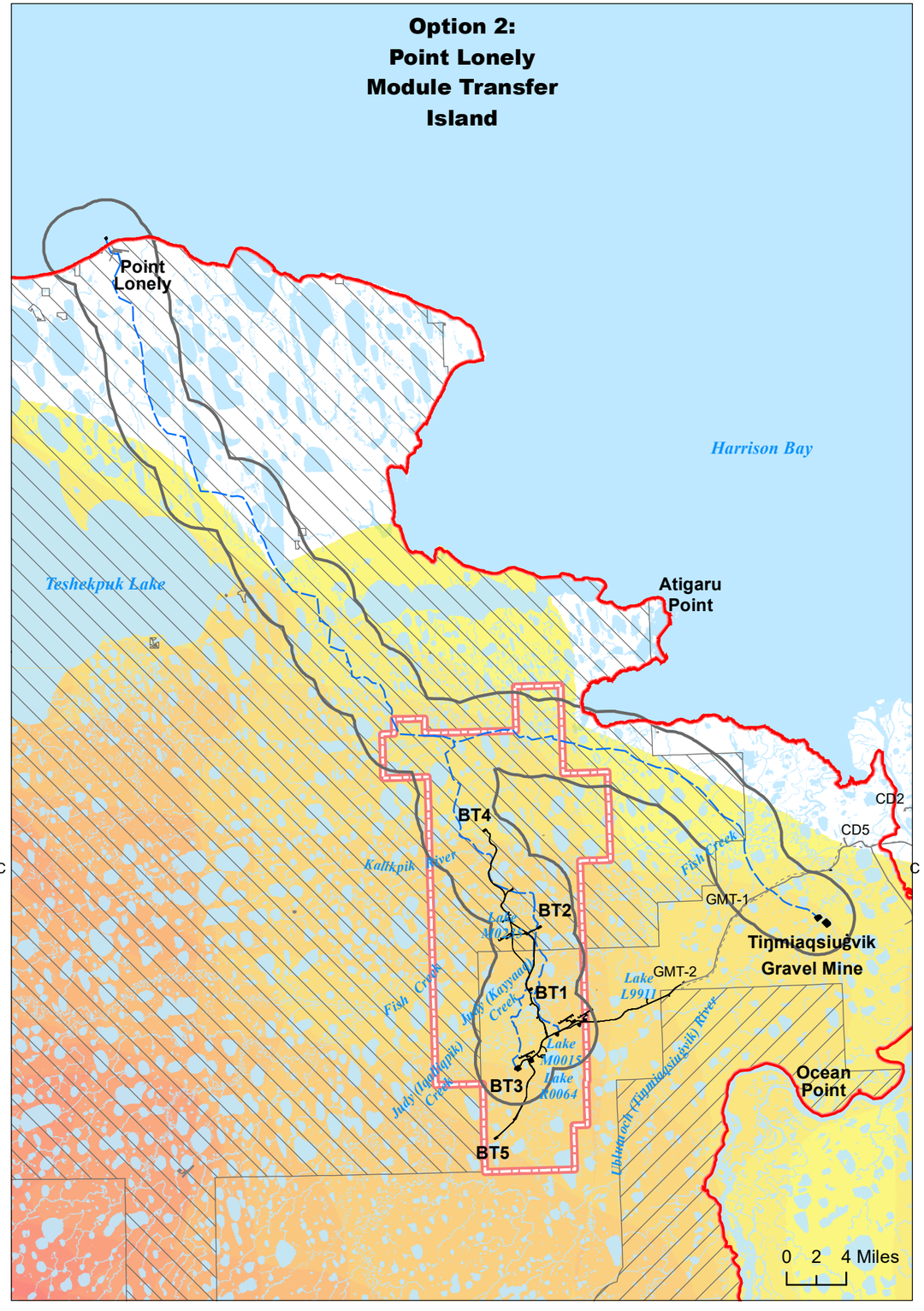
Source
a. SRB&A 2010a

Figure 17

Option 1: Atigaru Point Module Transfer Island



Option 2: Point Lonely Module Transfer Island



Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Wolf and Wolverine 1997-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 18

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Subsistence Resource Abundance

While construction activities associated with the MTI, including ice roads, would result in the temporary removal or disturbance of habitat for some resources and could cause direct mortality to individual animals, these are not expected to have population level effects on subsistence resources. Terrestrial mammals, including caribou, generally do not use sea ice habitat and therefore would not be directly affected by the MTI. Ice roads associated with the MTI occur within the TCH range but would be in an area of relatively low calving density (Willow MDP Supplemental EIS Section 3.12, *Terrestrial Mammals*). Traffic along ice roads, which would exceed 15 vehicles per hour during construction, could result in collisions and direct mortality of individual animals such as caribou. The area is not heavily used by caribou in winter and does not have a high density of wolf or wolverine; thus, the abundance of caribou, wolf, and wolverine available for subsistence use would not be impacted under module delivery Option 1.

While goose habitat occurs throughout the analysis area and could experience degradation or alteration, these changes are not expected to affect overall bird abundance. Individual mortalities could occur as a result of collisions with aircraft, vehicles, and infrastructure, but would not cause population-level effects (Willow MDP Supplemental EIS Section 3.11, *Birds*). Construction of the MTI would result in the direct loss of 12 acres of habitat for seals but is not expected to cause population-level effects to seals (Willow MDP Supplemental EIS Section 3.13, *Marine Mammals*). Fish, particularly broad whitefish, are harvested downstream from the proposed ice road crossing of Fish Creek. Nuiqsut residents generally do not harvest fish in Harrison Bay, but instead harvest them from river drainages. Water withdrawals for ice infrastructure could alter fish habitat but these alterations would be temporary and are not expected to affect fish populations in Fish Creek (Willow MDP Supplemental EIS Section 3.10, *Fish*). A large oil spill could have larger population-level effects to resource abundance, but such a spill is not expected to occur in association with the MTI or associated barging or ice road traffic (Willow MDP Supplemental EIS Sections 3.10, 3.11, and 3.13). Thus, the abundance of goose, seal, or fish available for subsistence use would not be impacted under module delivery Option 1.

Subsistence Resource Availability

A description of subsistence uses for Nuiqsut and Utqiaġvik is provided in Willow MDP Supplemental EIS Section 3.16.1, *Affected Environment,* and in Willow MDP Supplemental EIS Appendix E.16, *Subsistence and Sociocultural Systems Technical Appendix*. As noted above, use of the Option 1 analysis area for caribou hunting primarily occurs in the vicinity of ice roads—particularly gravel haul ice roads—associated with the MTI. The gravel haul ice road extending from the Tiŋmiaqsiuġvik mine site to Fish Creek occurs in areas of high overlapping use for Nuiqsut caribou hunting. Hunting along Fish Creek occurs by boat in the summer months; however, overland travel during the winter and summer months also occurs in the area between the mine site and Fish Creek. Hunting along Fish Creek by boat in the summer continues to be an important subsistence activity but the frequency has decreased in recent years; reasons for the decrease in use include difficulty accessing the mouth of Fish Creek due to increasingly shallow waters in nearshore areas near the mouth of the creek, and the high costs associated with traveling to Fish Creek via Harrison Bay (Northern Economics Inc. 2019; SRB&A 2019a). Subsistence boat ramps constructed as part of the Project may increase use of the Fish Creek area during the summer months. The overland area toward Fish Creek remains a heavily used area by the community of Nuiqsut during the summer and fall caribou hunting season and is primarily accessed by ATV, although residents increasingly access the area by truck along the road system. When traveling by ATV, residents can generally travel as far west as the Ublutuoch (Tiŋmiaqsiuġvik) River; however, access to the road system also allows residents to haul ATVs and travel farther toward Fish Creek than previously possible. Residents also hunt in coastal areas of Harrison Bay during the summer, with Atigaru Point being an important traditional hunting area where residents target TCH caribou during the insect relief season. In recent years, use of this area has decreased as a result of increased sedimentation and shallow waters along the coast, in addition to a reported decrease in the availability of caribou in the area (Willow MDP Supplemental EIS Section 3.16) (SRB&A 2018a).

Wolf and wolverine hunting within the Option 1 analysis area, particularly in the southern portions of the gravel haul and module transport ice roads, is similar to that described in Section B.2.a, *Evaluation of the Effects of Use, Occupancy, or Disposition on Subsistence Uses and Needs* (*Subsistence Resource Availability, Displacement of Furbearers*), and occurs primarily in the winter months to the west, south, and southeast of the Nuiqsut. Hunting of wolf and wolverine is less common in the northern portion of the Option 1 analysis area (Figure 15). For Utqiaġvik, wolf and wolverine hunting occurs primarily around the module transport ice road but extends throughout the southern portion of the analysis area (Figure 18).

Goose hunting in the Option 1 analysis area occurs most commonly in areas where the gravel haul ice road intersects with Fish Creek but also to the north and east of the Tiŋmiaqsiuġvik gravel mine site. Most goose hunting along Fish Creek and in overland areas occurs by snow machine in the months of April and May (Willow MDP Supplemental EIS Appendix E.16). Seal hunting by Nuiqsut residents occurs throughout Harrison Bay by boat, with moderate overlapping use offshore from Atigaru Point; high overlapping use occurs directly east of Atigaru Point in Harrison Bay. Seal hunting peaks in the months of July and August (Willow MDP Supplemental EIS Appendix E.16).

Noise and traffic associated with the gravel haul and module transport ice roads, and the physical presence of the ice roads themselves, could affect the availability of caribou, wolf, wolverine, and goose for Nuiqsut harvesters, and the availability of wolf and wolverine for Utqiaġvik harvesters. Depending on annual conditions, ice roads may still be present in late April, when goose hunting along Fish Creek intensifies (Figure E.16.1 in Appendix E.16); thus, goose hunters could experience direct hunting impacts while the gravel haul ice road is operational. This would only occur during a single winter ice road season when gravel haul to the MTI would take place. See Section B.2.a, *Evaluation of the Effects of Use, Occupancy, or Disposition on Subsistence Uses and Needs* (*Subsistence Resource Availability*), for a discussion of how roads and associated road traffic may affect the availability of caribou, furbearers, and other resources. Because MTI gravel haul and module transport ice roads would not be present during the fall caribou migration, it is unlikely they would cause overall changes in caribou distribution or migration; however, caribou may be deflected from ice roads in winter during times of heavy road traffic, affecting resource availability for caribou harvesters. Peak ground traffic levels associated with the MTI would reach up to 121 trips per hour in the winter and could have a high potential for disturbance. If ice roads are still in place and operational at the beginning of the waterfowl hunting season in mid-to-late April, residents may experience decreased harvesting success during this time for the single season during which the gravel haul ice road would be operational. Geese may be more easily disturbed or temporarily displaced due to traffic and noise, resulting in residents having greater difficulty hunting them.

Noise and human activity associated with construction of the MTI, which would occur during both the winter and summer seasons, could temporarily displace seals, periodically resulting in reduced harvest success for Nuiqsut seal hunters in the MTI area during the summer months. Vessel traffic between the MTI and Oliktok Point, which would occur throughout the open water season, may also cause temporary and periodic displacement of seals that could temporarily affect harvester success. The Project would require a total of nine sealift barges over the course of two delivery seasons; support vessel traffic would be much higher (an estimated 265 support vessels over the course of three open-water seasons). The presence of the MTI could also affect the distribution of marine mammals within the immediate area of the island (Willow MDP Supplemental EIS Section 3.13, *Marine Mammals*). However, noise and infrastructure related to MTI construction would not be likely to cause overall impacts to resource availability as most displacement would be temporary and localized; other suitable seal habitat would be available nearby, and residents would likely avoid areas where immediate disturbance is likely (e.g., around barges, support vessels, and the MTI during times of high activity) (Willow MDP Supplemental EIS Section 3.13). Noise and human activity at the MTI may also affect the availability of caribou along the coast during the summer; however, as discussed above, use of the coastal area in Harrison Bay has been limited in recent years due to access difficulties. Between 2008 and 2019, the Coastal West area has accounted for between zero and 2% of the total harvest (SRB&A 2021); thus, disruptions to caribou in this area would not likely affect overall resource availability for the Nuiqsut.

The Project would require additional fixed-wing aircraft and helicopter traffic to support module delivery Option 1. Most of this traffic would occur between Alpine and Willow. Potential impacts to resource availability related to air traffic are discussed in Section B.2.a, *Evaluation of the Effects of Use, Occupancy, or Disposition on Subsistence Uses and Needs* (*Subsistence Resource Availability*).

Access to Subsistence Resources

Potential impacts to harvester access are discussed in Willow MDP Supplemental EIS Section 3.16. Subsistence users would likely be prohibited from accessing the MTI area while it is under construction and operational, and the MTI would likely remain a gravel barrier island after decommissioning. Changes to coastal areas resulting from erosion and sedimentation around Atigaru Point is a key concern voiced by Nuiqsut residents who already have reported difficulty accessing nearshore areas in Harrison Bay in recent years. If construction of the MTI does contribute to the increasingly shallow waters in Harrison Bay, then it could further decrease access to coastal hunting areas. Long-term impacts to access would occur if construction of the MTI results in sedimentation or

ocean floor changes that affect access to coastal and nearshore areas; however, the MTI is not expected to cause additional sedimentation or shoaling (Willow MDP Supplemental EIS Section 3.16). Some individuals may use the MTI after it is decommissioned as a stopover point when hunting in Harrison Bay, similar to their use of other islands such as Thetis Island; however, it is unknown how accessible the island would be by boat.

Gravel haul ice roads associated with MTI construction would prohibit local use. Module transport ice roads would be restricted during periods of heavy use but would be available for local use during other times. Thus, some Nuiqsut furbearer, caribou, and goose hunters traveling overland by snow machine would likely experience reduced access during the winter and spring months when crossing through areas with ice roads. The gravel haul ice road between the MTI and the Tiŋmiaqsiuġvik gravel mine site would bisect high overlapping use areas for goose on Fish Creek. Thus, residents would likely experience reduced access to a portion of their goose hunting areas when ice roads continue to be operational in April. Impacts to access resulting from ice roads would only occur during the construction phase of the Project.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the Willow MDP EIS module delivery Option 1 is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the Willow MDP EIS module delivery Option 1 is identical to that provided above in Section B.2.c.

d. Findings

Module delivery Option 1 (Atigaru Point Module Transfer Island), in combination with any of the action alternatives (B, C, D, or E) would not result in any additional significant restriction on subsistence uses for communities in or near the Project area.

7. Evaluation and Finding for Module Delivery Option 2 (Point Lonely Module Transfer Island)

Module delivery Option 2 (Point Lonely Module Transfer Island) would locate the MTI at Point Lonely, a substantial distance west of Atigaru Point. Option 2 would also include module transport and gravel haul ice roads, but they would extend from the Tiŋmiaqsiuġvik gravel mine site and WPF to Point Lonely. This alternative would locate the MTI away from Harrison Bay, a key marine hunting area for Nuiqsut.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

The effects of module delivery Option 2 on subsistence would be like those described for module delivery Option 1 with three important differences:

1. Option 2 would reduce potential impacts to Nuiqsut marine subsistence uses for seal and coastal caribou hunting activities.
2. Option 2 would increase potential impacts to winter subsistence uses to Utqiaġvik furbearer harvesting and other activities around Teshekpuk Lake.
3. Option 2 would increase the area and likelihood of disturbance for TCH caribou.

For Nuiqsut, impacts related to ice roads would be similar to those described for Option 1, as they would terminate in the same Project area locations (i.e., WPF, mine site), would cross Fish Creek in a similar area, and would affect similar subsistence uses.

The location of the MTI at Point Lonely would move potential marine impacts out of an area of moderate to high marine subsistence use for Nuiqsut into an area of low to limited use for both Nuiqsut and Utqiaġvik (Willow MDP Supplemental EIS Section 3.16, *Subsistence and Sociocultural Systems*), thus reducing the likelihood of direct impacts on marine subsistence uses for either community. However, the gravel haul and module transport ice roads would extend farther west, along the east side of Teshekpuk Lake, and terminating to the north of Teshekpuk Lake at Point Lonely. Teshekpuk Lake is a traditional hunting ground for Nuiqsut and is still used by Nuiqsut hunters, particularly during the winter, and it is a key contemporary subsistence use area for many Utqiaġvik families and hunters year-round. In addition, the lands surrounding Teshekpuk Lake, including those to the north and east of the lake, are critical calving, post-calving, and insect relief habitats for TCH caribou. Ice roads associated with Option 2 would occur over a larger area, resulting in a greater area of disturbance for TCH

caribou. In addition, summer Project activities at Point Lonely and along the ice road route, including construction noise, litter clean up (known locally as stick picking), human presence, and air traffic, which would be somewhat higher under Option 2, could affect caribou during the calving and insect relief seasons. This increased disturbance could result in alterations to caribou distribution closer to Nuiqsut and increased disturbance of calving and migrating caribou.

While module delivery Options 1 and 2 would directly affect a similar percentage of Nuiqsut harvesters overall, Option 2 would affect a greater percentage of Utqiaġvik subsistence harvesters of wolf and wolverine (23%) and caribou (22%) (Willow MDP Supplemental EIS Table 3.16.11). The ice road would occur in areas of low to moderate overlapping use for wolf and wolverine for Utqiaġvik and could affect resource availability of furbearers for hunters in the vicinity of Teshekpuk Lake. However, these impacts would only occur for the length of ice road operations during MTI construction module hauling operations and would cause primarily indirect effects. The percentage of caribou harvesters using the analysis area for Option 2 was similar to Option 1, ranging from 33% to 72%; caribou harvests within the area ranged from 4% to 19% of the total harvest during individual study years (Willow MDP Supplemental EIS Table 3.16.12).

Overall, Option 2 would reduce direct impacts to Nuiqsut subsistence uses within Harrison Bay but would increase potential indirect impacts to caribou resource availability for Nuiqsut and Utqiaġvik and direct and indirect impacts to Utqiaġvik wolf and wolverine hunters. Under both options, the impacts would occur during the Project's construction phase. Direct impacts to key subsistence uses would be lower under Option 2 for Nuiqsut due to the decreased impacts to marine and coastal subsistence uses, with a slight increase in potential impacts to caribou availability and a slight increase in impacts to furbearer subsistence uses for Utqiaġvik.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the Willow MDP EIS module delivery Option 2 is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the Willow MDP EIS module delivery Option 2 is identical to that provided above in Section B.2.c.

d. Findings

Module delivery Option 2 (Point Lonely Module Transfer Island), in combination with any of the action alternatives (B, C, D, or E) would not result in any additional significant restriction of subsistence uses for communities in or near the Project area.

8. Evaluation and Finding for Module Delivery Option 3 (Colville River Crossing)

Module delivery Option 3 (Colville River Crossing), would not construct an MTI, instead relying on existing infrastructure at Oliktok Dock, as described under Alternative B. Similar to Options 1 and 2, Option 3 would include a module transport ice road, which would extend from the existing gravel road at Kuparuk drill site 2P (DS2P) to GMT-2, crossing the Colville River near Ocean Point (Figure 19). Some modifications to the existing Oliktok Road would be required to ensure an adequate turning radii for the module transporters; however, this area is not regularly used by contemporary Nuiqsut subsistence users. Option 3 would not require a separate gravel haul ice road from the mine site. Overall, Option 3 would make greater use of existing infrastructure but would cross through areas of heavy subsistence use to the south and southwest of the community.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs

The effects of module delivery Option 3 on subsistence would be like those described for module delivery Option 1 with four important differences:

1. Option 3 would reduce potential impacts to Nuiqsut marine subsistence uses for seal and eider and coastal caribou hunting activities (Figure 20 and Figure 21).
2. Option 3 would have a greater potential for direct impacts to Nuiqsut winter subsistence uses due to placement of the module transport ice road in key subsistence harvesting areas to the south and west of the community.
3. Option 3 would reduce the intensity and frequency of impacts associated with ice road traffic because of the lack of a gravel haul ice road and overall reduction in traffic levels.

4. Option 3 would reduce infrastructure and activity within subsistence harvesting areas for Utqiaġvik, thus minimizing direct impacts to that community.

Unlike Options 1 and 2, Option 3 would not require the construction of a gravel nearshore island and would instead use existing infrastructure at Oliktok Dock. Because Oliktok Dock would be used under all action alternatives, regardless of module delivery option, potential impacts associated with the use of the dock are discussed under Alternatives B, C, and D. The use of existing nearshore infrastructure at Oliktok Dock for module delivery would reduce impacts to marine subsistence uses for Nuiqsut and Utqiaġvik.

For Nuiqsut, the types of impacts related to ice roads would be similar to those described for Option 1 and would terminate in the same Project area locations (i.e., WPF, mine site). However, under Option 3, the ice road would originate from the east, crossing through areas of high winter subsistence use for Nuiqsut near the Colville River to the south, southwest, and west of the community. Construction of the ice road under Option 3 would result in the community of Nuiqsut being completely encircled to the north, west, south, and east by gravel or ice roads for two winter seasons. This encirclement would occur over two winter seasons and would therefore be temporary. In addition, the impacts would be additive to existing infrastructure and traffic impacts along the North Slope Borough's Community Winter Access Trail, which provides access for North Slope residents to the Dalton Highway. While impacts of the Option 3 ice road would be additive to the Community Winter Access Trail, they would also be higher, as residents may be less likely to cross or use these roads due to their association with industrial development. Option 3 would affect a slightly higher percentage of Nuiqsut harvesters, primarily because the ice road crosses through areas of high overlapping use for the community, including along the Itkillik River, the Colville River, and overland to the south and southwest of the community. As noted above, part of the ice road would intersect with the Community Winter Access Trail and therefore impacts would be additive in those areas.

Peak hunting activities in those areas occur in the summer and fall when the ice roads and associated activities would not be present. However, while overall hunting activity is lower in the winter, the area surrounding the Option 3 ice road is used heavily by those who conduct winter hunting of wolf (96% of harvesters) and wolverine (96%) (Figure 22), and caribou (91%). Compared to Options 1 and 2, a higher percentage of Nuiqsut caribou harvesters used the Option 3 analysis area over 12 study years (between 64% and 94%), and a greater percentage of caribou harvests came from this area (between 5% and 21%) (Willow MDP Supplemental EIS Table 3.16.12). While the area where the ice road crosses the Colville River is heavily used by Nuiqsut moose hunters (94%), these activities occur in the fall when the ice road would not be present. The road would also cross through areas of moderate overlapping use for waterfowl in areas used by 45% of goose harvesters (Figure 23). However, few birds are present in the ice road area during winter (Willow MDP FEIS, Section 3.11) and hunting activity in April is limited (SRB&A 2010b); therefore, impacts are unlikely. The ice road crossing on the Colville River is upstream from key fish harvesting areas on the Niġliq and East channels of the river; however, the crossing is located far enough upstream from the CRD that it would minimize impacts to fish passage. Option 3 would require one less winter ice road season (two winters) compared to Options 1 and 2 (three winters). In addition, substantially less ground traffic would be required under Option 3; therefore, the ice road and associated traffic are less likely to deflect or disturb subsistence resources such as caribou and are less likely to deter subsistence harvesters from crossing. Impacts to furbearer hunting success resulting from traffic along the 2L ice road (close to the proposed Colville River ice road crossing) were reported by a Nuiqsut furbearer hunter during recent interviews in Nuiqsut (SRB&A 2022).

The ice road would overlap with the periphery of overland subsistence use areas for Utqiaġvik in areas of low overlapping use (Figure 24). In addition, the ice road would overlap with areas of moderate overlap for Utqiaġvik moose hunting; however, these moose hunting activities generally occur in summer or fall, when the ice road would be absent, and therefore impacts would be minimal. Compared to Option 1, Option 3 would affect a similar percentage of harvesters for wolf and wolverine (Figure 25), and a slightly higher percentage of caribou harvesters, in areas of low overlapping use. Impacts under Option 3 would occur for the length of ice road and module hauling operations, which would occur over the course of two winter seasons.

Overall, Option 3 would reduce direct impacts to Nuiqsut and Utqiaġvik coastal and marine subsistence uses. Option 3 could potentially affect a greater percentage of Nuiqsut wolf and wolverine and winter caribou harvesters; however, the frequency and intensity of impacts would be less due to the lack of a gravel haul road and decrease in associated traffic, as well as the reduction in ice road seasons from three to two.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the Willow MDP EIS module delivery Option 3 is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the Willow MDP EIS module delivery Option 3 is identical to that provided above in Section B.2.c.

d. Findings

Module delivery Option 3 (Colville River Crossing), in combination with any of the action alternatives (B, C, D, or E) would not result in any additional significant restriction of subsistence uses for communities in or near the Project area.

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D
BT4
Kalikpik River
Fish Creek
Alt E
BT2
Lake M0233
BT2
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Fish Creek
BT1
GMT-2
Lake L9911
Uhlaqtoach (Tiŋmiaqsiuġvik) River
Itkillik River
Judy Creek (Kalikpik)
Lake M0015
BT3
Lake R0064
Ocean Point
DS2P
Alt E
BT5
Alt B, C, D
BT5

0 5 10 Miles

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 19

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D
BT4
Kulikpik River
Alt E
BT2
Fish Creek
Lake M0231
BT2
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Fish Creek
GMT-2
Lake L9911
Ublutuoch (Tiŋmiaqsiuġvik) River
BT1
Itkillik River
Lake M0015
Judy Creek (Kalikpik)
BT3
Lake R0064
Ocean Point
DS2P
Alt E
BT5
Alt B, C, D
BT5
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Caribou, 1995-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 20

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D
BT4
Kuliktpik River
Alt E
BT2
Fish Creek
Lake M0231
BT2
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Uhuktoch (Tiŋmiaqsiuġvik) River
Fish Creek
BT1
GMT-2
Lake L9911
Lake M0015
Lake R0064
BT3
Judy Creek (Kaliqpiki)
Ocean Point
Miluveach River
DS2P
Alt E
BT5
Alt B, C, D
BT5
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Caribou, January 2008 through December 2019 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2021

Figure 21

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D
BT4
Kalikpik River
Alt E
BT2
Fish Creek
Lake M0233
BT2
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Fish Creek
GMT-2
Lake L9911
Ublutuoch (Tiŋmiaqsiuġvik) River
BT1
Lake M0015
Judy Creek (Qalliqpiaq Creek)
BT3
Lake R0064
Ocean Point
Itkillik River
DS2P
Alt E
BT5
Alt B, C, D
BT5
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Wolf and Wolverine, 1995-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 22

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D BT4
Kalikpik River
Alt E BT2
BT2
Lake M0233
Fish Creek
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Uhuktoch (Tiŋmiaqsiuġvik) River
GMT-2
Lake L9911
BT1
Fish Creek
Lake M0015
Judy Creek (Qalliqpik)
BT3
Lake R0064
Ocean Point
Itkillik River
DS2P
Alt E BT5
Alt B, C, D BT5
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Goose, 1995-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

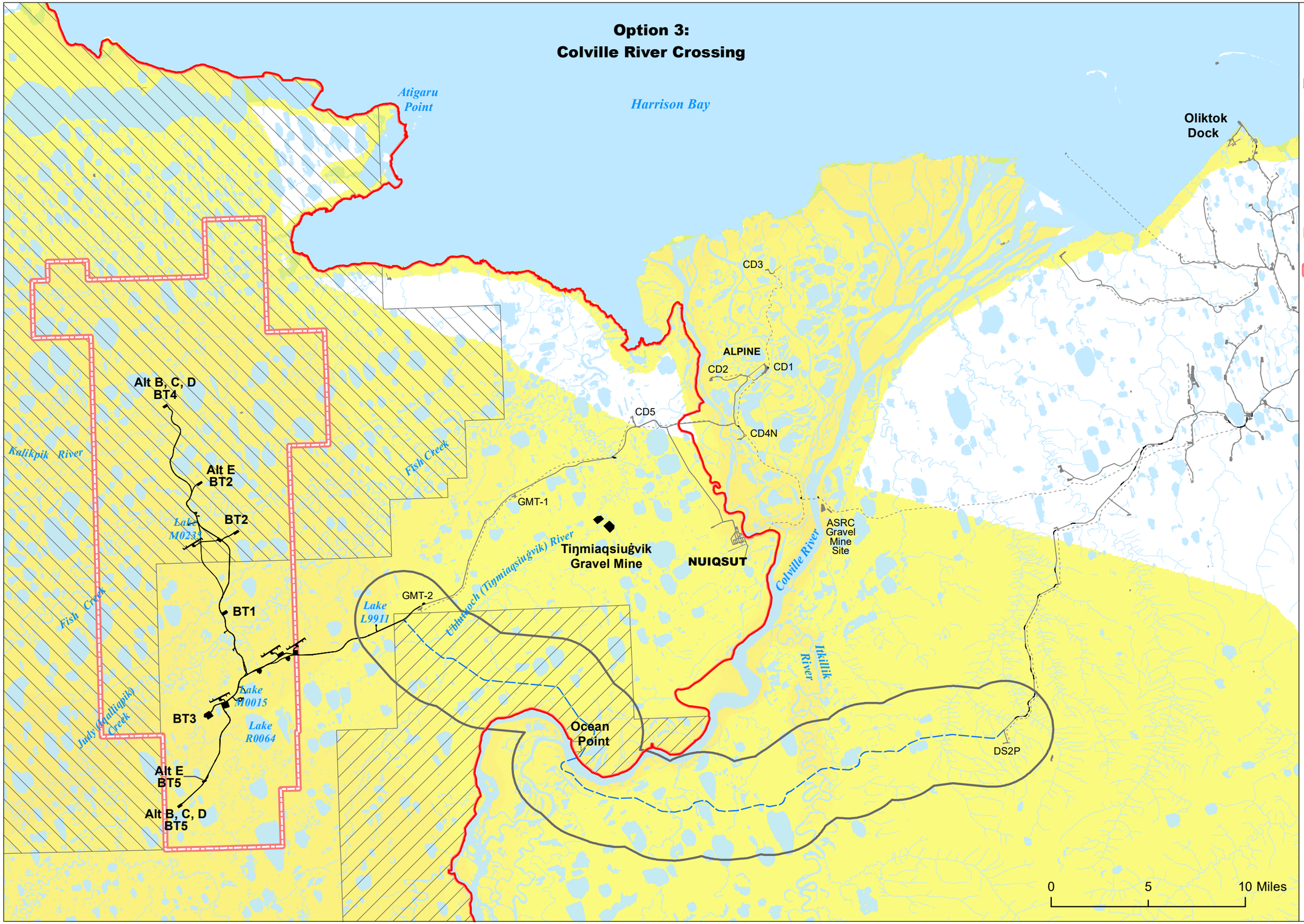
Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 23



Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Caribou, 1997-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 24

Option 3:
Colville River Crossing

Atigaru Point
Harrison Bay
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
Alt B, C, D
BT4
Kalikpik River
Fish Creek
Alt E
BT2
BT2
Lake M0233
GMT-1
Tiŋmiaqsiuġvik Gravel Mine
NUIQSUT
ASRC Gravel Mine Site
Colville River
Tiŋmiaqsiuġvik (Tiŋmiaqsiuġvik) River
GMT-2
Lake L9911
BT1
Fish Creek
Itkillik River
Lake M0015
Judy Creek (Qalliqpiik)
BT3
Lake R0064
Ocean Point
DS2P
Alt E
BT5
Alt B, C, D
BT5
0
5
10 Miles

Subsistence Data
- High / Low: Overlapping Subsistence Use Areas Wolf and Wolverine, 1997-2006 [a]

Willow Proposed Development Features
- Module Transport Analysis Area
- Ice Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Oil and Gas Unit
- Bear Tooth Unit

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Map prepared by
Stephen R. Braund & Associates

Source
a. SRB&A 2010a

Figure 25

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9. Evaluation and Finding for the Cumulative Case*

Willow MDP Supplemental EIS Section 3.19, *Cumulative Effects*, contains a description of the cumulative case, which evaluates the impacts of the proposed action in conjunction with past, present, and reasonably foreseeable future actions on subsistence. Reasonably foreseeable future actions considered in the cumulative analysis are provided in Willow Supplemental EIS Section 3.19 and include oil and gas exploration, pipeline and oil field development, and transportation projects. The cumulative impacts of climate change on subsistence are considered as part of the future condition on the North Slope.

Reasonably foreseeable oil development that could contribute to cumulative impacts on subsistence for Nuiqsut, Utqiaġvik, and other North Slope communities include continued development of Kuparuk and Prudhoe Bay, the Nanushuk Development, CPAI drill site 3T (formerly known as Nuna DS2), Liberty Development in the Beaufort Sea, state offshore lease sales and development, oil and gas leasing and development within the NPR-A, and the Alaska LNG or Alaska Stand Alone pipelines. In addition, BLM is currently developing an oil and gas leasing program in the Arctic National Wildlife Refuge, which could lead to oil and gas exploration and development in the 1002 (Coastal Plain) area. Development of offshore leases in federal waters is not projected to occur in the Chukchi Sea during the sealift operations for the Project, or within the foreseeable future. In the Beaufort Sea, Hilcorp is still pursuing its proposed Liberty project; however, the project schedule has been pushed back indefinitely until Hilcorp revises its oil spill response plan and reevaluates its development and production plan, at which time the Bureau of Ocean Energy Management (BOEM) would have to complete additional NEPA analysis before it could reapprove the project. Although BOEM is currently working on the next 5-year leasing program, BOEM's current 5-year leasing plan (ending 2022) does not allow for lease sales in either the Beaufort or Chukchi seas. With the exception of the proposed Liberty project and Northstar development (which has been in production for decades) to the east, almost all federal offshore leases in this area have been surrendered.

Other reasonably foreseeable transportation and infrastructure projects include airport and community infrastructure improvements; continued marine vessel and air traffic associated with shipping, development, scientific research, and recreation and tourism activities in the region; and new permanent or seasonal roads such as the Arctic Strategic Transportation and Resources Project, which could lead to development of roads linking North Slope communities to each other and ultimately the Dalton Highway.

a. Evaluation of the Effect of Use, Occupancy, or Disposition on Subsistence Uses and Needs*

Cumulative effects on subsistence would be similar if Alternatives B, C, or E are selected in the ROD for the Project. If Alternative D is selected, cumulative effects would differ due to the lack of a year-round gravel access road. Construction of the Project without a year-round access road could substantially reduce displacement or deflection of TCH caribou but would result in somewhat higher disturbances related to air traffic and would not provide year-round subsistence access. The module delivery options would not contribute substantially to the cumulative case as most associated activities would occur solely during construction. While Option 1 would have greater overall direct impacts to Nuiqsut marine and coastal subsistence uses, most of these impacts would cease after the construction phase ended.

Regardless of the alternative selected, cumulative oil and gas activity, transportation projects, and climate change will increasingly restrict subsistence uses and affect the availability of subsistence resources such as caribou and marine mammals. This analysis focuses in part on the impacts that would be associated with an access road to the Project (Alternatives B, C, and E) and assumes access roads to any future development west or south of the Willow development in the NPR-A. For the disconnected access road scenario (Alternative D), impacts from access roads as described below would not accumulate from development of the Project, though they may accumulate from other transportation projects in the region. Impacts related to air traffic would accumulate, to a greater degree, under Alternative D because of the slight increase in air traffic required to reach the Project area during the snow-free months.

Since 2000, oil and gas exploration and development has expanded into Nuiqsut's core subsistence use areas, including the CRD (Alpine drill sites CD1 through CD4) and to the north and west of the community toward Fish Creek (Alpine drill site CD5, GMT-1, and GMT-2). As a result, the frequency of conflicts between subsistence and development activities have increased (SRB&A 2019a). The Project, in addition to other reasonably foreseeable future activities such as the Nanushuk development, would contribute to the cumulative effects of development on subsistence resources and activities because it would represent a net increase in the amount of

land used for oil and gas and other development, in addition to a related increase in industrial activity, including air traffic.

The Alpine CD5, GMT-1, and GMT-2 development projects are present actions that are most closely connected to proposed development in the BTU. These developments were facilitated by previous developments, including Alpine CD5 (for GMT-1) and GMT-1 (for GMT-2). Alpine CD5 was the first major oil and gas development west of the CRD and is connected to Alpine via a bridge and road. Development of Project drill sites, particularly in the case of a year-round access road, would likely facilitate future development to the west and southwest of Nuiqsut within the NPR-A. Development of these drill sites, in combination with existing and future developments, would continue a pattern of development infrastructure surrounding Nuiqsut to the north, west, and southwest of the community. Despite the greater distance from the community, many in Nuiqsut perceive that they are also surrounded to the east by infrastructure associated with the Prudhoe Bay and Kuparuk developments. These areas are now considered off-limits to subsistence uses despite being considered part of the community's traditional use area (SRB&A 2018b). Development of the Pikka (formerly Nanushuk) project would introduce infrastructure directly to the east of the CRD in an area used for harvesting of caribou, seal, eider, and fish (e.g., Arctic grayling) and leave only the southerly direction untouched by oil and gas infrastructure. Despite the current lack of infrastructure to the south, oil and gas exploration has occurred to the south of the community and may result in oil and gas development in the future. There is potential to further expand the existing Alpine oilfield through the development of CD8, which would be located south of Nuiqsut, including a gravel road and pipeline connection to CD4. Activities to the south of Nuiqsut could affect hunting of caribou, moose, and furbearers, as well as fishing activities along the river. Finally, development of the BTU would introduce a major oil and gas development within Utqiaġvik's hunting area, although Project development would be located at the eastern edge of the subsistence use area for the community, within an area that provides a minimal amount of subsistence resources compared to land north and west of Teshekpuk Lake. Development of the BTU could lead to additional future development in the BTU, including development of the West Willow discovery, and elsewhere in the NPR-A that is within the core harvesting areas for Utqiaġvik and Atqasuk, thus increasing the potential for direct impacts to subsistence users from other communities. In addition to new developments, upgrades, expansions, and maintenance activities will be ongoing throughout the life of various existing developments. These could include a 5-acre K-Pad expansion and a new 15 to 30-acre gravel staging pad in the GMT unit.

In addition to the additive effects of increasing oil and gas infrastructure in the region, increased activity, including oil and gas exploration and seismic activity, air traffic, scientific research, recreation, and sport hunting and fishing activities, would also contribute to subsistence impacts by increasing the frequency of noise and air traffic disturbances, and interactions with non-local researchers, workers, and recreationists. Increased noise disturbances would contribute to existing impacts on subsistence resource availability. Ongoing disturbances within the NPR-A, in combination with the Project, would likely contribute to changes in the availability of caribou within Nuiqsut's harvesting area.

Barges and vessel traffic associated with the Project would be additive to shipping and scientific research in the Beaufort and Chukchi seas. Vessel traffic would be required for 4 years of the Project's construction phase to transport the modules needed to construct Project infrastructure, and cumulative vessel traffic during this time period would have relatively minimal impacts on marine mammal availability (see Figure 17 for Nuiqsut seal use areas, and Willow MDP Supplemental EIS Appendix E, Figures E.16.9 and E.16.20 for Nuiqsut and Utqiaġvik marine mammal use areas). Development of offshore leases in federal waters is not projected to occur in the Chukchi Sea during the sealift operations for the Project, or within the foreseeable future. In the Beaufort Sea, Hilcorp is still pursuing its proposed Liberty project, however the project schedule has been pushed back indefinitely until Hilcorp revises its oil spill response plan and reevaluates its development and production plan, at which time BOEM would have to complete additional NEPA analysis before it could reapprove the project. Though BOEM is currently working on the next 5-year leasing program, their current 5-year leasing plan (ending 2022) does not allow for the possibility of lease sales in either the Beaufort or Chukchi seas. With the exception of the proposed Liberty project and Northstar development (which has been in production for decades) to the east, almost all federal offshore leases in this area have been surrendered. The 2021 Conflict Avoidance Agreement (CAA) between whalers and oil and gas operators has been effective at reducing impacts to subsistence hunting of marine mammals. The CAA stipulates that all vessel routes should be planned so as to minimize potential conflicts with bowhead whales or subsistence whaling; in some areas, vessels are required to remain as far offshore as weather and ice conditions allow, and at least five miles offshore during transit. It is unlikely that transport of Project modules, normal shipping patterns, and the construction of the Liberty project would

cumulatively cause a significant restriction to marine mammal harvesters on the North Slope in the absence of significant offshore oil and gas exploration and development.

Competition with non-local hunters would contribute to subsistence impacts by potentially decreasing harvest success rates for local subsistence users. Nuiqsut hunters have reported concerns associated with sport hunters along the Dalton Highway and the impacts of those hunters on the movement of caribou toward the community's hunting grounds. In addition, impacts from guided sport hunts to the south of Nuiqsut near Umiat and closer to the foothills of the Brooks Range have been reported by residents of both Nuiqsut and Anaktuvuk Pass (SRB&A 2013c, 2019b). Data from the Alaska Department of Fish and Game (ADF&G) harvest ticket database, which captures primarily non-local harvests (until 2017, state residents north of the Yukon River did not have to use a harvest ticket, and it is presumed that local harvest reports with these permits are low) (Braem 2014), show approximately 16,000 caribou harvested within Game Management Units (GMUs) 26A and 26B between 2000 and 2020 (Table 1). Approximately 87% of these harvests occurred within GMU 26B, which extends to the east of the Colville River and includes the Dalton Highway. The vast majority of harvests within Unit 26B were reported to be CAH caribou. In Unit 26A, where the proposed Willow development area is located, nearly all harvests were reported to be Western Arctic Herd (WAH) caribou (ADF&G 2022). Data by smaller uniform coding unit for Unit 26A indicate that the majority of non-local harvests occur to the south of Umiat and near the Brooks Range (Braem 2014). Harvests of TCH caribou by non-residents are thought to be minimal due to difficulty accessing their central range near Teshekpuk Lake (Braem 2014). Based on available data, non-local harvests within Unit 26B have decreased somewhat in recent years, while harvests in Unit 26A have remained relatively stable.

Table 1. Caribou Harvests by Study Year in Game Management Sub-units 26A and 26B*

Harvest Year	Number Harvested 26A	Number Harvested 26B	Total Number Harvested
2000	68	493	561
2001	57	510	567
2002	79	413	492
2003	117	397	514
2004	115	625	740
2005	87	670	757
2006	91	831	922
2007	114	665	779
2008	94	716	810
2009	75	803	878
2010	65	1,212	1,277
2011	84	1,162	1,246
2012	95	1,003	1,098
2013	95	865	960
2014	121	915	1,036
2015	121	763	884
2016	163	588	751
2017*	156	232	388
2018*	110	224	334
2019*	118	300	418
2020*	89	427	516
All Years	**2,114**	**13,814**	**15,928**

Source: (ADF&G 2022)
* Starting in 2017, ADF&G required all state residents, including local residents, to use a registration permit. Prior to 2017, residents north of the Yukon River were not required to submit a harvest ticket. It is presumed that harvest reporting by local residents from 2017 to 2020 is low; however, a small number of the 2017–2020 reported harvest may be from local subsistence users.

Data on Special Recreation Permits from BLM for guided hunts in Unit 16A show three guide services operating during the 2017–2021 time period. One guiding service operated in the Umiat/Colville River area, taking between 8 and 56 flights and harvesting between 9 and 38 caribou annually. Hunting trips and harvests in the Colville River/Umiat areas were on the high end in 2020 and 2021, as were user days. Other guide services operated farther west and south, in the Nigu and Etivluk river drainages. Overall, hunting guides on BLM land in Unit 16A took 141 caribou during the 2017–2021 time period.

Competition with non-local hunters may contribute to impacts on local subsistence users if there is a decrease in the abundance of caribou or if caribou are deflected from traditional hunting grounds. While CAH caribou generally do not occur within the Willow development area, they do occur to the east of the Colville River and are harvested by Nuiqsut residents. If TCH caribou experience a decline or become more difficult to harvest due to changes in their distribution or behavior, then Nuiqsut residents may shift their focus to the CAH, thus increasing the likelihood of competition with non-local users. Similarly, other North Slope communities that hunt from the TCH (e.g., Utqiaġvik, Atqasuk, Anaktuvuk Pass, Wainwright) may increase their harvests from other herds (e.g., the WAH) if the availability of TCH caribou declines. If the population of the WAH also continues to decline, as it has in recent years (Hansen 2021), this could increase competition for caribou across multiple communities with non-local users.

Development activities and infrastructure can change hunting patterns and use areas over time by introducing barriers, impediments, or restrictions to access; by facilitating access to lesser used hunting areas via roads; or by causing changes to the availability of subsistence resources in the vicinity of development. Nuiqsut's core subsistence use area has shifted west over time due to Prudhoe Bay development, and recent research has documented decreased use of traditional use areas, including the Niġliq Channel, in part due to development activities and infrastructure (SRB&A 2019a).

Decreased use areas in some development areas have occurred while road-accessible areas have seen increased use. The Kuukpik Spur Road was constructed in 2014 and 2015 to facilitate access for Nuiqsut hunters to the Alpine development's roads. The road has provided access to residents, and the road system has seen increased use in every year since its construction. In 2018 and 2019, harvests of caribou within 2.5 miles of Alpine-related infrastructure were on the high end of all previous study years (SRB&A 2021). Some hunters indicate that their use of the road system offsets decreased harvests closer to the community, which they believe are a result of deflection from the road itself (SRB&A 2018a). Thus, facilitated access to hunting areas via roads is a countervailing effect that partially mitigates the impacts of roads and associated development on subsistence resource availability; this benefit is particularly prevalent for hunters who are less active, do not have access to other non-road modes of transportation (e.g., snow machines, ATVs), or have limited time to spend harvesting resources. However, use has also increased among active hunters who have access to various modes of transportation. Similar to the Spur Road, the recently built Colville River Access Road provides increased access to the upriver hunting areas along the Colville River and away from the area of development, which could also help to offset impacts resulting from increased development infrastructure to the north and west of the community. In recent years, access to the main channel of the Colville River has been difficult due to shallow river channels. During recent interviews in Nuiqsut, residents also reported using the road itself to hunt caribou (SRB&A 2021).

Increased development infrastructure on the North Slope would continue to cause alteration and degradation of habitats for key subsistence resources including caribou, furbearers, fish, and goose. Over time, these changes could affect the health and abundance of different subsistence resources on the North Slope. Risks of oil spills and contamination associated with increased development infrastructure and activity could result in increased avoidance of subsistence foods due to concerns about contaminated food sources. This may be more likely to occur with fish resources downstream from potential contamination sites but could also occur with terrestrial mammals, marine mammals, and bird resources. Avoidance of subsistence foods could have sociocultural effects by reducing food security and reducing opportunities to engage in the distribution (sharing), processing, and consumption of subsistence foods. If development were to continue westward into the core calving area for the TCH, or if it reduced access to key insect relief habitats, then the herd could experience an overall decline in productivity and abundance. Under this scenario, impacts related to the health and abundance of the TCH would likely extend to subsistence users of the herd including Nuiqsut, Utqiaġvik, Anaktuvuk Pass, Atqasuk, and Wainwright. However, under BLM's 2022 ROD for the NPR-A IAP/EIS, BLM selected Alternative A which prohibits new oil and gas leasing and new infrastructure associated with oil and gas development within the core calving area for the TCH, important insect relief habitat north of Teshekpuk Lake, and key migration corridors around Teshekpuk Lake. As such, an overall decline in productivity and abundance is not expected.

The cumulative effects of current and future activities related to restrictions on access to traditional areas, changes in hunting patterns, and reduced resource abundance and availability are likely to continue as long as oil and gas exploration and development continues on the North Slope.

b. Evaluation of the Availability of Other Lands for the Purpose Sought to be Achieved

The evaluation of the cumulative case is identical to that provided above in Section B.2.b.

c. Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Public Lands Needed for Subsistence Purposes

The evaluation of the cumulative case is identical to that provided above in Section B.2.c.

d. Findings*

1. **Reductions in the availability of subsistence resources described above for the cumulative case may significantly restrict subsistence uses of caribou and furbearers for the community of Nuiqsut.**

2. **Limitations on subsistence user access described above for the cumulative case may significantly restrict subsistence uses for the community of Nuiqsut.**

This evaluation concludes that the cumulative case is not expected to result in a large reduction in the abundance (population level) of caribou or any other subsistence resource. Neither is there any expectation that there will be a major increase in the harvest of caribou by non-subsistence users. Therefore, this finding of "may significantly restrict" is only triggered by two other primary factors that must be considered:

1. Reduction in the availability of resources caused by alteration of their distribution
2. Limitation of access by subsistence harvesters

Other development projects near the proposed Project in the BTU, specifically GMT-1 and GMT-2, previously included findings of "may significantly restrict" for additional communities under the Cumulative Case (BLM 2014, 2015). The Section 810 Analysis for GMT-1 concluded that the effects of the Cumulative Case "when taken in conjunction with all alternatives, fall above the level of significantly restricting subsistence use for the communities of Nuiqsut, [Utqiaġvik], Atqasuk, Anaktuvuk Pass, Point Lay, and Wainwright" (BLM 2014, Appendix L). The Section ANILCA Section 810 Analysis for GMT-2 concluded that the Cumulative Case "may result in a significant restriction to subsistence uses for the communities of Utqiaġvik, Atqasuk, and Anaktuvuk Pass due to impacts to terrestrial and marine subsistence resources and access" (BLM 2015, Appendix L). These findings were primarily based on anticipated impacts from additional federal and state offshore lease development in the Chukchi and Beaufort Seas and associated onshore development. Such developments could cause a synergistic increase in disturbances to resources, especially to marine species important to subsistence uses for the communities of Utqiaġvik, Point Lay, Wainwright, and Atqasuk. Additional onshore facilities to support offshore developments (e.g., pipelines, processing facilities) could impact terrestrial species including caribou and furbearers.

As noted above, development of offshore leases in federal waters in the Chukchi Sea is not projected to occur during sealift operations for the Project or within the foreseeable future. Hilcorp continues to pursue its proposed Liberty Project; however, the project schedule has been pushed back indefinitely until Hilcorp revises its oil spill response plan and reevaluates its development and production plan and until such time as BOEM can complete additional NEPA analysis. BOEM's current 5-year leasing plan (ending 2022) does not allow for lease sales in either the Beaufort or Chukchi seas. As such, the potential for impacts from offshore development and associated onshore development are reduced under the current analysis and therefore no finding of significant restriction is made for communities other than Nuiqsut. Rationale for these findings is included below.

*1. The Rationale for the Findings of Reduction in the Availability of Subsistence Resources Under the Cumulative Case**

The GMT-1, GMT-2, and Alpine CD5 development projects are present actions that are most closely connected to the proposed Project in the BTU. Impacts from these actions are localized to the area around Nuiqsut. Development of the Project, in combination with existing and future developments, would continue a pattern of development infrastructure surrounding Nuiqsut to the north, west, and southwest of the community that alter the traditional distribution of caribou within the Nuiqsut core subsistence use area. Additionally, despite the greater distance from the community, many in Nuiqsut perceive that they are also surrounded to the east by infrastructure associated with the Prudhoe Bay and Kuparuk developments. These areas are now considered off limits to subsistence uses despite being considered part of the Nuiqsut's traditional use area.

BLM concludes that altered distributions of TCH caribou and furbearers that are likely to occur during construction and operation of the Project, together with the existing GMT and Alpine developments and reasonably foreseeable developments within onshore NPR-A leases and on state land could cause a major redistribution of resources within the Nuiqsut core subsistence areas that would affect these resources for Nuiqsut hunters.

2. The Rationale for Findings of Limitations on Subsistence User Access Under the Cumulative Case

Nuiqsut's core subsistence use area has shifted west over time due to the development in Prudhoe Bay and recent research has documented decreased use of traditional use areas, including the Niġliq Channel, in part due to development activities and infrastructure (SRB&A 2019b). This shift, together with impacts anticipated to occur from development of the Project (described under Alternatives B, C, D, and E and Module Delivery Options 1, 2, and 3), BLM expects that limitations to subsistence access and the reduced resource availability attributable to development of the Project, would result in an extensive interference with Nuiqsut hunter access.

C. NOTICE AND HEARING*

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 Sections 810(a)(1) and (2). BLM provided notice in the *Federal Register* that it made positive findings pursuant to ANILCA Section 810 that Alternatives B, C, D, and E and the cumulative case presented in the Willow MDP Draft Supplemental EIS met the "may significantly restrict" threshold. As a result, public hearings were held in the potentially affected community of Nuiqsut in order to solicit public comments from the potentially affected community and subsistence users. Notice of these hearings were provided in the *Federal Register* and by way of the local media, including the Arctic Sounder newspaper, and KBRW, the local Utqiaġvik radio station with coverage to all villages on the North Slope. Meeting dates and times were posted on BLM's website at www.blm.gov/alaska. The public hearing was held in-person.

D. SUBSISTENCE DETERMINATIONS UNDER THE ANILCA SECTIONS 810(A)(3)(A), (B), AND (C)*

[DETERMINATIONS WILL BE MADE AVAILABLE IN THE WILLOW MDP RECORD OF DECISION]

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Willow Master Development Plan

Appendix H
Spill Summary, Prevention, and Response Planning

January 2023

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List of Acronyms

ADEC	Alaska Department of Environmental Conservation
BLM	Bureau of Land Management
CPAI	ConocoPhillips Alaska, Inc.
EPA	U.S. Environmental Protection Agency
FLIR	forward-looking infrared
HDD	horizontal directional drilling
IAP	Integrated Activity Plan
LS	lease stipulations
MDP	Master Development Plan
NPR-A	National Petroleum Reserve in Alaska
ODPCP	Oil Discharge Prevention and Contingency Plan
Project	Willow Master Development Plan Project
ROD	Record of Decision
ROP	Required Operating Procedure
SPCC	Spill Prevention, Control, and Countermeasure

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1.0 SPILL SUMMARY

Table H.1.1 summarizes drilling and operations spill types, spill volumes, spill likelihood, spill duration, and estimated geographic extent of spill for the action alternatives.

Table H.1.1. Potential Spill Types, Spill Volumes, Spill Likelihood, Spill Duration, and Estimated Geographic Extent of Spill during the Drilling and Operations Phases for Action Alternatives

Type	Spill Event	Type of Spill	Very Small Oil Spill Classification (< 10 gallons)a	Small Oil Spill Classification (10 to 99.9 gallons)a	Medium Oil Spill Classification (100 to 999.9 gallons)a	Medium-Large Oil Spill Classification (1,000 to 9,999.9 gallons)a	Large Oil Spill Classification (10,000 to 100,000 gallons)a	Very Large Oil Spill Classification (> 100,000 gallons)a	Likely Duration of Spill	Likely Geographic Extent of Spill
Oil wells	Shallow gas blowout	Drilling fluids (no produced fluids)	VL	VL	VL	VL	VL	VL	1 to 2 days	No crude oil would be spilled, but drilling muds and other drilling fluids could impact an area up to 20 to 25 acres adjacent to the well pad.
Oil wells	Reservoir blowout	Produced fluids and drilling fluids	VL	VL	VL	VL	VL	VL	A few days to a week or two	Modeling results suggest that up to 10% of the discharged oil would remain airborne as an aerosol and 90% would be expected to reach the ground surface in a swath up to 2,953 feet wide and up to 22,310 feet downwind of the well based on typical prevailing wind patterns at the time of the spill. (Details are in Section 4.3, *Potential Spills during Drilling and Operations*.)
Oil wells	Wellhead and well-casing leaks	Produced fluids	L	L	L	VL	VL	VL	A few hours for very small spills to a few days for large spills	Spills would be expected to be contained within the immediate vicinity of the well itself and would not be expected to reach areas off the gravel pad.
Pipelines	Facility piping	Produced fluids and various refined products	VH	VH	H	M	L	VL	Very short (less than 1 hour) for very small spills to a few days for large spills	Spills would be expected to be contained to the gravel pad and its immediate margin.
Pipelines	Infield flowlines	Multiphase produced fluids and produced water	L	L	L	VL	VL	VL	Very short (less than 4 hours) or could continue for days to weeks depending on the size and location of the leak along the flowline	Leaks could occur on gravel pads or on tundra and adjacent waterbodies between pads. Large spills that go undetected for a period of time could spread to an area a few acres in size before the spill is stopped. The area reached by materials from large spills would be influenced by the location and time of year of the spill. If a large spill were to occur in the vicinity of a river or during the spring when water flows are high, the geographic extent of such a spill could be larger.

Type	Spill Event	Type of Spill	Very Small Oil Spill Classification (< 10 gallons)a	Small Oil Spill Classification (10 to 99.9 gallons)a	Medium Oil Spill Classification (100 to 999.9 gallons)a	Medium-Large Oil Spill Classification (1,000 to 9,999.9 gallons)a	Large Oil Spill Classification (10,000 to 100,000 gallons)a	Very Large Oil Spill Classification (> 100,000 gallons)a	Likely Duration of Spill	Likely Geographic Extent of Spill
Pipelines	Process piping	Processed (sales-quality) oil	VH	VH	H	M	L	VL	Very short (less than 1 hour) for very small spills to a few days for large spills before the leak is repaired	Process piping associated with well manifolds and processing at the WPF would be expected to be contained to the gravel pad or its immediate margin, with very little reaching adjacent areas. The area reached by large spills would be influenced by the location and time of year the spill occurred.
Pipelines	Export pipeline	Processed (sales-quality) oil and make-up water (seawater)	VL	VL	VL	VL	VL	VL	Very short (less than 1 hour) or could continue for days to weeks before being detected depending on the size and location of the leak along the pipeline corridor	Leaks could occur on the WPF gravel pad or at the tie-in gravel pad at Alpine CD4N or on tundra and adjacent waterbodies between pads. Very small spills would be expected to be limited to a small area in the immediate vicinity of the spill; however, larger spills that go undetected for a period of time could extend to an area several acres in size before being stopped. The spill's location and the time of year also influence the extent of the spill. For instance, if a large or very large spill were to occur in the vicinity of a river, the geographic extent of such a spill could be much higher.
Aboveground storage tanks	Large aboveground storage tanks	Various refined products and processed (sales-quality) oil	L	L	L	L	VL	VL	Would likely be noticed within a day of the start of the leak, but securing the leak could take a few days depending on where the leak occurred on the tank	Spilled material would be captured within secondary containment. In the unlikely event that a spill escaped the secondary containment, it is expected that the spill would be contained to the pad itself and would not reach the tundra, adjacent waterbodies, or other sensitive habitats.

Type	Spill Event	Type of Spill	Very Small Oil Spill Classification (< 10 gallons)a	Small Oil Spill Classification (10 to 99.9 gallons)a	Medium Oil Spill Classification (100 to 999.9 gallons)a	Medium-Large Oil Spill Classification (1,000 to 9,999.9 gallons)a	Large Oil Spill Classification (10,000 to 100,000 gallons)a	Very Large Oil Spill Classification (> 100,000 gallons)a	Likely Duration of Spill	Likely Geographic Extent of Spill
Spills not specifically associated with petroleum development infrastructure	Spills associated with warehouse activities; storage facilities; equipment maintenance and repair activities; vehicle accidents; and vehicle and equipment refueling activities	Typically, a variety of refined products	VH	VH	H	L	VL	VL	On-pad spills would be observed and responded to quickly and be of short duration (less than 0.5 day). Spills from vehicle accidents would happen at the time of the accident and last less than an hour.	Spills would remain on the pad or within secondary containment; damage to areas adjacent to pads would not be anticipated. If a spill occurred due to a large bulk-fuel tanker truck accident and the tanker volume was released, the geographic extent would likely include the road, adjacent roadside habitats, and possibly waterbodies. The geographic extent of a spill of this size would vary depending location of the accident and the season in which it occurred; however, the spill would be localized and likely affect an area up to 0.5 acre in size.

Note: H (high); L (low); M (medium); VH (very high); VL (very low); WPF (Willow processing facility).
[a] Oil spill size classifications denote the likelihood of a spill or release occurring.

2.0 SPILL PREVENTION AND RESPONSE PLANNING

As described in Chapter 4.0, *Spill Risk Assessment*, ConocoPhillips Alaska, Inc. (CPAI) would implement numerous spill prevention and response planning measures as part of the Willow Master Development Plan Project (Project) to help prevent spills and minimize damage to human health and the environment in the unlikely event they occur. Spill prevention measures include the following:

- Specific design features to detect and contain leaks
- Adherence to required operating procedures (ROPs) and lease stipulations (LS)
- Systems to notify operators of potential leaks
- Procedures to maintain the pipelines and other infrastructure

Response planning measures include the following:

- Developing numerous response planning documents for a variety of spill scenarios
- Providing necessary equipment to prevent and respond to spills
- Ensuring personnel are trained and knowledgeable about the procedures to respond efficiently and effectively to oil spills and other accidental releases

Project facilities would be designed to mitigate spills with spill prevention measures and spill response capabilities. CPAI would implement a pipeline maintenance and inspection program and an employee spill prevention training program to further reduce the likelihood of spills occurring. CPAI's design of production facilities would include provisions for secondary containment of hydrocarbon-based and other hazardous materials, as required by state and federal regulations. If a spill occurs on a gravel or ice pad, the fluid would remain on the pad unless the spill is near a pad edge or exceeds the pad's retention capacity. Fuel transfers near pad edges would be limited to the extent practicable to mitigate this risk. In addition to regulations governing spill prevention and response, the Project would be managed under the BLM LS and ROPs described for solid waste, fuel, and chemical storage (BLM 2022) (Section 2.5, *Applicable Lease Stipulations and Best Management Practices*).

2.1 Spill Prevention

Spill prevention and response measures that would be used during construction, drilling, and operations would be outlined in the Project's Oil Discharge, Pollution, and Contingency Plan (ODPCP) and the Spill Prevention Control and Countermeasures (SPCC) Plan. The intent of the ODPCP and SPCC Plan is to demonstrate CPAI's capability to prevent oil spills from entering the water or land and to ensure rapid response in the event a spill occurs. The ODPCP would comply with applicable State of Alaska requirements (AS 46.04.030, 18 AAC 75) for spill prevention and federal U.S. Environmental Protection Agency (EPA) regulations in 40 CFR 112, D (Facility Response Plans). The SPCC Plan would comply with the federal EPA regulations contained in 40 CFR 112.

CPAI would design and construct pipelines to comply with state, federal, and local regulations. Pipelines would be constructed of high-strength steel and would have wall thicknesses in compliance with or exceeding design code regulatory requirements. Pipeline welds would be validated using nondestructive examination (i.e., radiography or ultrasonic) during pipeline construction to ensure their integrity and pipelines would be hydrostatically tested prior to operation. The production fluids, water injection, seawater, and export pipelines would be fully capable of accommodating pigs for cleaning and corrosion inspection.

CPAI would use two methods of leak detection for the seawater and diesel pipeline horizontal directional drilling (HDD) crossings under the Colville River: leak detection by mass balance (primary) and optical leak detection (secondary and within the pipeline carrier casing). To further prevent a pipeline leak under the Colville River, the diesel and seawater pipelines would be installed inside high-strength casing pipe. Simultaneous failure of both the pipeline and the associated casing is highly unlikely. If diesel or seawater leaked from the pipelines, it would be contained within the space between the outer walls of the pipelines and the inner wall of the casing rather than reaching the subsurface river environment. The design is analogous to secondary containment provided as a spill prevention technique for storage tanks. The casing would perform a second function: accommodating the external loads that would normally be carried by the pipeline. The casing and pipelines would not apply significant, direct loads onto each other, with some load transferred by the plastic casing isolators attached to the carrier pipeline. A deformation of the casing pipe would not necessarily cause deformation of the carrier pipelines, thus providing protection against external loads. To prevent external corrosion, the casing and pipelines would be protected by an abrasion-resistant coating, in accordance with industry standards.

There would be an increased potential for pipeline spills where pipelines cross under roads due to corrosion of the buried portion of the pipelines. The likelihood of corrosion occurring would be reduced through design and monitoring. CPAI would maintain corrosion control and inspection programs that include ultrasonic inspection, radiographic inspection, coupon monitoring, metal loss deflection pigs and geometry pigs (applicable to pig-capable pipelines), and infrared technology. The inspection programs are API Standard 570–based programs that focus inspection efforts on areas with the greatest potential for spills.

2.2 Spill Response

CPAI would implement the Project's ODPCP and SPCC Plan to minimize accidental oil spills and associated impacts. Through the ODCP, CPAI would demonstrate that readily accessible inventories of fit-for-purpose oil spill response equipment and personnel would be available for use at Project facilities. In addition, a state-registered primary response action contractor would serve as CPAI's primary response action contractor and would provide trained personnel to manage all stages of a spill response, including containment, recovery, and cleanup.

The threat to rivers and streams from a possible pipeline spill would be minimized by quickly intercepting, containing, and recovering spilled oil near the waterway-pipeline crossing points. The road would be used for access and staging for spill response. Valves would be installed on each side of pipeline crossings at Fish Creek and Judy (Iqalliqpik) Creek, which would allow isolation of produced fluids pipelines on either side of the bridges to minimize potential spill impacts in the event of a leak or break.

Spill response equipment would be pre-staged at strategic locations across the Project area as outlined in the ODPCP for an initial response. This strategy would facilitate the rapid deployment of equipment by personnel. The effective response time would be enhanced with pre-staged equipment, which would expedite equipment deployment to contain and recover spilled oil, reducing the overall affected area. During summer, pre-staged containment booms would be placed at strategic locations near selected river channels to facilitate a rapid response. Pre-deployed booms may also be placed within selected stream channels to mitigate a spill, should one occur. During summer, spill containment equipment would likely be staged or deployed using helicopters. If a spill occurs, spill response activity could include watercraft (e.g., airboats, jetboats) use to access affected areas.

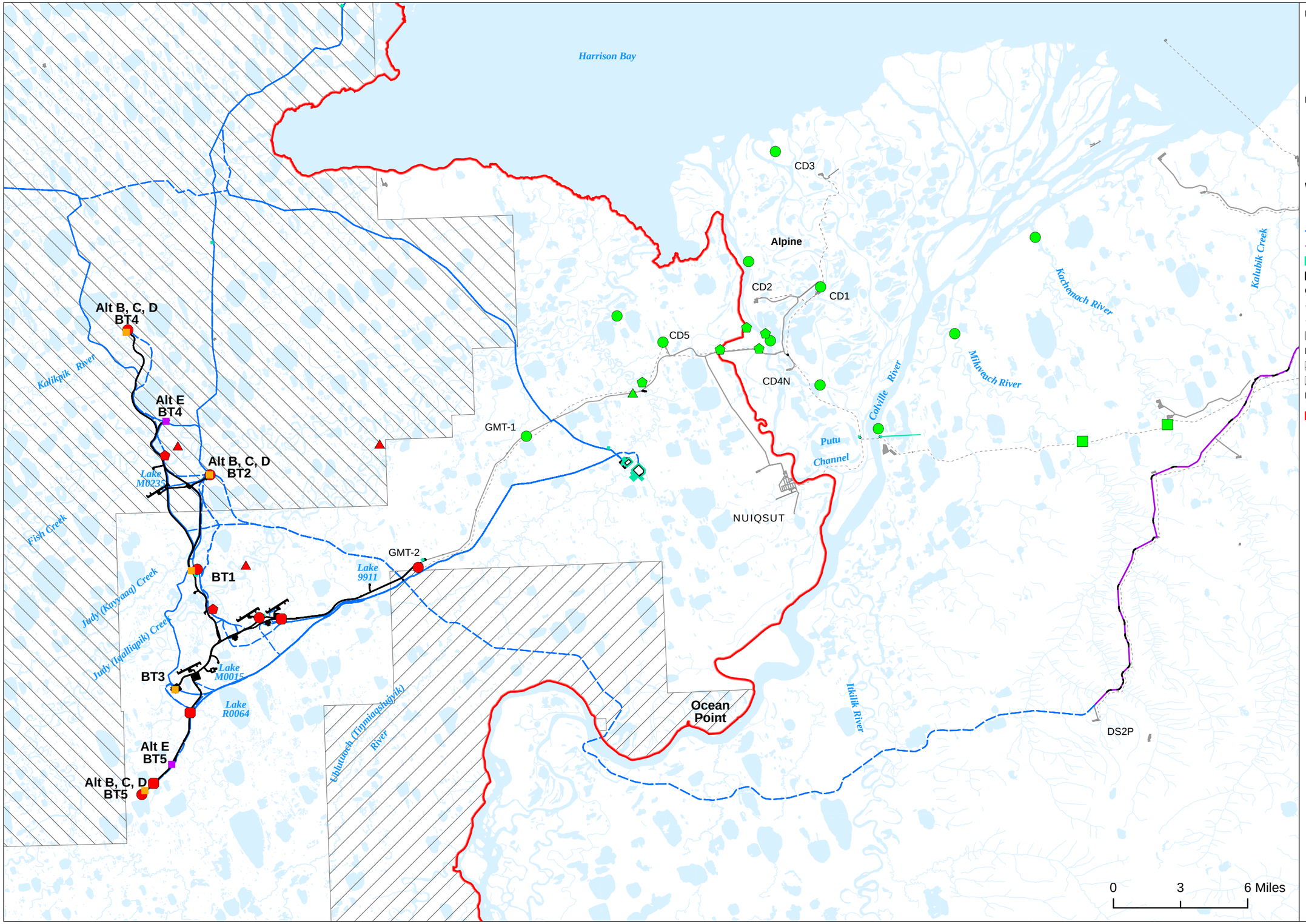
2.2.1 Pre-Staged and Pre-Deployed Equipment

Dedicated oil spill response equipment (e.g., boom, anchors, skimmers, hoses, pumps, portable storage) would be pre-staged and stored in connexes at dedicated storage locations near the pipelines and HDD crossing of the Colville River. Pre-staged equipment would be placed in close proximity to facilities and infrastructure, and in areas that are easily accessible, allowing for quick deployment. This includes equipment pre-staged along the east bank of the Colville River, just north of the existing Alpine HDD pipeline crossing (CPAI 2018).

Spill response team personnel may also pre-deploy diversionary or exclusion booms in the rivers each summer, including in the Colville River. Specific boom-laying configurations, and the exact footage lengths of booms pre-staged at each site may vary in response to seasonal changes in the river channel and weather-driven fluctuations in the river currents. At each pre-staging site, boom sections and anchors would be staged on the shoreline in a manner that optimizes the boom's intended use for containment and recovery. Response equipment would be maintained in such a manner that it could be deployed rapidly and in a condition for immediate use. CPAI would routinely inspect and test on-site response equipment. CPAI's spill response contractor would also perform routine inspection and maintenance of all response equipment.

CPAI currently pre-stages and pre-deploys equipment throughout the Alpine and Greater Mooses Tooth developments (Figure H.2.1), including spill response equipment and pre-deployed boom. Figure H.2.1 also reflects general planned locations for pre-staged and pre-deployed spill response equipment (CPAI 2020).

Figure H.2.1. Spill Response Equipment



Existing Spill Response Equipment
- Existing- Pre-staged equipment
- Existing - Pre-staged equipment/ Pre-deployed boom
- Existing - Pre-deployed boom
- Existing - Pre-deployed boom

Palnned Spill Response Equipment
- Planned - Pre-staged equipment
- Planned - Pre-deployed boom
- Planned - Pre-staged boom
- Planned - Pre-staged/Culvert blocking equipment

Willow Proposed Development Features
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Option 3 Existing Road
- Ice Pad
- Gravel Footprint

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

NPR-A Special Areas
- Colville River Special Area
- Teshekpuk Lake Special Area

Land Designation
- National Petroleum Reserve in Alaska

Figure H.2.1

2.3 Spill Response Training and Inspections

CPAI provides regular training for its employees and contractors on the importance of preventing oil or other hazardous material spills, including new employee orientation, annual environmental training seminars, and appropriate certification classes for specific issues covering spill prevention. CPAI's employees and contractors participate in frequent safety meetings that address spill prevention issues, as appropriate. The CPAI Incident Management Team participates in regularly scheduled training programs and conducts spill response drills in coordination with federal, state, and local agencies. Employees are encouraged to participate in the North Slope Spill Response Team where members receive regularly scheduled spill response training to ensure the continuous availability of skilled spill responders on the North Slope.

CPAI is required to conduct visual examinations of pipelines and facility piping with a frequency defined under 49 CFR 195.412 and 18 AAC 75.055 during operations at a minimum interval not exceeding 3 weeks. CPAI would provide aerial overflights as necessary to allow inspection both visually and with the aid of infrared technology, when required. Infrared technology allows for spill identification based on the temperature "signature" resulting when warm fluids leak. Infrared technology can detect warm spots in low-light conditions or when other circumstances such as light fog or drifted snow limit visibility. Infrared technology can also identify trouble spots along pipelines, such as damaged insulation, before a problem develops. CPAI would also conduct regular visual inspections of facilities and pipelines from gravel roads, where available, and from ice roads and aircraft for sections of pipelines not paralleled by gravel roads (Alternatives C and D).

2.3.1 Existing Area-Wide Oil Spill Response Training and Reconnaissance

In March 2020, BLM issued a Draft Update on North Slope Permitting and Activities (BLM 2020) for the NPR-A, including the Willow area. BLM intends to renew a right-of-way authorizing Alaska Clean Seas to conduct oil spill response training, deploy the equipment cache, and perform reconnaissance to determine the feasibility of pre-deploying a containment boom.

Summer reconnaissance activities will occur to determine the potential location of pre-staged equipment and pre-deployed containment boom sites and to obtain area knowledge to increase oil spill response preparedness. Training will consist of transporting Spill Response Team members to the sites and deploying boom and small skimming systems to determine the best methods of responding to an oil spill. This training would continue to identify ideal sites for collection and recovery of oil spilled from proposed pipelines and operating areas. These activities will occur regardless of the Project; however, it will affect preparedness and response for the Project should a spill occur and thus is considered when disclosing the Project's response training.

2.4 Fuel and Chemical Storage

Fuel and other chemicals would be stored primarily at the Willow central processing facility, with additional storage at the Willow Operations Center and drill sites. Diesel fuel would be stored in temporary tanks on-site during construction under all alternatives. During drilling and operations, the Willow Operations Center would include a diesel fuel supply storage tank(s), an associated fueling station, and a tank farm to store methanol, crude flowback, corrosion inhibitor, scale inhibitor, emulsion breaker, and various other chemicals as required.

Drill sites would have temporary tanks to support drilling activity, including brine tanks, a cuttings and mud tank, and a drill rig diesel fuel tank built into the drill rig structure. Production and operations storage tanks at drill sites would include chemical storage tanks that may contain any of the following depending on Project needs: corrosion inhibitor, methanol, scale inhibitor, emulsion breaker, antifoam, or ultra-low sulfur diesel. Portable oil storage tanks to support well and pad operational activities and maintenance (i.e., well work and well testing) may be present on an as-needed basis.

Fuel and oil storage would comply with local, state, and federal oil pollution prevention requirements, according to an ODPCP and a SPCC Plan. Secondary containment for fuel and oil storage tanks would be sized as appropriate to container type and according to the requirements in 18 AAC 75 and 40 CFR 112. Fuel and chemical storage associated with the Project would be managed under BLM LS and ROPs (Section 2.5 of this appendix, *Applicable Lease Stipulations and Best Management Practices*).

2.5 Applicable Lease Stipulations and Best Management Practices*

Table H.2.1 summarizes existing applicable NPR-A Integrated Activity Plan (IAP) LS and ROPs that would apply to Project actions on BLM-managed lands and are intended to mitigate impacts to the environment from

spills and accidental releases. CPAI would comply with applicable existing NPR-A IAP LS and ROPs related to fuels and hazardous materials handling and storage, spill prevention, and spill response, as outlined in BLM (2022). The LS and ROPs would reduce impacts to the environment from accidental spills or releases associated with the construction, drilling, and operations of oil and gas facilities. In 2021, BLM was directed to reevaluate the 2020 NPR-A IAP. The NPR-A IAP reevaluation resulted in the issuance of a new NPR-A IAP Record of Decision (ROD) that selected an alternative similar to the 2013 NPR-A IAP ROD. Full text of the requirements is provided in BLM (2022).

Table H.2.1. Summary of Applicable Lease Stipulations and Required Operating Procedures Intended to Mitigate Impacts from Potential Spills*

LS or ROP	Description or Objective	Requirement/Standard
ROP A-3	Minimize pollution through effective hazardous-materials contingency planning.	A hazardous materials emergency contingency plan shall be prepared before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. The plan shall include a list of resources available for response. In addition, contingency plans shall include requirements to: a. Provide refresher spill-response training to NSB and local community spill-response teams on a yearly basis b. Plan and conduct a major spill-response drill annually c. Develop spill prevention and response contingency plans and participate in the North Slope Subarea Contingency Plan for Oil and Hazardous Substances Discharges/Releases for the NPR-A operating area.
ROP A-4	Minimize the impact of contaminants on fish, wildlife, and the environment, including wetlands, marshes, and marine waters, as a result of fuel, crude oil, and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety.	Before initiating any oil and gas or related activity or operation, develop a comprehensive spill prevention, control, and countermeasure plan per 40 CFR 112. The plan shall consider the following requirements: a. Sufficient oil-spill-cleanup materials shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by crews on all overland moves. b. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Fuel, petroleum products, and other liquid chemicals that in total exceed 1,320 gallons shall be stored within an impermeable lined and diked area or within approved alternate storage containers. Within 500 feet of waterbodies, fuel containers are to be stored within appropriate containment. c. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. d. Permanent fueling stations shall be lined or have impermeable protection. e. All fuel containers shall be marked with the responsible party's name, product type, and year filled or purchased. f. Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the authorized officer as soon as possible, but no later than 24 hours after occurrence. g. All oil pans (i.e., “duck ponds”) shall be marked with the responsible party’s name.
ROP A-5	Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.	Refueling of equipment within 500 feet of the active floodplain of any waterbody is prohibited. Fuel storage stations shall be located at least 500 feet from any waterbody with the exception that small caches (up to 210 gallons) for motorboats, float planes, ski planes, and small equipment.
ROP A-7	Minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment.	Discharge of produced water in upland areas and marine waters is prohibited.
ROP E-4	Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents.	All pipelines shall be designed, constructed, and operated under an AO-approved Quality Assurance/Quality Control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.

Source: BLM 2022
Note: AO (authorized officer); LS (lease stipulation); NPR-A (National Petroleum Reserve in Alaska); NSB (North Slope Borough); ROP (required operating procedure).

3.0 REFERENCES

BLM. 2020. *Update on BLM North Slope Permitting and Activities, March 2020*. Fairbanks, AK.

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CPAI. 2018. *Oil Discharge Prevention and Contingency Plan: Alpine Field and Satellites and Alpine Pipeline System*. ADEC Plan No.17-CP-4140. Anchorage, AK.

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