BLM

FINAL

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT for the Alpine Satellite Development Plan for the Proposed Greater Mooses Tooth One Development Project

Volume 1: Chapters 1-6

October 2014

Alaska

Cooperating Agencies:
U.S. Bureau of Ocean Energy Management • U.S. Environmental Protection Agency • U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers, Alaska District • State of Alaska •North Slope Borough • Native Village of Nuiqsut

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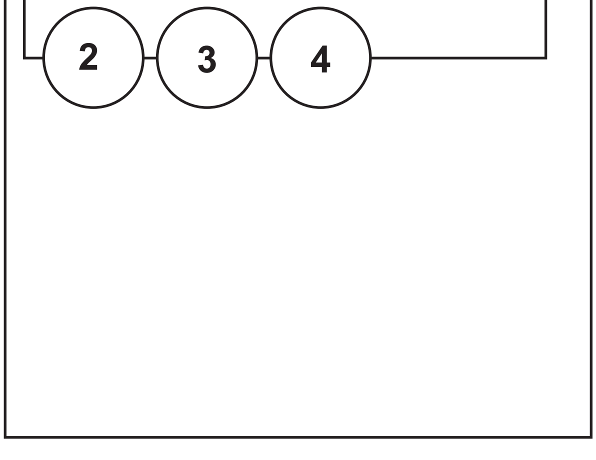

Cover Photos:

1. Aerial of Blackfish Creek downstream from GMT1 Drilling pad, National Petroleum Reserve in Alaska.

2. Caribou, North Slope, Alaska

3. Ice road construction, National Petroleum Reserve in Alaska.

4. Aerial of production pad, North Slope, Alaska. © ConocoPhillips.

Alpine Satellite Development Plan GMT1 Development Project

Final

Supplemental Environmental Impact Statement

Volume 1: Chapters 1-6

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. DOI Fish and Wildlife Service
U.S. DOI Bureau of Ocean Energy Management
State of Alaska
Native Village of Nuiqsut
North Slope Borough

October 2014

Alpine Satellite Development Plan
GMT1 Development Project
Final Supplemental Environmental Impact Statement

Lead Agency U.S. Department of the Interior (USDOI), Bureau of Land Management (BLM)

Proposed Action: To provide ConocoPhillips Alaska, Inc. (CPAI) with legal access across public land managed by the BLM, and authorizations to construct, operate, and maintain a drill site, pipelines, an access road, and ancillary facilities to develop and produce petroleum resources on BLM-managed lands within the Greater Mooses Tooth Unit (GMTU) of the National Petroleum Reserve in Alaska (NPR-A).

Abstract:

CPAI is proposing to produce hydrocarbon resources from a surface location on federal oil and gas lease AA-081798 in the NPR-A. The proposed GMT1 Project includes a drill site in the GMTU, a pipeline and road corridor to CPAI facilities at Colville Delta 5 (CD5), an ancillary water pipeline between CD1 and CD4, and a new gravel source. CD1, CD2, CD3, and CD4 are existing facilities. CD5 is currently authorized and expected to be in operation by late 2015. Development of the GMT1 Project is dependent on construction of CD5.

This Final Supplemental Environmental Impact Statement (SEIS) is being prepared to evaluate relevant new circumstances and information which have arisen since the Alpine Satellite Development Plan (ASDP) Final EIS was issued in September 2004, to provide opportunities for public participation, as well as to address changes to CPAI's proposed development plan for GMT1 (referred to as CD6 in the ASDP EIS).

GMT1 is part of the ASDP, for which a Final Environmental Impact Statement (EIS) was prepared by the BLM, with a Record of Decision (ROD) approving issuance of the BLM authorizations needed for development of the Alpine Field. The currently proposed GMT1 Development Project is very similar to the CD6 development approved for permitting in the 2004 ASDP ROD, with changes which reduce the overall impact. These changes include moving the drill site location out of the Fish Creek setback, reducing the road and pipeline length, thereby reducing amount of fill required and impacts to wetlands and increasing the length of the Tiŋmiaqsiġvik (Ublutuoch) River bridge.

The BLM has lead responsibility for preparation of this Final SEIS. The U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, USDOI Fish and Wildlife Service, USDOI Bureau of Ocean Energy Management, State of Alaska, Native Village of Nuiqsut, and the North Slope Borough are participating in the analysis as Cooperating Agencies.

The Final SEIS documents the potential effects to: Physiography, Geology, Soils and Permafrost, Sand and Gravel, Paleontological

Resources, Water Resources, Surface Water Quality, Climate and Meteorology, Air Quality, Noise, Terrestrial Vegetation and Wetlands, Fish, Birds, Terrestrial Mammals, Marine Mammals, Threatened and Endangered Species, Sociocultural Environment, State and Local Economy, Subsistence Harvest and Uses, Environmental Justice, Public Health, Cultural Resources, Land Use, Recreation, Visual Resources, and Transportation. The potential effects of spilled crude oil produced fluids, seawater, and other chemicals have also been evaluated.

This Final SEIS provides documentation of the analysis of five proposed action alternatives, and the No Action alternative. After further analysis, additional cooperating agency coordination, tribal consultation, and input from the public during the public comment period on the Draft SEIS, BLM has identified Alternative B as its Preferred Alternative for the GMT1 Final SEIS.

Further Information:	Contact Bridget Psarianos of the Bureau of Land Management, at (907-271-4208) or visit the SEIS website at www.blm.gov/ak.

Executive Summary

What is the Bureau of Land Management (BLM) proposing to do in this Supplemental Environmental Impact Statement (SEIS)?

BLM-Alaska prepared this SEIS to analyze an application by ConocoPhillips Alaska, Inc. (CPAI) to construct, operate, and maintain a drill site, access road, pipelines, and ancillary facilities to support development of petroleum resources at the proposed Greater Mooses Tooth 1 (GMT1) site, within the National Petroleum Reserve in Alaska (NPR-A). The key issues in the SEIS will center on oil and gas production decisions, the protection of surface resources, and appropriate mitigation measures.

The purpose of the SEIS is to evaluate any relevant new circumstances and information that have arisen since the Alpine Satellite Development Plan (ASDP) Final EIS, dated September 2004. Additionally, the BLM completed the NPR-A Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) Record of Decision (ROD) in 2013 to determine the appropriate management of the BLM-administered lands (public lands) in the nearly 23-million-acre NPR-A. This SEIS tiers to both of these previous National Environmental Policy Act (NEPA) analyses and incorporates them by reference.

What are the major issues and focus of controversy?

The key issues in the SEIS are analysis of impacts to surface resources and analysis of mitigation measures. Much of the analysis focuses on issues raised in scoping and public comments on the Draft SEIS, such as subsistence and wildlife protections; impacts to water quality and air quality; air traffic effects, such as noise disturbance to wildlife; economic benefits to Alaska Natives; and cumulative effects from future westward development within the Greater Mooses Tooth and Bear Tooth units. The SEIS examines a range of alternatives for the GMT1 development, and considers relevant and reasonable mitigation measures, consistent with BLM policy.

Of particular interest is the proximity of the GMT1 site to the village of Nuiqsut, and potential impacts to subsistence. Potential impacts to subsistence may result from hunter avoidance of the area, changes in access to subsistence use areas, resource (particularly caribou) availability, community participation in subsistence activities, aircraft traffic, spills, and rehabilitation of infrastructure upon abandonment.

What measures are being taken to reduce impacts?

All action alternatives incorporate CPAI's existing lease stipulations for the GMT Unit, as well as Best Management Practices (BMPs) contained in the 2013 NPR-A IAP/EIS ROD. CPAI has requested that BLM grant deviations to five stipulations/BMPs (Appendix F). BLM will determine whether or not to grant these deviations in its ROD.

As the GMT1 Applicant and primary oil development company in the Nuiqsut area, CPAI has recently attempted to mitigate impacts from flights in its exiting Alpine development field, and financially contributes to subsistence support programs in the community. CPAI has also incorporated project designs in a manner that reduces impacts to subsistence and other resources, detailed in Section 4.7.

BLM is considering the adoption of new potential mitigation measures as part of its GMT1 SEIS authorization, which are analyzed for applicable resources throughout Chapter 4 of the document and summarized in Appendix C. BLM will determine which new mitigation measures to adopt in its ROD.

What are the major changes between the Draft and Final SEIS?

The Final SEIS clarifies and expands upon the analysis in the Draft SEIS in response to additional studies and information and updated traffic data that have become available since the Draft SEIS was printed. The Final SEIS includes a sub-alternative to Alternative D, which analyzes a seasonal drilling restriction at GMT1. The Final SEIS also identifies a preferred alternative, discussed below.

The Final SEIS incorporates changes based on comments received from the public during the comment period. BLM received comments from stakeholders including tribes, Native corporations and other Native organizations, government agencies, elected officials, industry and business organizations, conservation organizations, and individual citizens. Also, BLM Field and State office staff gathered comments at eight public meetings in North Slope villages and other locations.

What alternatives are being considered by BLM?

The Final SEIS contains five action alternatives, and a No Action Alternative (Alternative E). Alternative B is BLM's preferred alternative, which was not identified in the Draft SEIS. The Draft SEIS contained four action alternatives, including: Alternative A, CPAI's proposed action; Alternative B, which avoids placing infrastructure in the setback surrounding Fish Creek; Alternative C, which uses Nuiqsut as a hub for development activity; and Alternative D (now D1), which does not provide road access to the GMT1 site. The BLM analyzed a roadless sub-alternative in the Final SEIS, Alternative D2, which examines seasonal (winter-only) drilling restriction at the GMT1 site.

The BLM preferred alternative — Alternative B — focuses on keeping the proposed road and pipeline outside of the BLM-established Fish Creek buffer, and has two fewer stream crossings than Alternative A.

In terms of overall subsistence impacts, BLM's Final SEIS analysis concluded that development of GMT1 could have major impacts to subsistence; however, Alternatives A and B would likely have the fewest impacts to subsistence. These alternatives require less air traffic close to the community than Alternatives C, D1, and D2, and development-related ground traffic would be limited to the road between CD5 and GMT1. Air traffic is the most frequently reported caribou hunting impact associated with development.

What is next?

The BLM will make no decision until at least 30 days have elapsed after this Final SEIS has been issued. The agency would then issue one or more Record of Decision, adopting new mitigation measures, and issue or deny a right-of-way grant and related authorizations.

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See Volume 3 for public comments pertaining to the Draft SEIS and BLM's responses.

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Acronyms

μg/m³	micrograms/cubic meter
⁰F	degrees Fahrenheit
AAAQS	Alaska Ambient Air Quality Standards
AAC	Alaska Administrative Code
ABR	ABR Inc.
AC	Alaska Commercial Company
ACP	Arctic Coastal Plain
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOR	Alaska Department of Revenue
ADP	Alpine Development Project
AEIDC	Arctic Environmental Information and Data Center
AES	ASRC Energy Services, Inc
AHRS	Alaska Heritage Resource Survey
Anadarko	Anadarko E&P Onshore LLC
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
AO	Authorized Officer
AOGCC	Alaska Oil and Gas Conservation Commission
APDES	Alaska Pollutant Discharge Elimination System
APF	Alpine Central Processing Facility
AQRV	Air Quality Related Values
AS	Alaska Statute
ASA	Aquatic Site Assessment
ASDP	Alpine Satellite Development Project
ASH	Alaska Safety Handbook
ASME	American Society of Mechanical Engineers
ASOS	Automated Surface Observing System
ASRC	Arctic Slope Regional Corporation
ASTt	Arctic Small Tool tradition
ATV	All Terrain Vehicle
BBO	Billion barrels of oil
BLM	Bureau of Land Management
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
BOPD	Barrels of oil per day

BPMSL	BP mean sea level
C-Plan or ODPCP	Oil Discharge Prevention and Contingency Plan
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAH	Central Arctic Herd
CD	Colville Delta
CDSA	Colville Delta Study Area
CEQ	Council on Environmental Quality
CERCLIS	Comprehensive Environmental Response Compensation and Liability Information System
CFR	Code of Federal Regulations
CO	Carbon Monoxide
Corps	U.S. Army Corps of Engineers
CPAI	ConocoPhillips Alaska, Inc.
CPF	Central Production Facility
CPU	Coastal Plain Unit
CRAR	Colville River Access Road
CRU	Colville River Unit
CWA	Clean Water Act
cy	cubic yards
DAT	Deposition Analysis Threshold
dBA	A weighted decibel(s)
DEW	Distant Early Warning
DO	Dissolved Oxygen
DOI	Department of Interior
DPS	Distinct Population Segment
ddv	delta deciview
dv	deciview
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERD	extended-reach drilling
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLIR	forward-looking infrared
FLM	Federal Land Manager

FLPMA	Federal Land Policy and Management Act
FOD	Frequency of Detection
FOSC	Federal On-Scene Coordinator
FRP	Facility Response Plan
ft	feet
FWTAP	Foothills West Transportation Access Project
GC	Gathering Center
GHG	Green House Gases (e.g., carbon dioxide [CO_2], methane, nitrous oxide)
GIS	geographic information system
GMT	Greater Mooses Tooth
GMT1	Greater Mooses Tooth 1
GMTU	Greater Mooses Tooth Unit
gpd	gallons per day
GPS	Global positioning system
HMRT	Hazardous Materials Response Team
HSM	Horizontal Support Member
IAP	Integrated Activity Plan
ICAS	Iñupiat Community of the Arctic Slope
IDLH	Immediately Dangerous to Life or Health
IHLC	Iñupiat History, Language, and Culture
IMPROVE	Integrated Monitoring of Protected Visual Environments
in	inch
ISO	International Organization for Standardization
ITU	Integrated Terrain Unit
km	kilometer
KSOPI	Kuukpik Subsistence Oversight Panel, Inc.
LCF	loss carry forward
LEDPA	Least Environmentally Damaging Practicable Alternative
LOA	Letter Of Authorization
MAPA	More Alaska Production Act
MBTA	Migratory Bird Treaty Act
MEI	Maximally Exposed Individual
MG	million gallons
mg/m^3	micrograms/cubic meter
MI	Miscible Injectant
MLE	Most Likely Exposure
MMbbl	million barrels
MMPA	Marine Mammal Protection Act
MMS	U.S. Department of the Interior, Minerals Management Service
MOU	Memorandum of Understanding

MPH	miles per hour
MVA	mega volt ampere
MW	megawatt
MWe	megawatt electrical
NAAQS	National Ambient Air Quality Standards
NAC	Northern Air Cargo
NASA	NPR-A Study Area
NDE	Non-destructive Examination
NDVI	Normalized Difference Vegetation Index
NE	Northeast
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMIM	National Mobile Inventory Model
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
NPR-A	National Petroleum Reserve in Alaska
NPRPA	Naval Petroleum Reserves Production Act
NPS	National Park Service
NRC	National Research Council
NSB	North Slope Borough
NVN	Native Village of Nuiqsut
NWI	National Wetlands Inventory
OCS	Outer Continental Shelf
ODPCP or C-Plan	Oil Discharge Prevention and Contingency Plan
OHA	Office of History and Archaeology (Alaska DNR)
OHW	Ordinary High Water
ORV	Off-road Vehicle
OSHA	Occupational Safety and Health Administration
Pb	Lead
PCB	Polychlorinated Biphenyl
PCH	Porcupine Caribou Herd
PM_{10}	Particulate Matter <10 microns
$PM_{2.5}$	Particulate Matter <2.5 microns
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
REIM	Remote Electrical and Instrumentation Module

REL	reference exposure level
RfC	Reference Concentrations for Chronic Inhalation
RFD	Reasonable Future Development
RFF	Reasonably Foreseeable Future
RMMS	Regional Mitigation and Monitoring Strategy
ROD	Record of Decision
ROP	Required Operating Procedure
ROS	Recreation Opportunity Spectrum
ROW	Right of Way
RPS	Response Planning Standard (C-Plan)
SAP	Subsistence Advisory Panel
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SHPO	State Historic Preservation Office
SLR	SLR International Corporation
SNAP	Scenarios Network for Alaska Planning
SO_2	Sulfur Dioxide
SPCC	Spill Prevention Control and Countermeasures
SPM	Semi-primitive, motorized
sq km	square kilometer
SRB&A	Stephen R. Braund & Associates
SWPPP	Storm Water Pollution Prevention Plan
TAPS	Trans Alaska Pipeline System
TCF	Trillion cubic feet of gas
TH	Teshekpuk Herd
TLUI	Traditional Land Use Inventory
TRS	Total Reduced Sulfides
TWUP	Temporary Water Use Permit
UAV	Unmanned Aerial Vehicles
UIC	Underground Injection Control
ULSD	Ultra Low Sulfur Diesel
UM	Umiat Meridian
USC	United Sates Code
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency (for reference as author)
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
VRM	Visual Resource Management

VSM	Vertical Support Members
WAH	Western Arctic Herd
WQS	Water Quality Standards
WRI	World Resources Institute
WRF	Weather Research and Forecasting Model

CHAPTER 1: INTRODUCTION

In July 2013, ConocoPhillips Alaska, Inc. (CPAI), as Operator and working interest owner in the Greater Mooses Tooth Unit (GMTU), filed applications for permits to develop hydrocarbon resources of the GMTU from a surface location on a federal oil and gas lease in the National Petroleum Reserve in Alaska (NPR-A).

The proposed Greater Mooses Tooth 1 Development Project (GMT1 Project) includes a drill site on federal land in the GMTU, access road and pipelines on federal and private land in the NPR-A, and a pipeline and pipe rack on private and state lands outside the NPR-A. GMT1 was formerly known as Colville Delta 6 (CD6) development production pad, one of the five drill sites comprising the Alpine Satellite Development Plan (ASDP), for which a Final Environmental Impact Statement (EIS) was prepared by the U.S. Department of the Interior (USDOI) Bureau of Land Management (BLM). The 2004 ASDP Record of Decision (ROD) approved issuance of the BLM authorizations needed for development of the satellites.

Recently, the BLM completed an EIS to fulfill the requirements of the National Environmental Policy Act of 1969 (NEPA) for approving a new Integrated Activity Plan (IAP) for the NPR-A, including oil and gas lease sales and associated development. Several alternative development scenarios were evaluated, and the related environmental consequences were analyzed. Reasonably foreseeable development that could occur from discovered petroleum resources in the GMTU was consistently considered in all development alternatives, including the alternative adopted by the 2012 NPR-A IAP and 2013 IAP ROD.

The currently proposed GMT1 Project is similar to that approved for permitting in the 2004 ASDP ROD, and evaluated in the 2012 NPR-A IAP/EIS, with changes which reduce the overall impact. These changes include: moving the drill site location out of the Fish Creek setback; reducing the road and pipeline length, and thereby reducing the amount of fill required and associated impacts to wetlands; and increasing the length of the Tiŋmiaqsiġvik (Ublutuoch) River bridge. There is no application for development of GMT2; accordingly, information on GMT2 is conceptual and is considered only in the cumulative analysis.

This Supplemental EIS (SEIS) will assist the BLM and other federal, state and North Slope Borough (NSB) agencies in evaluating CPAI's permit applications for this project by considering relevant new information or circumstances to determine whether the impacts of the proposed GMT1 Project are still within the range of impacts analyzed in the BLM 2004 ASDP Final EIS and the BLM 2012 NPR-A IAP/EIS. The SEIS will re-analyze the proposed project in accordance with the requirements of NEPA (42 United States Code [USC] 4321, et seq.) as implemented by Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508).

1.1 Project Location and Land Status

The proposed GMT1 Project is located on the North Slope of Alaska within the NPR-A, immediately to the west of the Colville River delta. The proposed GMT1 pad is wholly on federal lands within the northeastern portion of the NPR-A. The proposed road and pipeline corridors cross both federal lands and private lands held by the Kuukpik Corporation (Nuiqsut Village Corporation) within the NPR-A (Map 1.1-1). The northern portion of the pipeline corridor between CD1 and CD4 North (an area of intersecting pipeline segments north of CD4 known as CD4N) is on land owned by the State of Alaska, and managed by the Alaska Department of

Natural Resources (ADNR). Kuukpik owns land along the southern portion of the pipeline corridor between CD1 and CD4N and from CD4N to CD5. Gravel will be obtained from the Native-owned ASRC Mine site. None of the proposed project facilities are located on or near Native allotments. However, within the planning area outside of the NPR-A there is one Native allotment (see Section 4.4.5).

The proposed GMT1 pad is located in the GMTU on federal lease AA-081798, issued by the BLM to CPAI and Anadarko E&P onshore LLC (Anadarko), the other working interest owner in the GMTU. A portion of the GMT1 pad for Alternatives A and C also cross into the southern portion of federal lease AA-081818, which has the same working interest owners. Location of lease AA-081798 and AA-081818, and the GMTU boundaries are shown on Map 1.1-1.

The 2008 GMTU Agreement (BLM 2008b, No. AA-087852) was entered into by CPAI, Anadarko, and Arctic Slope Regional Corporation (ASRC), and approved by the BLM; ASRC has applied for subsurface estate within the GMTU for lands selected by Kuukpik Corporation under the Alaska Native Claims Settlement Act (ANCSA), 43 USC 1601 et seq., and Section 1431(o) of the Alaska National Interest Lands Conservation Act (ANILCA). The GMTU was expanded in September 2009 to include leases east of the original unit area.

The GMTU Agreement identifies notional Participating Area boundaries (Map 1.1-1). These boundaries delineate the leases or areas of leases (tracts) which are expected to contribute a portion of the production from each reservoir to the agreement. In the GMTU, where only exploration drilling has occurred at this point, these boundaries represent a theoretical interpretation of the reservoir locations. As geophysical data are evaluated, exploration and production wells are drilled, and the physical extents of each reservoir are discovered, enough information is collected to reasonably determine which leases should be included in a Participating Area. These boundaries are used by BLM to allocate production for royalty purposes to each committed tract within the Participating Area. Royalties are calculated using the allocation method agreed to in the unit agreement. See 43 CFR Section 3131.81.

ASRC has assumed administration of some leases on Kuukpik land in the NPR-A pursuant to 43 CFR 3135.1-8(b). Pursuant to 43 CFR 3135.1-8(c), the lease terms and conditions continue to apply to the lessee; however, only ASRC (as the new lessor) may enforce the lease stipulations on the conveyed lands; BLM no longer has jurisdiction to do so. BLM remains the land manager and lessor on lands that have been selected but not yet conveyed, and thus BLM continues to enforce the lease stipulations and Best Management Practices (BMPs) on such lands. BLM's BMPs only apply on BLM-managed lands (including selected lands); but on conveyed lands the new land owner Native corporation may adopt BMPs similar to or the same as those required by BLM on lands that BLM manages.

1.2 History of Operations in the Area

In 1923, the 23-million-acre Naval Petroleum Reserve Number 4 (Pet-4) was created by President Warren G. Harding via Executive Order (EO) 3797 to protect a future oil supply for the Navy. In 1976, the Naval Petroleum Reserves Production Act (NPRPA) renamed Pet-4 as the NPR-A and transferred management to the Secretary of the Interior. In 1980, Congress authorized petroleum production in the NPR-A and directed the USDOI to undertake *"an expeditious program of competitive leasing of oil and gas"* in the Reserve (P.L. 96-514). Several lease sales were held in the early 1980s, and one exploration well was drilled.

Interest in leasing within the NPR-A lagged until the mid-1990s, when development on adjacent state lands made exploration in the NPR-A an economical option. To pursue this renewed interest, the BLM developed an Integrated Activity Plan (IAP) and associated EIS, assessing potential use of the Northeast NPR-A for oil development. The IAP/EIS was completed in August 1998, with a ROD signed in October 1998, making approximately 87 percent (4 million acres) of the Northeast planning area available for oil and gas leasing. Lease AA-081798 was issued under the 1998 ROD and included numerous stipulations to protect habitat, subsistence use areas, and other resources in the planning area.

CPAI's first exploration program on leases obtained under the 1998 lease sale included the Lookout prospect. Exploration was authorized by BLM, based on a program-specific Environmental Assessment (EA) (BLM 2000) tiered to the 1998 IAP/EIS. Results of exploration indicated that developable reserves exist at Lookout. Lookout was subsequently planned for development as a satellite to CPAI's Alpine Development Project (ADP) in the Colville River Unit (CRU) and the associated drill site was named CD6. Development of the ADP began with construction of the Alpine CD1 and CD2 drilling sites and associated facilities. Oil production from CD1 commenced in November 2000 and from CD2 in November 2001.

In total, the ASDP included five satellite developments (CD3 through CD7) as potential extensions of the ADP. These satellites were planned to bring 3-phase (oil, water, and gas) hydrocarbon production to the Alpine Central Processing Facility (APF) at CD1 for processing and transport via the existing APF and Kuparuk common carrier oil pipelines to the Trans Alaska Pipeline System (TAPS).

In January 2003, the BLM and cooperating agencies (U.S. Army Corps of Engineers [Corps] the U.S. Environmental Protection Agency [EPA], the U.S. Coast Guard [USCG], the State of Alaska [State], and the NSB) initiated the ASDP EIS for the five proposed drill sites. The Final EIS was issued in September 2004. In November 2004, the Secretary of the Interior issued a ROD which approved the two satellites on federal lands (CD6 and CD7). CD3 was subsequently constructed on State of Alaska lands and CD4 was constructed on Kuukpik land. Production began at those sites in 2006. After a lengthy permit review process, including relocation of the Nigliq Channel bridge and adjustment of the road and pad to conform with the new bridge location, the Corps issued a permit for CD5 development on Kuukpik land, which is expected to be in operation by late 2015. Development of the GMT1 Project is dependent upon construction of CD5.

While the CD5 approval was in process, it was established that the two satellites on federal land (CD6 and CD7) were not located in the same reservoir as CD1, CD2, CD3, CD4, and CD5. As a result, CPAI requested that the BLM designate and approve the proposed Unit Area so CPAI could perform exploration and development operations in an efficient and logical manner under a unit plan of development. CD6 was renamed to GMT1 after it was determined that it would not be part of the CRU and would be in the newly established GMTU.

1.3 Purpose and Need for the Project

The purpose of the proposed GMT1 Project is to construct a drill site, access road, pipelines, and ancillary facilities to support development and transportation of petroleum reserves from the GMT1 production pad, while protecting important surface resources. The project will produce 3-phase hydrocarbons (oil, gas, and water) which will be carried by pipeline to the APF at CD1 for processing. Sales quality crude oil produced at the APF will be transported from CD1 via the existing Alpine Sales Oil Pipeline and Kuparuk Pipeline to the TAPS for shipment to market.

Under the NPRPA, the Secretary is required to conduct oil and gas leasing and development in the NPR-A (42 USC § 6506a). The Department of the Interior and Related Agencies' Fiscal Year (FY) 1981 Appropriations Act specifically directs the Secretary to undertake *"an expeditious program of competitive leasing of oil and gas"* in the Petroleum Reserve. The GMT1 Project helps satisfy the purpose to develop oil and gas resources in the NPR-A. Specifically, the NPRPA, as amended, encourages oil and gas leasing in the NPR-A while requiring protection of important surface resources and uses. EO 13212 (May 2001) directs federal agencies to give priority to energy-related projects:

> *"For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections."*

The NPRPA provides that the Secretary *"shall assume all responsibilities"* for *"any activities related to the protection of environmental, fish and wildlife, and historical or scenic values"* [42 USC § 6503(b)] and authorizes the Secretary to *"promulgate such rules and regulations as he deems necessary and appropriate for the protection of such values within the reserve."*

Development and production of hydrocarbons from GMT1 will help offset declines in production from the Alaskan North Slope. Development will also provide benefits to local, state, and national economies through local hire for jobs created during construction and operations, tax revenues, revenue sharing, royalties, and new resources to help meet US domestic energy demand.

1.4 Purpose and Need for Federal Action

The CEQ regulations direct that an EIS *"shall briefly specify the underlying purpose and need to which the agency is responding …"* (40 CFR 1502.13). The agency purpose and need for action triggers the NEPA analysis, and also dictates the range of alternatives and provides a basis for the rationale for eventual selection of an alternative and making a decision (BLM 2008c). This document brings together the evaluation needs of the BLM, Corps, and other federal agencies.

The purpose of the BLM federal action is to provide CPAI with legal access across public land managed by the BLM and authority to construct, operate, and maintain drill sites, pipelines, an access road, and ancillary facilities to develop and produce petroleum resources on BLM-managed lands within the GMTU of the NPR-A, for which CPAI holds federal oil and gas leases issued by BLM.

The purpose and need of the Corps federal action is founded in the regulations of two laws: NEPA and the Clean Water Act (CWA). Under NEPA, the purpose and need for federal action is to issue a permit pursuant to the CWA to place fill into waters of the U.S., including wetlands, as necessary to construct, operate and maintain drill sites, pipelines, an access road, and ancillary facilities to develop and produce petroleum resources within the GMTU. Under Section 404(b)(1) guidelines, the Corps has a *basic purpose* to determine whether the proposed project is water dependent. Then, the Corps has an *overall purpose* that, based on the Applicant's purpose and need, serves as the basis for identifying practicable alternatives to the Applicant's proposed project (see further discussion in Section 2.3). By this definition, the overall purpose is to develop, produce and transport hydrocarbons from the GMT1 production pad.

The need for the action is established by the federal agencies' responsibilities under various federal statutes including the Mineral Leasing Act, NPRPA, and the CWA to respond to CPAI's requests for a right-of-way grant, drilling permits, fill material discharge permit, and other related authorizations to develop and produce petroleum in the GMTU.

The BLM, the Corps, and other authorizing federal agencies will decide whether or not to approve the respective proposed federal authorizations, and if so, under what terms and conditions. Although this SEIS considers the reasonably expected impacts of the GMT1 development on Kuukpik, ASRC, and state-owned surface and subsurface estates, these non-federal entities are responsible for land management decisions on their respective lands.

This SEIS has been developed to supplement the 2004 ASDP EIS, focusing on the changes that have occurred in the interim to the project design, the affected environment, and the regulatory framework in order to provide sufficient information for BLM and other federal agencies to fulfill their NEPA responsibilities.

1.4.1 Support for Federal Decisions

In proposing to undertake an action (e.g., issue a permit), federal agencies are required under NEPA to analyze the reasonably foreseeable probable environmental impacts from a proposed project and a reasonable range of alternatives, including a decision to take no action. If more than one federal agency is involved in a related action, a single NEPA document may be developed to meet the requirements of all federal agencies. Typically, as with this project, one agency is designated as the lead agency with other agencies serving as cooperating agencies.

1.4.2 Laws, Regulations, and Permits

Requirements of federal, state, and local laws and regulations associated with development activities in the NPR-A were discussed in detail in the ASDP Final EIS (2004, §§ 1.1.3-1.1.4) and the NPR-A IAP/EIS (2012, §§ 1.8-1.9), which are incorporated by reference. A summary is provided below.

Comprehensive planning and management of oil and gas leasing, exploration, and future development in the NPR-A have been addressed in a series of documents, including the: *NPR-A Final Environmental Assessment Federal Oil and Gas Lease Sale* (BLM 1981); *Final Environmental Impact Statement for Oil and Gas Leasing and Development in the National Petroleum Reserve in Alaska* (BLM 1983); *Northeast National Petroleum Reserve Alaska Integrated Activity Plan/Environmental Impact Statement* (BLM 1998b); *Northeast NPR-A Final Amended IAP/EIS* (BLM 2005); *Northeast National Petroleum Reserve Alaska Final Supplemental Integrated Activity Plan/Environmental Impact Statement* (BLM 2008); and *National Petroleum Reserve–Alaska (NPR-A) Final Integrated Activity Plan (IAP)/ Environmental Impact Statement (EIS)* (BLM 2012).

1.4.2.1 Lead and Cooperating Agency Authorities

As the federal manager of the NPR-A, the BLM is responsible for land-use authorizations on federal land in the NPR-A. Upon completion of the SEIS process, the BLM will make decisions regarding CPAI's proposal. The authority for management of the land and resource development options presented in the SEIS comes from several statutes including NEPA, the Federal Land Policy and Management Act (FLPMA), the Federal Oil and Gas Royalty Management Act of 1982, the Minerals Leasing Act, the Naval Petroleum Reserves Production

Act of 1976 (NPRPA), as amended, Department of the Interior Appropriations Act Fiscal Year 1981 (P.L. 96-514), which amended the NPRPA, and Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA). These BLM authorities are further described below:

- NEPA sets out policy and provides the means by which the federal government, including both the BLM and the federal cooperating agencies, examines major federal actions that may have significant impacts on the environment, such as the authorization of oil and gas development contemplated in this SEIS (42 USC § 4231 et seq.).
- Under the FLPMA, the Secretary of the Interior has broad authority to regulate the use, occupancy, and development of public lands and to take whatever action is required to prevent unnecessary or undue degradation of public lands (43 USC § 1732). In accordance with the FLPMA, the BLM manages its lands and their uses to ensure healthy and productive ecosystems.
- The proposed action helps satisfy the purpose of the NPRPA to explore and develop oil and gas resources in the NPR-A. Specifically, the NPRPA, as amended, requires oil and gas leasing in the NPR-A while also requiring protection of important surface resources and uses.
- The NPRPA provides the Secretary of the Interior with the authority to: protect *"environmental, fish and wildlife, and historical or scenic values"* in the Reserve [42 USC § 6503(b)]; and provide *"conditions, restrictions, and prohibitions as the Secretary deems necessary or appropriate to mitigate reasonably foreseeable and significantly adverse effects on the surface resources of the National Petroleum Reserve in Alaska"* [42 USC § 6506a(b)].
- Title VIII of ANILCA establishes procedures for federal land managing agencies to evaluate impacts on subsistence uses and needs and means to reduce or eliminate such impacts (16 USC § 3120).
- The Mineral Leasing Act (MLA) (30 USC § 185, 43 CFR Part 2880), provides BLM with the authority to issue right-of-way grants for oil and natural gas pipelines and related facilities (not authorized by appropriate leases). Pursuant to this right-of-way grant, BLM will attach appropriate requirements for the construction, operation, maintenance and reclamation of the proposed pipeline between CD5 and GMT1.

The Corps has the authority to issue or deny permits for placement of dredge or fill material in the waters of the United States, including wetlands (which incorporate the vast majority of the project study area) and for work and/or structures in, on, over, or under navigable waters of the United States. Consequently, Corps authority extends, and its decisions following completion of the SEIS will extend, to CPAI's entire proposal, regardless of who owns the land. These Corps authorities are set forth under:

- Section 404 of the CWA (33 USC § 1251 et seq.), the Corps regulates placement of dredge and fill material in waters of the United States, including wetlands. The proposed project is located in an area that is entirely comprised of wetlands that are within the Corps' jurisdiction.
- In accordance with 33 CFR 332.1(c)(3), *"compensatory mitigation for unavoidable impacts may be required to ensure that an activity requiring a section 404 permit complies with the Section 404(b)(1) Guidelines."* Pursuant to this authority, the Corps can require compensatory mitigation calculated based on the entire functional value of each acre of the direct project footprint, plus an additional multiple of lost functional

value associated with impacts to the aquatic ecosystem surrounding the project footprint.

- Section 10 of the Rivers and Harbors Act (33 USC § 401), the Corps has regulatory authority for work and structures performed in, on, over, or under navigable waters of the United States.

The EPA authority to regulate oil and gas development is contained in the CWA (33 USC § 1251 et seq.), Clean Air Act (CAA) (42 USC § 7401 et seq.), and the Safe Drinking Water Act (SDWA) (42 USC § 300f et seq.). Like the authority of the Corps, the EPA's authority extends, and its decisions following completion of the SEIS will extend, to CPAI's entire proposal, regardless of who owns the land. These authorities are under:

- Section 402 of the CWA (33 USC § 1251 et seq.), the State of Alaska is delegated authority to issue permits for facilities operating within state jurisdiction of permits issued for the discharge of pollutants from a point source into waters of the United States for facilities, including oil and gas facilities. Point-source discharges that require an Alaska Pollutant Discharge Elimination System (APDES) permit include, but are not limited to, sanitary and domestic wastewater, gravel pit and construction dewatering, and hydrostatic test water, storm water discharges, etc. (40 CFR 122).
- Section 404 of the CWA (33 USC § 1251 et seq.), the EPA reviews and comments on Corps Section 404 permit applications for compliance with the Section 404(b)(1) guidelines and other statutes and authorities within its jurisdiction (40 CFR 230).
- The SDWA (42 USC § 300f et seq), the EPA's responsibilities include the management of the Underground Injection Control (UIC) program and the direct implementation of Class I and Class V injection wells in Alaska for injection of non-hazardous and hazardous waste through a permitting process for fluids that are recovered from down hole, as well as municipal waste, stormwater, and other fluids that did not come up from down hole (40 CFR 124A, 40 CFR 144, 40 CFR 146). The EPA oversees the Class II program delegated to the State of Alaska that is managed by the Alaska Oil and Gas Conservation Commission (AOGCC), which includes Class II enhanced oil recovery, storage, and disposal wells that may receive non-hazardous produced fluids originating from down hole, including muds and cuttings (40 CFR 147).
- Sections 165 and 502 of the CAA (42 USC § 7401 et seq.), the State of Alaska is delegated authority to issue air quality permits for facilities operating within state jurisdiction for the Title V operating permit (40 CFR 70) and the Prevention of Significant Deterioration (PSD) permit (40 CFR 52.21) to address air pollution emissions. The EPA maintains oversight authority of the State's program.
- Section 311 of the Federal Water Pollution Control Act of 1972, as amended (CWA, 33 USC § 1321, 40 CFR Part 112) requires a Spill Prevention Containment and Countermeasure (SPCC) Plan for storage of over 660 gallons of fuel in a single container or over 1,320 gallons in aggregate aboveground tanks.
- The CWA as amended (Oil Pollution Act; 33 USC Chapter 40; FRP Rule; 40 CFR Part 112, Subpart D, §§ 112.20 and 112.21) requires a Facility Response Plan (FRP) to identify and ensure the availability of sufficient response resources to respond to the worst case discharge of oil to the maximum extent practicable, *"…generally for facilities that transfer over water to or from vessels, and maintaining a capacity greater than 42,000 gallons, or any facility with a capacity of over one million gallons."*

- 40 CFR parts 1500-1508 and Section 309 of the CAA (42 USC § 7609) requires a review and evaluation of the Draft and Final EIS for compliance with CEQ guidelines.

The USFWS decisions to be made are centered on its responsibilities in enforcing the Endangered Species Act (ESA; including marine mammal and bird species subject to the Act). Specifically, the USFWS will provide consultation (recommendation) as required under Section 7 of the Act. The USFWS also provides consultation under the Fish and Wildlife Coordination Act regarding impacts to fish and wildlife resources.

BOEM's Office of Environmental Programs conducts NEPA analyses and compliance documents for each major stage of energy development planning related to offshore oil and gas development. BOEM will not issue permits associated with this project; however, BOEM has provided subject matter expertise in its review of this NEPA document. The Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska, established under EO 13580, adopted the concept of Integrated Arctic Management to ensure development and conservation decisions made in the arctic are driven by science, stakeholder engagement, and government coordination. BOEM's participation as a cooperating agency furthers these goals by enabling coordinated government efforts on natural resource development planning in the arctic.

In addition to the statutory authorities described above, a number of EOs apply to all federal agencies. These include: EOs 11988 (Floodplain Management), 11990 (Protection of Wetlands), 12898 (Environmental Justice), 13075 (Tribal Consultation), and 13112 (Invasive Species Control).

The State and the NSB require permits for certain activities within the NPR-A. The NSB, as a Home Rule Borough, issues development permits and other authorizations for oil and gas activities under the terms of its ordinances (NSB Municipal Code Title 19).

The State has responsibility for issuance of several permits. Alaska's Department of Natural Resources issues temporary water use and water rights permits, permits for cultural resource surveys, cultural resource concurrences, and other authorizations for activities associated with oil and gas development. The Alaska Department of Fish and Game (ADF&G) issues fish habitat permits. Under their state implementation plan, the Alaska Department of Environmental Conservation (ADEC) issues prevention of significant deterioration and other air quality permits. The ADEC is responsible for issuing several permits and plan approvals for oil and gas exploration and development activities, including the storage and transport of oil and cleanup of oil spills. The Alaska Oil and Gas Conservation Commission (AOGCC) is responsible for issuing drilling permits and for production, injection, and disposal plan approvals for exploration and development activities in the State of Alaska (BLM 2012, p. 13). Additional state authorities are presented below.

ADNR:

- Issues Rights-of-Way (ROW) and Land Use permits for use of state land, ice road construction on state land, and state freshwater bodies under AS 38.05.850.
- Issues a Temporary Water Use and Water Rights permit under AS 46.15 for water use necessary for construction and operations.
- Issues Alaska Cultural Resource permits cultural resource surveys under the Alaska Historic Preservation Act (AS 41.35.080).

- Issues Cultural Resources Concurrences for developments on state land (but not federal land) that may affect historic or archaeological sites under the National Historic Preservation Act of 1966, as amended (16 USC § 470 et seq.), and the Alaska Historic Preservation Act (AS 41.35.010 through .240).

ADEC:

- ADEC issues an APDES wastewater discharge permit and mixing zone approval for wastewater disposal into all state waters under a transfer of authority from the EPA National Pollutant Discharge Elimination System (NPDES) Program under Section 402, Federal Water Pollution Control Act of 1972, as amended (CWA, 33 USC § 1342); AS 46.03.020, .100, .110, .120, and .710; 18 AAC chapters 15, and 70, and; § 72.500.
- Issues a Certificate of Reasonable Assurance/NPDES and Mixing Zone Approval for wastewater disposal into all state waters under Section 402, Federal Water Pollution Control Act of 1972, as amended (CWA; 33 USC § 1342); AS 46.03.020, .100, .110, .120, and .710; 18 AAC chapters, 10, 15, and 70, and; § 72.500.
- Issues a Class I well wastewater disposal permit for underground injection of non-domestic wastewater under AS 46.03.020, .050, and .100.
- Reviews and approves all public water systems including plan review, monitoring program, and operator certification under AS 46.03.020, .050, .070, and .720, 18 AAC § 80.005.
- Approves domestic wastewater collection, treatment, and disposal plans for domestic wastewaters (18 AAC Chapter 72).
- Approves financial responsibility for cleanup of oil spills (18 AAC Chapter 75).
- Pursuant to the Oil Pollution Act of 1990 (OPA 90), ADEC reviews and approves the Oil Discharge Prevention and Contingency Plan (ODPCP) and the Certificate of Financial Responsibility for storage or transport of oil under AS 46.04.030 and 18 AAC Chapter 75. The State review applies to oil exploration and production facilities, crude oil pipelines, oil terminals, tank vessels and barges, and certain non-tank vessels.
- Issues a Title V Operating Permit and a PSD permit under Clean Air Act Amendments (Title V) for air pollutant emissions from construction and operation activities (18 AAC Chapter 50).
- Issues solid waste disposal permit for state lands under AS 46.03.010, 020, 100, and 110; AS 46.06.080; 18 AAC § 60.005; and 200.
- Reviews and approves solid waste processing and temporary storage facilities plan for handling and temporary storage of solid waste on federal and state lands under AS 46.03.005, 010, and 020; and 18 AAC § 60.430.
- Approves the siting of hazardous waste management facilities.

ADF&G:

- Issues Fish Habitat Permits under AS 16.05.871 and AS 16.05.841 for activities within streams used by fish that the agency determines could represent impediments to fish passage, or for travel in, excavation of, or culverting of anadromous fish streams.
- AS16.05.841 – Fishway Act deals exclusively with fish passage, applies to streams with documented resident fish use and without documented use by anadromous fish.

- AS16.05.871 – Anadromous Fish Act – applies to streams specified in the Anadromous Waters Catalog (AWC) as important for the spawning, rearing or migration of anadromous fishes – much broader authority and extends to anadromous fish habitat.

  The ADF&G is also responsible for evaluating potential impacts to fish, wildlife and fish and wildlife users, and presenting any related recommendations to state land managers (ADNR) or, via the Fish and Wildlife Coordination Act, to federal permitting agencies.

AOGCC:

- Issues a Permit to Drill under 20 AAC § 25.05.
- Issues approval for annular disposal of drilling waste (20 AAC § 25.080).
- Authorizes Plugging, Abandonment, and Location Clearance (20 AAC § 25.105 through 25.172).
- Authorizes Production Practices (20 AAC §§ 25.200 through 25.245).
- Authorizes Class II Waste Disposal and Storage (20 AAC § 25.252).
- Approves Workover Operations (20 AAC § 25.280).
- Reports (20 AAC §§ 25.300 through 25.320).
- Authorizes Enhanced Recovery Operations under 20 AAC §§ 25.402-460.

1.4.2.2 GMT1 Permit Requirements

Key permits, approvals, and requirements associated with GMT1 development are summarized in Table 1.4-1.

Table 1.4-1. Key Permits, Approval, and Other Requirements for GMT1

Agency	Permits, Approvals, and Other Requirements
FEDERAL AGENCIES	
Lead and Cooperating Agencies	NEPA Review; Supplemental EIS
Bureau of Land Management	• Application for Permit to Drill • Right of Way • Temporary Use Permit • Material Sale • Threatened and Endangered Species formal consultation Biological Assessment; ESA determination for National Marine Fisheries Service-managed species • Essential Fish Habitat (EFH) Assessment • ANILCA 810 Evaluation and Findings • Compliance with Section 106 of the National Historic Preservation Act • Off-Lease Disposal of Produced Water • Production Commingling and Allocation Approval (CAA) • EO 13075 Tribal Consultation • Deviation for K-1 (Fish Creek Setback) Approval
U.S. Army Corps of Engineers	• CWA Section 404 Permit • Rivers and Harbors Act Section 10 Permit
U.S. Environmental Protection Agency	• Underground Injection Control Class I (Industrial; non-hazardous) disposal well • Spill Prevention, Control, and Countermeasure (SPCC) Plan • FRP
U.S. Fish and Wildlife Service	• Letter of Authorization (LOA) for Incidental Take of Polar Bears • Threatened and Endangered Species formal consultation Biological Opinion
National Marine Fisheries Service (NOAA)	Section 7 Consultation (Endangered Species Act: bowhead whale, bearded seal, and/or ringed seal)
U.S. Coast Guard	Bridge permit for Tiŋmiaqsiġvik (Ublutuoch) River crossing in compliance with 33 CFR Parts 114 and 115, the Rivers and Harbors Act, and the General Bridge Act. 33 USC 401, 491, 525.
STATE AGENCIES	
Alaska Department of Natural Resources	• Land use (ice roads and pads on state land) • Temporary Water Use Permit • Cultural Resourced Coordination/Consultation with State Historic Preservation Office (SHPO)
Alaska Department of Fish and Game	Title 16 Fish Habitat Permits for all activities occurring below ordinary high water (OHW) of anadromous waters and often resident fish streams, including vehicle crossings (summer and winter), bridges, culverts, water withdrawals, pipeline vertical support member (VSM) installation, etc.
Alaska Department of Environmental Conservation	• Air Quality Permit • APDES permit (wastewater/stormwater/hydrotest) discharge • ODPCP • Section 401 Water Quality Certification • Certificate of Financial Responsibility

Table 1.4-1. Key Permits, Approval, and Other Requirements for GMT1 (Continued)

Agency	Permits, Approvals, and Other Requirements
Alaska Oil and Gas Conservation Commission	• Permit to Drill • Approval for Annular Disposal of drilling wastes • Area Injection Order
Office of Public Safety	Fire Marshal approval
LOCAL ENTITIES	
North Slope Borough	• Rezoning to Resource Development District – Master Plan • Title 19 Development Permit/Administrative Approval • Iñupiat History, Language, and Culture Division – Traditional Land Use Inventory Clearance
Arctic Slope Regional Corporation	Grant relief of Lease Stipulation K-1 (Fish Creek Setback) (Note: K-1 is in effect on conveyed lands, and may be enforced by ASRC.[1])
Kuukpik Corporation	Land Use authorization for facilities constructed on Kuukpik land
Native Village of Nuiqsut	EO 13075 Tribal Consultation

1.4.3 Related NEPA Analyses

CEQ Regulations for the implementation of NEPA direct agencies to reduce excessive paperwork and eliminate repetitive discussion of issues by tiering to existing NEPA documents to focus on actual issues ripe for decision (40 CFR 1502.20 and 40 CFR 1502.21). This SEIS seeks to adhere to the CEQ recommendation by summarizing the issues discussed in broader/existing NEPA documents and adopting these discussions by reference. This SEIS tiers to the following NEPA documents:

- 2004 ASDP Final EIS
- 2004 ASDP ROD
- 2008 Northeast NPR-A Final Supplemental IAP/EIS
- 2012 NPR-A Final IAP/EIS
- 2013 NPR-A IAP ROD

The 2004 ASDP Final EIS (BLM 2004) was prepared by BLM to evaluate a proposal by CPAI for the phased development of five satellite oil discoveries — two in the Colville River delta (CD3 and CD4) and three in the NPR-A (CD5, GMT1 [formerly CD6], and GMT2 [formerly CD7]). CD5 is on land conveyed to Kuukpik within the NPR-A boundary while the GMT1 pad is on federal lands administered by the BLM in the NPR-A. Both the potential impacts of proposed development activities and a range of alternatives were evaluated. No additional NEPA analysis was envisioned as necessary to support the proposed development.

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[1] The landowner may or may not choose to enforce stipulation K-1 on conveyed land in NPR-A.

The 2004 ASDP ROD (BLM 2004a) states:

> *"This Record of Decision (ROD) documents the Department of the Interior's decision to approve rights-of-way and permits to drill on public lands in response to an application by ConocoPhillips Alaska, Inc. (CPAI). BLM (2004) fulfills the obligation of BLM and its federal cooperating agencies under the National Environmental Policy Act (NEPA), 42 USC § 4321, to analyze the environmental impacts of federal authorizations necessary for CPAI to undertake its proposed development."*

The 2008 Northeast NPR-A Final Supplemental IAP/EIS (BLM 2008) was designed to address the Nation's need for production of more oil and gas through leasing lands in the northeast NPR-A. BLM (2008) provides local environmental resource information and includes GMT1 development as a basic assumption in the analyses. In addition, BLM (2008) alternatives evaluated both prescriptive and performance-based lease stipulations and other protective measures intended to mitigate impacts.

The 2012 NPR-A Final IAP/EIS (BLM 2012) was completed by BLM to fulfill the NEPA requirements for oil and gas lease sales (authorized by the 2013 ROD) and for potential renegotiations of the stipulations of previously leased tracts in the entire NPR-A. Several alternative development scenarios were evaluated, with the assessment of related environmental consequences based on a number of assumptions, including potential development of the GMTU (BLM 2012, §§ 4.1 and 4.2). The proposed GMT1 Project is consistent with development scenarios considered in all action alternatives (BLM 2012, § 4.2.1.2, Vol. 2, p. 51).

The 2012 Point Thomson Project Final EIS, which analyzed development of natural gas resources east of Prudhoe Bay in an undeveloped region of the North Slope of Alaska, is also referenced in this SEIS. This SEIS references its recent cumulative impacts analysis and many of its impact criteria.

Additional NEPA analysis is required prior to BLM approval of proposed construction of infrastructure for development of a petroleum discovery based on specific and detailed information about where and what kind of activity is proposed (BLM 2012, p. 9). GMT1 development was subject to a detailed NEPA analysis in BLM (2004), and was reconsidered in BLM (2012). This SEIS focuses on changes and additional information that could affect federal decisions on the permit applications currently under review.

1.4.4 Scope of SEIS

This SEIS will supplement BLM (2004), specifically addressing changes in the project, the affected environment, and regulations that might affect the determinations and decisions associated with BLM (2004) and BLM (2004a). This effort is greatly facilitated by tiering to and incorporating by reference BLM (2004) and BLM (2004a), as well as sections of BLM (2012) and BLM (2013) where applicable.

The scope of this SEIS includes analysis of potential impacts of the proposed GMT1 Project, based on the analyses performed in existing NEPA documents, with a focus on updated or more site-specific information. Resources that have been addressed thoroughly in existing NEPA documents and for which there are no changes in regulation or resource status are briefly summarized in Chapters 3 and 4 (*Affected Environment* and *Environmental Consequences*, respectively). For those resources where additional data, particularly site-specific and updated information has been identified, or if there has been a change in status, this information is presented in Chapter 3 and incorporated into the analysis of Chapter 4. See Section 4.1.3 for a discussion on how expected levels of impact are determined.

1.4.5 Changes and New Information

The primary objective of this SEIS is to identify changes to the project design since it was described in BLM (2004), and to determine whether the impacts of the proposed project are still within the range of impacts analyzed in BLM (2004). A secondary objective is to review the description of the affected environment and consider whether new information or circumstances exist, and if so, to evaluate the potential environmental impacts of the project against the updated description of the affected environment. A summary of changes in GMT1 Project design is provided in Table 1.4-2, with additional detail provided in Chapter 2.

Table 1.4-2. Summary of Changes in GMT1 Project Design Since 2004

Facility	Change Since 2004
Gravel drilling pad	Moved gravel drilling pad outside the Fish Creek 3-mile setback area; increased pad size
Gravel access road connecting CD5 to GMT1	Reduced total length of access road from CD5 to GMT1 and reduced length of access road crossing through the Fish Creek setback area; thereby reducing footprint
Bridges over fish-bearing streams	Designed longer bridge over the Tiŋmiaqsiġvik (Ublutuoch) River. Bridge over Crea Creek instead of culverts. Eliminated one stream crossing (bridge) by moving drilling pad out of Fish Creek setback area
Pipeline connecting GMT1 to CD5 tie-in to pipeline going to CD1/APF for processing	Reduced total length of pipeline from GMT1 to CD5 and reduced length of pipeline crossing through the Fish Creek setback area
ASRC Mine site	Gravel source is the commercial ASRC Mine site
CD5 site	Proposed CD5 pad is located approximately 1.5 miles west of the location analyzed in BLM (2004)

A review of new data and information contained in BLM (2012) shows there are no appreciable changes in the physical, biological, or social resources associated with the project study area since BLM (2004). New data includes multi-year studies on hydrology, birds, and caribou. Recent climate data may change some projected outcomes. Many advances have been made in the study of climate change on the North Slope since 2004. In addition, CPAI's proposed project was modified to reduce impacts, and more information on the material site (potential gravel source) has been collected. The regulatory framework remains essentially the same, except for several new ESA listings and air quality regulations. Additionally, the project will be subject to various lease stipulations and the new BMPs adopted in BLM (2013).

A summary of changes and additional information by resource is provided in Table 1.4-3.

Table 1.4-3. Environmental Changes and New Information in Project Study Area Since 2004

Resource	Changes in Nature of Resource	New Project Information or Regulatory Controls
Physical Terrestrial Environment	No appreciable change since BLM (2004)	Site-specific information on some paleontological resources in the area based on archaeological surveys.
Physical Aquatic Environment	No appreciable change since BLM (2004)	Site-specific information on water bodies, hydrology, and interactions during high-water events (e.g., breakup) based on field surveys.
Physical Atmospheric Environment	No appreciable change since BLM (2004)	Detailed information on air pollutant concentrations in Nuiqsut based on ambient air quality monitoring. New air quality regulations and agency guidelines.
Climate Change	Continuing trend of effects	Current reports addressing climate change in Alaska.
Vegetation and Wetlands	No appreciable change since BLM (2004)	Site-specific information on vegetation, wetlands, and habitat types for the realigned project, based on surveys initially performed for the 2004 EIS.
Fish	No appreciable change since BLM (2004)	Site specific information regarding fish-bearing lakes from lake studies and anadromous waterways from the ADF&G ***Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes.***
Birds	No appreciable change since BLM (2004)	Site-specific information regarding observances of selected bird species based on multi-year surveys performed for CPAI.
Terrestrial Mammals	No appreciable change since BLM (2004)	Site-specific information regarding caribou migration patterns and use of the project study area based on multi-year surveys performed for CPAI. Additional information on migrations patterns since 2004 has been collected by NSB, ADF&G and BLM.
Threatened and Endangered Species	Changing habitat of marine mammals (USFWS 2009a; NMFS 2012) Concern about the vulnerability of yellow-billed loon population due to low starting population, low reproductive rate, and specific breeding habitat requirements (USFWS 2009b)	The polar bear and two species of ice seal were listed, and the yellow-billed loon was designated as a candidate species under the ESA. On October 1, 2014 the USFWS made the decision that listing the yellow-billed loon under the ESA was not warranted. The loon no longer has status under the ESA, but the species is still recognized as a special status species by the BLM and as a species of conservation concern by the USFWS. New site-specific information regarding observations of spectacled eiders based on surveys performed for CPAI. Site-specific information on polar bear sightings and den locations provided by CPAI and USGS, respectively. Information on potential denning habitat provided by U.S. Geological Survey (USGS).
Sociocultural	No appreciable change since BLM (2004)	Updated population data based on 2010 U.S. Census results. Updated economic data. Community health and welfare information based on a Health Analysis Report published by NSB (McAninch 2012).
Subsistence	No appreciable change since BLM (2004); however, continuing development in the vicinity of Nuiqsut puts additional pressure on subsistence access and resources	Updated information regarding subsistence activities published in 2010 by Stephen R. Braund & Associates (SRB&A).

Table 1.4-3. Environmental Changes and New Information in Project Study Area Since 2004 (Continued)

Resource	Changes in Nature of Resource	New Project Information or Regulatory Controls
Cultural Resources	No appreciable change since BLM (2004)	Site-specific information on cultural resources in the area based on several archaeological surveys and SHPO consultation.
Land Use	Two new land use plans in the NPR-A: 2008 Northeast NPR-A IAP ROD and 2013 NPR-A IAP ROD Both new land use plans designate a 0.5-mile setback from Tiŋmiaqsiġvik (Ublutuoch) River and include restrictions for permanent facilities Both 2008 and 2013 RODs authorize new lease sales in the project study area Selected land in project study area transferred to Kuukpik Corporation (2010 conveyance), and subsurface transferred to ASRC. Administration of some oil and gas leases transferred to ASRC (Kuukpik land) New leases, exploration, and development on state land and water New OCS leases and planned exploration CD3 and CD4 constructed and operating CD5 scheduled for construction beginning winter 2014 Nuiqsut Spur Road is permitted and currently under construction Inter- and intra-state gas pipeline(s) permitting underway	For purposes of the analysis, Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek setbacks are considered to be in effect on Kuukpik land as well as federal land. A permit from the land owner (Kuukpik) will be required for road and pipelines on private land. The cumulative impacts analysis of BLM (2012) and the *Point Thomson Project Final Environmental Impact Statement* (FEIS; Corps 2012) address relevant new and reasonably foreseeable projects as used in the analysis.

1.5 Public Involvement

Public involvement is an important part of the NEPA process. CEQ regulations require agencies make diligent effort to involve the public in preparing and implementing their NEPA procedures [40 CFR 1506.6(a)]. Typically, public involvement begins with scoping and continues throughout preparation of the analysis and the decision (BLM 2008c, § 6.9).

1.5.1 Scoping

Additional scoping for a SEIS is not required [40 CFR 1501.9(c)(4)]; however, scoping is an effective process by which the BLM can acquire internal and external input on the issues, impacts, and potential alternatives to be addressed, as well as determine the extent to which those issues and impacts will be analyzed. The intent of scoping is to focus the analysis on significant issues and reasonable alternatives in order to eliminate extraneous discussion, and reduce the length of the EIS (BLM 2008c, § 9.1.3).

The BLM solicited public scoping comments on the GMT1 Project in the Notice of Intent to Prepare a SEIS, published in the Federal Register on August 16, 2013. Scoping comments were formally accepted through September 6, 2013, but scoping comments received after that date have been also considered in identifying the range of issues and additional mitigation measures to be addressed in the SEIS.

In all, 14 sets of comments were received from private citizens, environmental organizations, and government agencies, including the NSB, Kuukpik Corporation, and the Native Village of Nuiqsut (NVN). The comments were tabulated and a number of themes were identified. These include:

- Potential impacts of past and proposed development on community health;
- Potential impacts on the availability of key subsistence resources, particularly caribou and fish, and access to those resources;
- Potential impacts of increased development and activity on the local lifestyle, on wildlife, and associated cumulative impacts;
- Potential impacts on fish and wildlife and their habitats;
- Existing impacts of noise and disturbance created by aircraft and concern over additional and cumulative impacts;
- Potential impacts of existing and proposed development on local water quality and associated effects on people and wildlife;
- Potential impacts of existing development and proposed development on air quality, including the need for a comprehensive assessment and modeling of pollutants to determine nearfield and farfield impacts, cumulative impacts, and impacts on Nuiqsut (e.g., particulates, NO_2);
- Effects of greenhouse gas emissions and climate change;
- Need to consider a range of alternatives to the proposed project, including a roadless alternative, alternative source of support services (e.g., Nuiqsut), and the environmentally preferable or least environmentally damaging alternative;
- Effectiveness of mitigation and permit requirements; spill mitigation; and
- Ensure meaningful public involvement, specifically for Nuiqsut.

A number of local, state, and federal agencies have been involved in identifying issues for the SEIS. Key agency issues to date have focused on:

- Impacts of road development on hydrology and sheet flow;
- Impacts on air quality;
- Impacts on aquatic resources; and
- Impacts on and of oil and gas development.

1.5.2 Other Stakeholder Opportunities

In addition to scoping, the public had opportunities to become involved in the NEPA process. The draft SEIS was available for public comment for a period of no less than 60 days. The document was available over the internet and hard copies were provided for public review in Barrow, Nuiqsut, Atqasuk, Wainwright, Point Lay, Anaktuvuk Pass, Fairbanks, and Anchorage. Meetings will also be held in interested communities during the public comment period to ensure better understanding of the project, the alternatives, and impacts as well as to obtain public comments. BLM provides NEPA documents and public notices on their website and takes input from the public throughout the NEPA process.

During the development of BLM (1998b), BLM (2004), BLM (2008), and BLM (2012), extensive input from other federal agencies, the State, the NSB, thousands of individuals, and many institutions was received by the BLM. BLM consults with federally-recognized tribes and holds meetings in local communities to discuss oil and gas activities in the NPR-A as part of its NEPA processes.

Additionally, since 1998, the BLM has required Applicants to engage in community consultation before conducting activities in the NPR-A and to submit documentation of that consultation to BLM. BLM also holds Subsistence Advisory Panel meetings twice a year in rotating NPR-A villages to talk with residents about impacts to and concerns about subsistence.

The NVN is participating in the SEIS process as a cooperating agency in addition to participating through the Government-to Government (G2G) consultation process. EO 13175 (November 2000), *Consultation and Coordination With Indian Tribal Government*s, was signed to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications and to strengthen the United States government-to-government relationships with Native Americans and Alaska Natives. BLM has also engaged in consultation with Kuukpik Corporation and the ASRC.

CHAPTER 2: PROPOSED PROJECT AND ALTERNATIVES

The GMT1 Project is the first satellite to be developed in the GMTU, in the Northeast NPR-A on Alaska's North Slope near the Beaufort Sea. The project was originally described in detail in BLM (2004, §§ 2.3 and 2.4).

2.1 Project as Proposed in 2004 ASDP Record of Decision

The following describes what was adopted as the Preferred Alternative in BLM (2004a).

The Preferred Alternative described in BLM (2004) specified that a 9.1-acre drill site would be constructed on Kuukpik-owned land inside the 3-mile Fish Creek setback, with the capacity for 20 to 30 wells. Produced fluids would be transported by a 13.2-mile pipeline to CD5. A 13-mile gravel road would connect the drill site with CD5, with a 120-foot bridge constructed across the Tiŋmiaqsiġvik (Ublutuoch) River. All roads would be designed and constructed to provide adequate cross-flow to prevent raising the water level on the upstream side by more than 6 inches compared to that of the downstream side for more than one week after peak discharge. Gravel would be extracted from the ASRC Mine site or, if necessary, the Clover site. Upon completion of construction and drilling activities, crews based at APF would service and maintain the GMT1 pad.

The BLM Preferred Alternative described in BLM (2004) was adopted by BLM (2004a) with the following minor modifications: (1) the acceptance of CPAI's proposed bridge and approach design; (2) the inclusion of requirements for sedimentation monitoring to determine if additional erosion mitigation might be required for the bridge; and (3) the adoption of terms and conditions and a conservation recommendation included by the USFWS in the Endangered Species Act Biological Opinion. The BLM (2004) project adopted by the BLM (2004a) serves as the basis of the Applicant's proposed action in the GMT1 SEIS.

2.1.1 Summary of Proposed Project Changes from 2004

The GMT1 Project (Alternative A) is similar to the project approved for permitting in the BLM (2004a), with several notable changes. Notable changes to the GMT1 site from 2004 include:

- Relocated GMT1 pad, approximately 2.7 miles of access road, and approximately 2.4 miles of pipeline corridor have been moved out of the Fish Creek setback, in response to agency, community, and village corporation concerns;
- Reduced road length as a result of drill site relocation;
- Reduced pipeline length as a result of drill site relocation;
- Increased Tiŋmiaqsiġvik (Ublutuoch) River Bridge length from the minimum 120 feet (defined in BLM 2004a) to 350 feet, in response to agency concerns;
- Increased pad footprint from 9.1 acres to 11.8 acres to account for an increase in the number of wells.

- The net amount of fill for the construction of the GMT1 pad and shorter road length would be reduced by approximately 30 acres, though the proposed GMT1 pad will be 2.7 acres larger;
- The gravel source will be the ASRC Consolidated Use Gravel Mine site (ASRC Mine site). The Clover site is no longer being considered as the material source; and
- Added 3.3 miles of pipe rack to support ancillary injection water pipeline from CD1 to ensure sufficient supply of water for enhanced recovery injection and provide space for a future 24-inch line.

Other components of the GMT1 Project are also different than originally proposed in BLM (2004a). The CD5 pad location is approximately 1.5 miles west of its location in the BLM (2004a).

2.2 BLM Lease Stipulations and BMPs

CPAI is subject to the BMPs in the 2013 IAP/EIS ROD, and 2008 Northeast NPR-A lease stipulations, which were in place when CPAI renewed its lease in 2008. To BLM's knowledge, these stipulations and BMPs are not inconsistent with each other. To the extent any are found to be inconsistent, the 2008 lease stipulations would control.

CPAI is subject to all applicable stipulations and BMPs, but may request a deviation from these standards. The 2013 IAP ROD outlines the basis for a deviation from requirements/standards of stipulations and best management practices as part of an authorization application:

> *"Prior to approving an alternative procedure as part of the authorization, BLM's staff would analyze the proposal and determine if the proposal incorporating the alternative procedure would achieve the objectives of the stipulations and best management practices. If the BLM determines that the alternative procedure proposed by the applicant would meet the stipulation's or best management practice's objective, BLM could approve the alternative procedure. If BLM determines that the alternative procedure proposed by the applicant is unlikely to meet the objectives of a stipulation or best management practice, the requirements/standards would still be required. However, the Authorized Officer may allow a deviation from the objectives and requirement/standard in a new decision document supported by additional NEPA analysis."*

The BLM (2004a) granted deviations to three BLM stipulations controlling activities in the NPR-A at that time (i.e., BLM 1998a). Two of the three stipulations are applicable to GMT1. The rationale provided in BLM (2004a, pp. 3, 4, and 16 through 20) for granting those two deviations is described below:

- BLM Lease Stipulation 39(d) (now Stipulation K-1[e]) prohibits permanent oil facilities within the 3-mile setback from Fish Creek, but essential road and pipeline crossings within the setback may be approved on a case-by-case basis. Approval for an exception in 2004 was based on technical, economic, and environmental factors. The original Stipulation 39[d] was redesignated as Lease Stipulation K-1[e] in BLM (2008a) and carried forward in BLM (2013).

- BLM Lease Stipulation 41 (now Stipulation E-2) prohibits oil infrastructure within 500 feet of water bodies. Approval for an exception in 2004 was based on technical infeasibility of total compliance due to the hydrology and number of water bodies in the area as well as implementation of other measures that would protect water bodies (e.g., use of secondary containment). The original Stipulation 41 was re-designated as Lease Stipulation E-2 in BLM (2008a) and carried forward in BLM (2013), with the most recent 500-foot setback restricted to fish-bearing water bodies.

In addition to the two deviations from BLM stipulations granted by BLM in 2004, CPAI is also requesting a deviation to BLM Lease Stipulation E-7 and BMP A-5:

- BLM Lease Stipulation E-7(a) requires that above ground pipelines be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members
- BLM Lease Stipulation E-7(c) requires that a minimum separation distance of 500 feet between pipelines and roads be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs, and possible burial within the roads will be considered by the Authorized Office. Three stretches of road would not meet this requirement: a curved portion of the route turning south from the CD5 road tie in' the approaches to the CD5 bridge; and the pipeline/road crossing near the GMT1 pad.
- BLM BMP A-5 prohibits the refueling of equipment within 500 feet of the active flood plains of water bodies, to minimize the potential for a release of fuel. CPAI has requested this deviation to construct the Ublutuoch River and Crea Creek bridges, in order to refuel equipment located on the ice during pier, abutment, and bridge infrastructure installation.

The requirement to deviate from Stipulation E-7 is as a result of the pipeline crossing under the road in two locations for Alternatives A and B, and in a single location for Alternative B. For more detailed information regarding CPAI's request for deviations from stipulations and BMPs, see Appendix F.

2.3 Alternatives to the Proposed Project

NEPA directs the BLM to *"study, develop, and describe appropriate alternatives to recommend courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources…"* [NEPA, Section 102(2)(E)]. In determining the alternatives to be considered in satisfying the purpose and need, the emphasis is on what is *reasonable* rather than on whether the Applicant likes or is itself capable of implementing an alternative (40 CFR 1502.14; BLM NEPA Handbook.p.49). *"Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."* (CEQ, 1981 as amended--Question 2a, CEQ, Forty Most Asked Questions Concerning CEQs NEPA Regulations.)

Guidelines developed under Section 404(b)(1) of the CWA direct the Corps to use the overall project purpose (based on the Applicant's purpose and need) to define alternatives and determine which alternative is the least environmentally damaging practicable alternative. Where an activity is not "water dependent," practicable alternatives that do not involve special aquatic sites are presumed to be available, and presumed to have less adverse impact to the aquatics ecosystem, unless it is clearly demonstrated otherwise [40 CFR § 230 10(a)(3)]. The term *practicable* means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purpose [40 CFR § 230 3(q)].

2.3.1 Alternatives Selection Process

In supplementing BLM (2004), this SEIS began the process of developing alternatives with an appraisal of the full range of applicable alternatives that were considered by the BLM and cooperating agencies in BLM (2004). For the 2004 analysis, the BLM and other cooperating agencies (Corps, EPA, U.S. Coast Guard, and State) in the BLM (2004) developed alternatives to CPAI's proposed action by considering comments from scoping and public reviews, input from tribal consultations, and the purpose and need for the ASDP Project. The alternatives covered the full range of reasonable development scenarios, while addressing specific concerns associated with components of the proposed ASDP development.

The alternatives and related analyses in BLM (2004) were based on development of five Alpine Satellites under conditions existing at that time. Since then, two of the satellites (CD3 and CD4) have been constructed. Construction of a third satellite (CD5) is underway, with the design and location of CD5 facilities modified during permitting. These and other changes and new information, as summarized in Section 1.4.5, need to be considered in the current update and analysis of alternatives for the GMT1 SEIS. Additionally, there have been changes to CPAI's proposed GMT1 Project.

Changes to the existing infrastructure include construction and operation of facilities that were not in place at the time of the BLM (2004) described above, as well as changes that are not yet operational, but are reasonably foreseeable (e. g., Nuiqsut Spur Road). Additionally, other factors have changed, including land status, oil field practice, technology, and regulatory controls. New information has been collected, including biological studies, oil and gas resource updates, and subsistence surveys. Several comprehensive NEPA analyses, such as Point Thomson and the 2012 NPR-A EIS, have more recently evaluated North Slope development, both current and reasonably foreseeable future development, expanding the information base on which to develop alternatives.

2.3.1.1 Development and Screening of Alternatives

BLM and the cooperating agencies held a series of meetings to develop, screen, and select alternatives for full analysis in the SEIS, as summarized in Table 2.3-1.

Table 2.3-1. Alternatives Development Meeting Summary

Meeting Date	Cooperating Agencies [a]	Objective
9/12/2013	BLM, Corps, EPA, USFWS, BOEM, State, NSB, NVN	Review range of alternatives considered for BLM (2004). Identify reasonable alternatives to the GMT1 Project.
9/16/2013	BLM, Corps, EPA, USFWS, BOEM, State, NSB, NVN	Develop framework for defining and evaluating limited access/roadless alternative.
9/18/2013	BLM, Corps, EPA, USFWS, BOEM, State, NSB, NVN	Review Nuiqsut hub alternative and alternative that complies with all BLM lease stipulations. Advance development of limited access alternative. Consider options for gravel supply.
9/27/2013	BLM, Corps, USFWS, BOEM, State, NSB, NVN	Review and refine alternatives discussed at first three meetings for screening.
10/21/2013 Teleconference [b]	BLM, Corps	Discuss screening criteria to determine alternatives to carry forward through full analysis.
10/24/2013	BLM, Corps, USFWS, EPA, NSB	Review screening criteria and screen alternatives. Identify final alternatives to carry forward for full analysis.

[a] BLM - Bureau of Land Management (lead); Corps – U.S. Army Corps of Engineers, EPA – U.S. Environmental Protection Agency; USFWS – U.S. Fish and Wildlife Service;. BOEM – Bureau of Ocean Energy Management; State – State of Alaska; NSB – North Slope Borough; NVN – Native Village of Nuiqsut.

[b] Teleconference was to develop information to facilitate the full team of cooperating agencies moving forward following the three-week federal government shutdown, during which no meetings were held.

During the first meeting, the BLM and cooperating agencies concluded that the alternatives considered, but not carried forward for analysis in BLM (2004), offer no new or different environmental benefit and would not be carried forward in this SEIS. The considered alternatives that were not carried forward are summarized below in Section 2.3.2. It was also determined that three action alternatives in BLM (2004) remain conceptually reasonable alternatives to GMT1, and were therefore selected for further evaluation in the SEIS, based on agency and public scoping comments as well as current conditions and available information.

Throughout the next five meetings, the three action alternatives carried forward from BLM (2004) were modified and updated for conditions specific to the GMT1 Project. These alternatives were evaluated for potential benefit based on a number of criteria including footprint size, on-site activity, subsistence and other environmental impacts, reservoir production, and support for future development. It was concluded that the three action alternatives from BLM (2004) remain conceptually reasonable alternatives to CPAI's proposed GMT1 Project, and they are analyzed in this SEIS, as further described in Section 2.3.3.

2.3.2 Alternatives Considered But Not Carried Forward

A range of alternatives were evaluated in BLM (2004). At that time, alternatives that were considered, but not carried forward for further detailed analysis included: buried pipelines; pipelines elevated more than 7 feet; pile-supported production pads; drill pad(s) at substantially different locations; supporting western ASDP development from a Nuiqsut Operations Center; and development with access other than gravel road or air. The rationale that eliminated these alternatives from further consideration is provided in BLM (2004, § 2.6). Drilling from different locations using extended-reach drilling (ERD) is an evolving technology; however, ERD is still not technically feasible for the GMT1 Project based on well completion requirements to develop the reservoir and variations in subsurface geology. The BLM (2004a, p. 17) noted that ERD is problematic due to the geologically unstable shales in this area that tend to collapse.

BLM, in consultation with the cooperating agencies, reviewed these alternatives and the rationale for eliminating them from detailed analysis in 2004. BLM found that there have been no new circumstances or information since 2004 that would make these alternatives viable for the current project and the rationale for eliminating them in 2004 is still applicable. CPAI proposes to bury the pipeline in two sections to allow for road crossings; however, the practice of burying the pipeline for the entire distance was not considered in this SEIS.

2.3.3 Alternatives Carried Forward in the SEIS

As noted above in Section 2.3.1, BLM and other cooperating agencies reconsidered the action alternatives analyzed in BLM (2004), and brought forward certain components of those alternatives in order to create conceptually similar, updated versions of these alternatives for the GMT1 Project SEIS. In this SEIS, Alternative A is the CPAI proposed GMT1 Project, which is based on the Preferred Alternative of BLM (2004). Alternative B is based on the 2004 Alternative B, Conformance with Stipulations. Alternative C is based on the 2004 Alternative C, Alternative Access Routes. Alternatives D1 and D2 are based on the 2004 Alternative D Roadless Development. Alternatives B, C, D1, and D2 maintain the concept or theme of the 2004 action alternatives, but have been updated to fit existing conditions (and seasonal drilling for Alternative D2). The No-action Alternative must be evaluated in the SEIS [40 CFR 1502.14(d)].

Table 2.3-2 summarizes the components of the action alternatives. The project component values, such as road lengths and pad acreage, are approximations based on best available data. Due to differences in data processing systems (e.g., GIS) and methodologies (e.g., number rounding), the values presented in the Final SEIS may differ slightly from values presented in other project-related documents such as permit drawings. These differences have been reviewed and determined to be insignificant to the analysis as well as to the overall permitting process.

Table 2.3-2. Components of Action Alternatives

Major Project Components

Component	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2
Drill Pad	11.8 acres	11.8 acres	11.8 acres	15.7 acres	15.7 acres
On-Site Facilities	Emergency shutdown valve skid; remote electrical and instrumentation module; pig launching/receiving module; chemical injection module (including tanks, containment, and truck loading area); production heater, communication tower; and lighting			Limited access requires that certain services, equipment and supplies otherwise provided at the Alpine Processing Facility would need to be duplicated at the site (in addition to those required for Alternatives A-C) primarily including: incremental 200-man construction camp and 40-man drilling camps; solid waste staging and processing; waste water treatment plant; fueling station;10-month supply of drilling tubulars and tools; emergency response facility; and fleet maintenance shop	
Air Access Facilities	0	0	Nuiqsut airport access road, taxiway, and turnaround; runway extension; corridor; 400 ft x 400 ft pad (16.7 acres)	Airstrip and apron, airstrip access road, occupied pad (70.5 acres)	Airstrip and apron, airstrip access road, occupied pad (69.2 acres)
Road	7.6 miles (GMT1 to CD5)	8.6 miles (GMT1 to CD5)	7.6 miles (GMT1 to CD5)	1.3 miles (Airstrip to GMT1 Pad)	1.3 miles (Airstrip to GMT1 Pad)
Road Pullouts[1]/ VSMs	Pullouts: 0.9 acres VSMs: 0.1 acre	Pullouts: 0.9 acres VSMs: 0.1 acre	Pullouts: 0.9 acres VSMs: 0.1 acre	Pullouts: 0 VSMs: 0.1 acre	Pullouts: 0 VSMs: 0.1 acre
Pipeline System	8.3 miles	8.6 miles	8.3 miles	8.4 miles	8.4 miles
Additional road access to Nuiqsut	0	0	5.8 miles (upgrade the Nuiqsut Spur Road); 16.3 acres	0	0
Bridge(s)	2 (Ublutuoch River and Crea Creek)	1 (Ublutuoch River)	2 (Ublutuoch River and Crea Creek)	Seasonal ice bridge at Ublutuoch River and Nigliq Channel	Seasonal ice bridge at Ublutuoch River and Nigliq Channel
Culverts	81	91	81	13	13
Ice Roads	45 miles: Year 1	43 miles: Year 1	50 miles: Year 1 (includes upgrade to spur road)	33 miles: Year 1	33 miles: Year 1
	36 miles: Year 2 (Additional ice roads needed for pipeline installation in all alternatives)	36 miles: Year 2	30 miles: Year 2	36 miles: Year 2	36 miles: Year 2
	6 miles: (Every 5 years post drilling) Years 3-30	6 miles: (Every 5 years post drilling) Years 3-30	2 miles: Years 3-30 (connect to spur road from stream crossing)	15 miles: Years 3-30 (requires an additional 9-miles within the NPR-A)	15 miles: Year 3-36 (requires an additional 9-miles within the NPR-A)

Table 2.3-2. Components of Action Alternatives (Continued)

Component	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2
Total Gravel Footprint	72.7 acres	80.4 acres	105.8 acres	87.4 acres	85.8 acres
Total Gravel Requirement	628,050 cubic yards	684,550 cubic yards	862,250 cubic yards	845,600 cubic yards	830,800 cubic yards
Total Water Use	358.7 million gallons	355.7 million gallons	376.7 million gallons	1,018.6 million gallons	1,256.1 million gallons

[1] Pullouts are 0.3 acre (3 each for roaded alternatives) = 0.9 acre.

Aircraft Flights Annually

	New flights above annual average of 2,997 flights per year into Alpine			New flights above annual average of 2,997 to GMT-1 Airport /Alpine/Total					
Year	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D1**			**Alternative D2**		
				To GMT1	**To Alpine**	**Total**	**To GMT1**	**To Alpine**	**Total**
2016	539	539	539	591	90	681	591	90	681
2017	504	504	504	1,261	110	1,371	281	110	391
2018	115	115	115	1,604	0	1,604	631	0	631
2019+	115	115	115	573	0	573	573	0	573

Dates

	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2
Production Start Date	2017	2017	2017	2017	2023
Drilling Completion Date	2021	2021	2021	2021	2042

The BLM did not identify a Preferred Alternative in the Draft SEIS, because the BLM did not have one at that time. After further analysis, additional cooperating agency coordination, tribal consultation, and input from the public during the public comment period on the Draft SEIS, the BLM is identifying Alternative B as its Preferred Alternative for the GMT1 Final SEIS. While Alternatives A and B are similar, Alternative B would require full compliance with BLM's BMP/Lease Stipulation K-1(e) for oil and gas development in the NPR-A, which prohibits permanent oil and gas facilities, including gravel pads, roads, and pipelines, within a three-mile setback in the streambed and adjacent to Fish Creek. In consultation with residents of Nuiqsut and the NSB, the BLM established the three-mile Fish Creek setback in the 1998 Northeast NPR-A ROD to protect important subsistence activities and resources. In 2013, when BLM adopted its new ROD for the NPR-A, BLM maintained the Fish Creek setback. The Alternative B route maintains the Fish Creek setback for subsistence, and minimizes potential disturbance from the road in Nuiqsut' s subsistence use areas by keeping traffic and infrastructure closer to the village. Aside from reducing subsistence impacts, the Alternative B route eliminates the bridge and pipeline crossing over Crea Creek and the crossing of Barely Creek, which are components of the Alternative A route. This reduces impacts to fish.

While the BLM is identifying Alternative B as its Preferred Alternative, it is important to note that the Corps has not yet determined which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) in implementing its responsibilities under the CWA. The Corps' determination will be considered by the BLM in making a final decision, and could result in the modification or change in the alternative ultimately selected by BLM in its ROD.

2.4 Features Common to All Alternatives

The following section provides descriptions of features that are common to several of the action alternatives. Specific descriptions of components that vary from the general descriptions presented in this section are presented in descriptions of each specific alternative, described below.

2.4.1 Location

All action alternatives have project components in the same general location. The proposed GMT1 pad is in Section 6, Township 10N, Range 3E (T10N, R3E), Umiat Meridian (UM), and the GMT1 pad for Alternatives A and C also cross into Section 31, T11N, R3E, UM. The pipeline corridors cross through Sections 4 and 6, T10N, R3E UM; Sections 24 through 29 and 31 through 35, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM. The road corridors for Alternatives A, B, and C cross through Sections 24 through 28, 31 through 35 and Sections 18 and 19, T11N, R4E UM.

All of the action alternatives (A, B, C, D1, and D2) require crossing the Tiŋmiaqsiġvik (Ublutuoch) River. Stipulation K-1(g), which was adopted in BLM (2008a) and carried forward in BLM (2013) specifies a 0.5-mile setback for the Tiŋmiaqsiġvik (Ublutuoch) River, but allows for essential road and pipeline crossings of the main channel of the Tiŋmiaqsiġvik (Ublutuoch) River. This crossing is part of the GMT1 Project under all action alternatives. Much of the land in the vicinity of the Tiŋmiaqsiġvik (Ublutuoch) River crossing has been conveyed to Kuukpik Corporation; since it is not BLM lands, the provisions of this stipulation cannot be enforced by BLM. Only a small portion of the remaining Tiŋmiaqsiġvik (Ublutuoch) River setback is impacted by the GMT1 Project alternatives.

The ASRC Mine site is 4.5 miles east of Nuiqsut and east of the East Channel of the Colville River within T10N, R5E, Sections 10, 11, 14, and 15 at latitude 70.225° N and longitude -150.803° W.

The location of the proposed GMT1 pad and the ASRC Mine site do not vary among the alternatives.

2.4.2 Drill Site Design and Facilities

The proposed GMT1 pad would be constructed with gravel and be a minimum of 5 feet thick with side slopes of 2 feet wide to 1 foot high (2:1) (Appendix A, Sheet 24 of 33). Additional pad thickness would be provided if needed for thermal protection of permafrost. The pad surface designs and locations vary between alternatives and are discussed in their respective sections.

The pad is sized and designed to allow for all drilling and operation of site facilities, wellhead shelters, drill rig movement, drilling material storage, and well work equipment. A total of 33 wells at 20-foot wellhead spacing (Appendix A, Sheet 16 of 33) are planned. Insulated conductors and thermosyphons would be used to reduce subsidence and protect structural components from freeze-thaw damage.

The GMT1 pad layout under all action alternatives would include the following on-pad (GMT1 pad) facilities. Additional facilities would be needed under Alternatives D1 and D2, described in Sections 2.8 and 2.9, respectively:

- Emergency shutdown valve skid
- Fuel gas conditioning skid
- Test separator
- Remote electrical and instrumentation module
- Pig launching/receiving module
- Chemical injection module (including tanks, containment, and truck loading area)
- Production heater
- Communication tower
- Lighting as needed
- Switchgear- utility room module/transformer
- Chemical storage
- Well houses
- 1.5 Mega Volt Ampere (MVA) transformer platform (400-gallon oil-insulated)
- 1.5 MVA transformer platform (1,700-gallon oil-insulated)
- Envirovac
- Low pressure and high pressure pipe rack

No processing of production fluids beyond royalty determinations and process fluid heating is planned at the drill site. The pad would be oriented northeast to southwest to minimize snow accumulation on the site.

Electric power for GMT1 operations would be provided by the existing APF power system. Power cables would be suspended from the pipeline horizontal support members (HSMs) via a messenger cable, as shown in Appendix A, Sheets 19 and 20 of 33. The drill rig would be initially powered with a temporary power connection to the CD1/APF power system until the GMT1 project power connection at the drill site is commissioned. A fiber optic cable providing communication support between APF (CD1) and GMT1 would be suspended from VSMs via the same messenger cable as the power lines, as shown in Appendix A, Sheets 19 and 20 of 33.

2.4.3 Pipelines

The proposed GMT1 Project includes three pipeline segments:

- GMT1 to CD5 pipelines/systems (Appendix A, Sheets 6 through 11 of 33), includes:
  - 20-inch produced fluids pipeline – crude oil, gas, and water from GMT1 to APF for processing.
  - 14-inch injection water pipeline – seawater or produced water transported from APF for injection to support enhanced oil recovery.
  - 6-inch gas pipeline – lean gas transported from APF for artificial lift.
  - 6-inch MI pipeline – Miscible-Injectant transported to GMT1 from APF and tied in at CD5 for injection to support enhanced oil recovery.
  - Power and fiber optic communication lines.
  - Space for a 24-inch pipeline.
- CD5 to CD4N 14-inch injection water pipeline supported on an existing pipe rack – seawater or produced water transported from APF to GMT1 for injection to support the enhanced oil recovery.
- CD4N to APF 14-inch water pipeline for seawater or produced water transported from APF to GMT1 for injection to support the enhanced oil recovery. New pipe rack and VSMs would be installed along this route. This pipe rack would support the new pipeline as well as provide space for future installations (Appendix A, Sheets 14 and 15 of 33), as follows:
  - 14-inch injection water pipeline – water transported from APF for injection.
  - Space for an 8-inch future pipeline.
  - Space for a 24-inch future pipeline – produced crude or gas from the conceptual GMT2 Project.

The project would produce oil, gas, and water that would be carried from the GMT1 pad by pipelines that tie into the CD5 pipeline (at the CD5 drill site) going to the APF at CD1 for processing. Sales quality crude oil processed at the APF would be transported from CD1 via the Alpine oil pipeline and Kuparuk pipeline to TAPS for shipment to market. MI and injection water (for enhanced oil recovery) would be delivered to the GMT1 pad from CD1 by pipelines that tie-in at CD5 and APF, respectively. Lean gas for artificial lift would also be transported from CD1 to GMT1 (via a tie-in at CD5). The production crude and water injection pipelines would be designed to allow pipeline inspection and maintenance (e.g., pigging) between GMT1 pad and APF.

Pipelines would be supported on common VSMs placed approximately 55 feet apart. Approximately 1,000 new VSMs would be required between GMT1 and CD5 (footprint approximately 0.07 acre). Fiber optic cable and power cables would be suspended from the same VSMs via messenger cable. The decision to use messenger cables rather than cable trays (as proposed in BLM [2004]) was based on CPAI's experience showing that over time cable trays do not have sufficient structural integrity to span the distance between VSMs; messenger cables are the current industry design standard. Pipelines (including suspended cables) would be a minimum of 7 feet above ground surface as shown in Appendix A, Sheets 19 and 20 of 33, except where the pipeline crosses and is buried in the gravel road. This also decreases the risk of reduced clearance between the snow surface and the bottom of pipelines, especially during harsh winters (Lawhead et al. 2006).

At each stream or river crossing, the pipeline would be installed on a straight-line elevation between VSMs on each side of the crossing. Where possible, pipelines would be constructed at least 500 feet from the road to minimize caribou disturbance (Lawhead et al. 2006), as recommended by Cronin et al. (1994) to support greater crossing success. This also prevents excessive snow accumulation from snow drifts. Three stretches of road would not meet this requirement: a curved portion of the route turning south from the CD5 road tie in' the approaches to the CD5 bridge; and the pipeline/road crossing near the GMT1 pad. Pipelines are typically constructed within 1,000 feet of roads to allow for visual inspection for leak detection from the road. With more sophisticated leak detection methods now available, such as monitoring from aircraft equipped with thermal imaging equipment, some newer pipelines have been constructed without any gravel roads nearby. Pipeline design would comply with the American Society of Mechanical Engineers (ASME) Codes B31.4 and B31.8, applicable federal and state standards, and CPAI internal standards. All pipelines would be hydrotested prior to startup as required by the code of construction (e.g., B31.4 and B31.8).

The proposed GMT1 14-inch water injection pipeline would be installed on the existing pipe rack from CD5 to CD4N. From CD4N, the water injection pipeline would be routed approximately 3.3 miles north on a new set of VSMs, parallel to the existing CD4 pipeline and the existing Alpine oil pipeline. This new set of pipeline VSMs are required because there is insufficient capacity for transport of water to GMT1 pad in existing pipelines. Approximately 400 new VSMs (footprint approximately 0.03 acre) would be aligned to match existing VSM spacing to avoid offsets (also known as "picket-fence effect") that could impede caribou movement.

2.4.3.1 Manual Valves

Manual valves would be installed on each side of the Tiŋmiaqsiġvik (Ublutuoch) River, isolating the production pipeline on either side of the bridge to minimize potential spill impacts in the event of a leak or break. A manual valve approximately 1,700 feet west of the Tiŋmiaqsiġvik (Ublutuoch) River bridge will be on a 0.35 acre gravel pad adjacent to the gravel road. A similar manual valve and valve pad will be approximately 700 feet east of the bridge adjacent to the gravel road (Appendix A, Sheets 17 and 25 of 33).

The use of vertical loops can be a cause for operational concerns specific to multi-phase flow (as opposed to similar loops in use on the North Slope for sales-quality single-phase product such as at the Alpine line across the Colville River), including slugging and the settlement of solids. Slugging occurs when the liquid portion of the product accumulates at the lower elevation, forming a plug behind which pressure builds. Once pressure behind this liquid plug builds up sufficiently, the liquid would be pushed through the loop at a high rate of flow. Undesirable effects of slugging include vibrations in the pipeline, increased local stresses at the bend and increased loading to pipeline supports. The abrupt elevation change at vertical loops can also cause solids in the multi-phase flow to settle out of the stream and accumulate at the upstream bend in the vertical loop. These solids could lead to an increased rate of corrosion immediately upstream of the vertical loop (CPAI 2014a).

Automatic valves, which can immediately be shut in the event of a spill, would be located at GMT1 and CD5. Topographically the elevation declines towards the CD5 pad, thus oil in the pipeline would flow toward CD5. BLM is considering the requirement of automatic valves, rather than manual valves, at the Ublutuoch River crossing, as a potential new mitigation measure (see Section 4.7, *Mitigation Measures and Monitoring).*

2.4.4 Gravel Supply Options

Issuance of BLM permits for the sale and extraction of gravel from an approximately 65-acre Clover site was approved in BLM (2004a, p.3). BLM (2004a) included mitigation requiring that the mine (Clover site) be rehabilitated, based on the rehabilitation plan included as Appendix O of BLM (2004), including interim reclamation (BLM 2004a, p. 23). The ASRC Mine site is currently proposed as the potential gravel source. CPAI alerted BLM of its intent to use the ASRC Mine site shortly after publication of the Draft SEIS. The Clover site would require further NEPA analysis should CPAI or another group propose to develop it in the future.

The ASRC Mine site is an existing commercial gravel source on the East Channel of the Colville River, approximately 6 miles southeast of CD4, 15.5 miles east of GMT1, and 4.5 miles east-northeast of Nuiqsut. The ASRC Mine site is on ANCSA Native corporation land: the surface estate is owned by Kuukpik Corporation and ASRC owns the subsurface estate including sand and gravel resources.

In 1997, the ASRC Mine site received permit authorization from the Corps for the ten-year, phased development of the 150-acre site including the excavation of up to 5 million cubic yards of sand and gravel material. Extraction of material from within the 67-acre Phase 1 operating area produced 1.03 million cubic yards of gravel (Corps 2012). Subsequent reclamation of Phase 1 has foreclosed the area to future mining, although overburden material may still be disposed of on site to facilitate creation of bird nesting islands and shallow water habitat.

In 2004, ASRC obtained permits from the Corps to continue extraction of gravel material from the 83-acre Phase 2 area of the mine site. Two cells have been mined within the Phase 2 operating area: approximately 20 acres in 2005 and 5 acres in 2007 (Corps 2012). Additional gravel extraction from Phase 2 was authorized under permit POA-1996-869-M5 for up to 2 million cubic yards from two cells: Cell #1 in the eastern portion and Cell #2 in the western portion (Corps 2013a).

A total of 1.1 million cubic yards of gravel from Phase 2 has been designated for two existing projects: approximately 595,700 cubic yards for CD5 (Corps 2011) and approximately 455,000 cubic yards for the Nuiqsut Spur Road project (Corps 2013b). Phase 2 work was partially completed in 2014.

Phase 3 of the ASRC Mine site, an approximately 430-acre area immediately south of the Phase 2, has known sand and gravel deposits. Phase 3 is not currently permitted; authorization would have to be obtained from the Corps prior to gravel extraction. Upon permitting, the material in this area will be available for use by public and private projects in the Colville River delta area and adjacent areas. Winter geotechnical work would occur as needed to delineate and assess sand and gravel resources. All gravel mining work would be performed in the winter season (Corps 2012). It is expected that the permit will stipulate that no gravel extraction activities would occur until a written enforceable contract is in place for sale and delivery of gravel.

It is reasonable to assume there is a similar source of gravel within Phase 3, equal to quantities of gravel per acre as identified within Phase 2. For example, under a similar footprint of 58 acres within Phase 3, there may be approximately 2 million cubic yards of gravel available for GMT1 and other future projects. The GMT1 Project would require between 628,050 cubic yards (Alternative A) and 862,250 cubic yards (Alternative C). Based on permitted gravel extraction and committed gravel resources, gravel from the ASRC Mine site is potentially available for use in the GMT1 Project.

A general relationship of one acre disturbed for a gravel mine to meet the gravel needs for five acres of gravel pad, road, airstrip, or other development is identified in BLM (2012, § 4.2.2, p. 26). However, information regarding the ASRC Mine site is available since it is currently operating.

Mined gravel would be transported from the ASRC Mine site to the project area over ice roads during Year 1 (January – April 2016 and June – August 2016). Approximately 14,000 trips would be required to transport the gravel. Average gravel transportation trips for Alternatives A, B, and C would be approximately 17.1 miles, while average trips for Alternatives D1 and D2 would be slightly longer at 17.4 miles. The difference in trip distance is because of the location of infrastructure to be constructed (i.e., construction of the CD5-GMT1 road or occupied pad and airstrip near the drilling pad).

The ASRC Mine site is an existing commercial mine. Some impacts such as disturbance of vegetation and habitat associated with removal of overburden, and creation of ramps are potentially less than for developing a new mine in an undisturbed location. Impacts that could be caused by or result from mining at the ASRC Mine site are addressed for each affected resource in Sections 4.2, 4.3, and 4.4 of this SEIS, as applicable.

A Reclamation Plan was developed for the ASRC Mine site as part of the original permitting process. A revised Reclamation Plan was approved by the Corps in 2004 for Phase 1 and 2 areas. The purpose of the revised reclamation plan was to modify the earlier reclamation requirements based on the experienced gained from the reclamation work at the site between 1998 to 2004. The reclamation and mitigation goal is for waterfowl habitat with a matrix of undisturbed tundra, deep water, shallow and very shallow littoral, and waterfowl nesting islands. A Long-Term Adaptive Management Plan was developed to ensure the long-term sustainability of the reclamation and enhanced waterfowl habitat created. All reclamation work will occur as part of an overall gravel mining operation because both the overburden material and heavy equipment necessary for the activities would be available (ASRC 2012).

2.4.5 Construction Activities

CPAI proposes to construct the GMT1 facilities on a two-year construction schedule in 2016 and 2017. The list below summarizes the key construction milestones and critical supporting activities leading to start of construction:

- 3Q 2013 – Submit permit applications and supporting documents

- 4Q 2014 to 1Q 2015 – Order long-lead materials for the GMT1 Project (e.g., bridge and pipeline steel)
- 4Q 2015 – Begin first season ice road construction in support of GMT1 construction
- 1Q 2016 – Gravel Mining
- 1Q 2016 – Construction of gravel road and pad, bridge piers substructure and superstructure
- 4Q 2016 – Begin second season ice road construction in support of GMT1 construction
- 1Q 2017 – Install VSMs, pipelines, power and telecom cables, and facilities
- 4Q 2017 – First production

As detailed design progresses, the schedule may be modified. However, the identified work would occur in the indicated seasons and sequence. Well maintenance operations would occur intermittently throughout the life of the field.

Av-gas, for planes and helicopters, would be trucked to the Alpine field via the haul road and the ice road and may be flown in several times during the non-ice road (summer) season. Diesel would be transferred via a 2-inch pipeline from Kuparuk. There would be no barging of fuel to support construction at GMT1.

2.4.5.1 Camp Requirements

During construction, the following camps may be used:

- GMT1 pad – an electrified camp associated with the drill rig
- One or more electrified camps in Nuiqsut
- Existing facilities at APF

Sanitary wastes that may be generated from a temporary construction camp would be hauled to an approved disposal site, or treated and discharged under the North Slope General APDES Permit AKG-33-1000. Food waste would be incinerated at APF and non-burnable waste would be recycled or transported to the NSB landfill at Deadhorse.

2.4.5.2 Water Use

Fresh water would be required for domestic use at remote construction camps and for construction and maintenance of ice roads and ice pads. Potable water requirements are based on a demand of 100 gallons per day (gpd) per person (estimated up to 100 people at a remote camp), totaling approximately 10,000 gpd during construction seasons. If several additional camps were in place approximately 30,000 to 40,000 gpd would be required. Freshwater may be used for hydrostatic testing. Approximately 1.5 million gallons (MG) of water per mile are used for ice road construction and maintenance. Ice roads would typically be available for use for 90 days each winter season.

Water for construction and maintenance of ice roads and pads would be withdrawn from lakes in the vicinity of the GMT1 Project as authorized by State of Alaska temporary water use permits and fish habitat permits where necessary. Table 2.3-2 lists water use for the project action alternatives. Water use is also presented in the discussion of each alternative.

2.4.6 Drilling and Operations

In all action alternatives, other than D2, drilling is planned to begin in the second quarter of 2017 and would continue until all planned wells are completed, estimated to be a total duration of 4.75 years. This range assumes that only the Lookout Participating Area will be developed with 9 wells, in no less than 15 months. Drilling may take up to 48 months if Lookout, Mitre, and Flat Top Participating Areas are drilled consecutively; however, BLM does not require that the wells be drilled continuously. The timing of drilling is a decision which CPAI makes depending on economics and rig availability. For NEPA purposes, BLM has assumed that CPAI will develop all potential participating areas.

The drill rig and drill camp would use a temporary power connection, fueled by ultra low sulfur diesel (ULSD) until the permanent GMT1 drill site power supply system is commissioned. No permanent camp facilities would be required at GMT1.

Following the initial round of drilling, “typical operations” would comprise well operations, production, and transportation of produced hydrocarbons. Standard CPAI operations and maintenance practices would be implemented. Key elements of drilling and operations are addressed below.

2.4.6.1 Water Use

Fresh water is required for domestic use at the drill rig camp and during drilling activities. Potable water requirements are based on a demand of 100 gpd per person (estimated up to 75 people), totaling approximately 7,500 gpd during drilling. Drilling water requirements are estimated at 40,000 to 45,000 gpd (2 MG/well x 8 wells/yr = 16 MG/yr or 43,000 gpd). A 16-acre ice pad, requiring 4 MG of water would be required to support drilling activities under all alternatives. Water for drilling would be withdrawn from lakes in the vicinity of the project as authorized by temporary water use permits and fish habitat permits where necessary. See Table 2.3-2 for water use for the project alternatives.

2.4.6.2 Erosion Control Measures

The GMT1 Project would follow the Alpine Facilities Erosion Control Plan, which was updated to include GMT1. The erosion protection design for GMT1 culverts and bridges are included in Appendix A, Sheets 28, 30 and 32 of 33. The Alpine Facilities Erosion Control Plan outlines procedures for operation, monitoring, and maintenance of various erosion control methods. Erosion control at APF is accomplished using a combination of biotechnical and engineering control (physical armor) methods. Temporary erosion protection would be placed before breakup following the first construction season to provide protection from a flood event. The temporary protection would be replaced with permanent erosion protection once the gravel had been allowed to season (settle and drain). Alpine’s Storm Water Pollution Prevention Plan (SWPPP) would be amended to cover management of GMT1 and other pads’ drainage.

The Alpine Erosion Control plan also contains snow removal and dust control plans. Snow removal plans include the use of snow blowing equipment to minimize gravel carryover to the tundra and placing cleared snow in designated areas. The Alpine Erosion Control Plan discusses snow removal in Section 3.1.2 on page D-17 and gravel deposition removal in Section 3.4 on page D-22. CPAI selects snow push areas annually, based on avoiding areas of thermokarsting, proximity to water bodies, and evaluating how the area looks based on previous years’ activities. Snow clearing typically results in small amounts of gravel being pushed onto the tundra. As noted in Section 3.4 of the Alpine Erosion Control Plan, gravel removal from tundra will typically be performed by personnel using hand tools, but may require the use of heavy equipment for large depositions. The dust control plan includes watering gravel roads to minimize dust impacts on the tundra and maintain the integrity of the roads.

2.4.6.3 Spill Prevention

GMT1 Project facilities have been designed to minimize the possibility of spills. For a detailed discussion of the impacts associated with potential spills, and for potential new mitigation measures related to spill prevention and response, see Section 4.5. In addition, CPAI would implement a pipeline maintenance and inspection program and an employee spill prevention training program to further reduce the likelihood of spills occurring. BLM received scoping comments suggesting new potential mitigation measures and BMPs related to spill prevention and response, which it has considered as part of this NEPA process. During development of its ROD, BLM will determine whether and which of these new potential mitigation measures will be adopted as part of BLM's authorization for the project.

CPAI would design and construct the pipelines to comply with applicable state, federal, and local regulations, and would go beyond those minimum requirements, as described below. The pipelines would be constructed of high-strength steel and would have wall thicknesses equal to or in excess of regulatory requirements. Welds would be validated using non-destructive examination (NDE) (i.e., radiography and ultrasonic) during pipeline construction to ensure their integrity, and the pipelines would be tested hydrostatically prior to operation. The production crude and water injection pipelines would be fully capable of using pigs for cleaning and corrosion inspection operations. Manual valves would be placed on the production pipeline on both sides of the Tiŋmiaqsiġvik (Ublutuoch) River to minimize spill volume in the event of a release. Automatic valves, which can be immediately shut in the event of a spill, will be located at GMT1 and CD5.

CPAI’s design of production facilities would include provisions for secondary containment for hydrocarbon-based and hazardous materials, as required by state and federal regulatory requirements.

Spill Prevention and Response

Spill prevention and response measures that would be used during construction and operation at the GMT1 pad are outlined in the Alpine Development Participating Area ODPCP and Alpine SPCC Plan (CPAI 2014d). The intent of the ODPCP and SPCC Plan are to demonstrate CPAI’s capability to prevent oil and hazardous materials spills from entering the water and land and to ensure rapid response if a spill event occurs. The Alpine ODPCP complies with State of Alaska requirements in AS 46.03.020(10)(A) and 18 AAC 75, federal EPA regulations in 40 CFR 112 for FRPs, and U.S. Department of Transportation (USDOT) requirements in 49 CFR 194. The SPCC Plan complies with the federal EPA regulations in 40 CFR 112. Additional new potential spill response mitigation measures can be found in Section 4.5.

CPAI would implement the ODPCP/SPCC plans designed to minimize accidental oil spill impacts. The current Alaska Department of Environmental Conservation (ADEC) approved Alpine ODPCP would be amended to include the GMT1 pad. Through the amended Alpine ODPCP, CPAI will ensure that readily accessible inventories of appropriate oil spill response equipment and personnel at Alpine will be available for use at the drill site. In addition, the spill response cooperative, Alaska Clean Seas (ACS), will act as CPAI’s primary response action contractor and will provide trained personnel to manage all stages of a spill response, from containment, to recovery, and cleanup.

The threat to rivers and streams from a possible pipeline spill between the drill site and Alpine would be minimized by quickly intercepting, containing, and recovering spilled oil near the waterway-pipeline crossing points. The response strategy for GMT1 development involves two approaches: (1) a design component, and (2) equipment pre-staging, as described below:

> (1) The pipelines would be north (downstream) of the road from CD4N westward until exiting the western edge of the delta. The pipelines mostly continue on the north side of the road outside of the delta until near their connection at the CD5 pad. In the delta, placing the pipelines on the downstream side (i.e., north) side of the road would prevent ice impacts to the pipelines during breakup because the road would act as a barrier to ice. The road stream crossings would be used as the primary control points to contain potential spilled oil. The road could be used for access and staging for spill response.
>
> (2) Spill response equipment would be placed at the drill site for an initial response. This strategy would facilitate the rapid deployment of equipment by personnel. The effective response time would be considerably reduced by this pre-staging concept and this would expedite equipment deployment to contain and recover spilled oil and to minimize the affected area. During summer, pre-staged containment boom placed at strategic locations in selected river channels would also help to mitigate a spill and facilitate a rapid response.

There is potential for pipeline spills where the pipeline crosses under the road, due to corrosion of the underground portion of the pipe. The likelihood of corrosion occurring is reduced through pipeline design and monitoring. CPAI maintains a corrosion control program and an inspection program, including ultrasonic inspection, radiographic inspection, coupon monitoring, metal loss detection pigs and geometry pigs, and forward-looking-infrared (FLIR). The inspection programs are API 570-based programs that focus the inspection effort on areas of greatest potential. These programs are more fully described in the Alpine ODPCP.

The Alpine SPCC Plan is implemented to prevent oil discharge to waters of the U.S. and incorporates a comprehensive spill prevention program to minimize the potential for oil discharges at Alpine facilities. The plan would be updated to include GMT1 facilities.

Spill Training and Inspections

CPAI provides regular training for its employees on the importance of preventing oil or hazardous material spills, and spill response. CPAI provides new-employee orientation, annual environmental training seminars, and appropriate certification classes about specific issues, including spill prevention and response. CPAI employees participate in frequent safety meetings, which address spill prevention and response issues, as appropriate. The CPAI Incident Management Team also participates in regularly scheduled training programs and conducts spill response drills in coordination with federal and state agencies.

CPAI is required to conduct visual examinations of the pipeline and facility piping at least monthly during operations. CPAI is capable of providing aerial overflights as necessary to allow inspection both visually and with the aid of FLIR technology. Infrared technology permits identification of spills based on the temperature “signature” resulting when warm fluid (oil) leaks. The FLIR technology is capable of detecting warm spots in darkness or when other circumstances such as light fog or drifted snow limit visibility. FLIR technology also has the ability to identify trouble spots along the pipeline, such as damaged insulation, before a problem occurs. CPAI would also conduct regular ground-based visual inspections of facilities and pipelines from gravel roads under Alternatives A, B and C. Inspections would be conducted via ice road and aircraft under Alternatives D1 and D2.

For additional information and analysis on impacts of potential spills and mitigation measures, see Section 4.5.

2.4.6.4 Fuel and Chemical Storage

Diesel will be stored on site during drilling and construction under all alternatives. During the operations phase other fluids that may be stored include corrosion inhibitor, scale inhibitor, methanol, emulsion breaker, and foam inhibitor.

Fuel storage would comply with state and federal oil pollution prevention requirements, according to the Alpine ODPCP and SPCC Plan. Secondary containment for fuel storage tanks would be sized as appropriate to container type and according to governing regulatory requirements in 18 AAC 75 and 40 CFR 112. BLM is also analyzing new potential mitigation measures related to fuel storage, found in Section 4.5.

2.4.6.5 Waste Handling and Disposal

Sanitary wastes that may be generated from the camp would be hauled to an approved disposal site or treated and discharged under the North Slope General APDES Permit AKG-33-1000. Food waste would be incinerated at APF and non-burnable waste would be recycled or transported to the NSB landfill at Deadhorse. Other hazardous and solid waste associated with the GMT1 Project would be managed under ADEC and EPA regulations as well as BLM BMPs A-1, A-2, A-6 and A-7 (BLM 2013).

Drilling wastes (i.e., muds and cuttings) would be disposed of through annular disposal on site and/or transported to an approved disposal well such as the APF disposal well at CD1. Annular disposal occurs in the well at the space between two casing strings, known as the annulus. Drill cuttings may be washed and reused. Reserve pits are not required and would not be constructed. A temporary storage cell would be constructed for staging of muds and cuttings prior to disposal. Produced water would be processed and re-injected to the subsurface. Well work waste materials would be managed according to the Alaska Waste Disposal and Reuse Guide. Under Alternatives D1 and D2, a Class 1 disposal well and injection facility would be located on the GMT1 pad.

2.5 Alternative A: CPAI Proposed Project

CPAI's proposed GMT1 Project is approximately 14 miles west of the CPAI-operated Alpine field (Map 2.5-1).

Table 2.5-1 provides the major infrastructure components of Alternative A, the Proposed Action.

Table 2.5-1. Infrastructure for Alternative A, Proposed Action

Component	Alternative A Proposed Action
Gravel Drill Pad	11.8 acres
Wells	33
Access Road	7.6 miles
Road Pullouts	0.9 acre
Elevated Pipelines on VSMs	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5 17.9 miles TOTAL
Manual Valve Gravel Pads	2 (0.35 acre each)
Bridges	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	ASRC Mine site
Total Gravel Footprint	72.7 acres
Ice Road	36 to 45 miles

CPAI's proposed project is depicted on Map 2.5-2. More detailed design drawings for the GMT1 Project are included in Appendix A.

In siting the GMT1 pad, the access road (CD5-GMT1 gravel road), and the pipeline, eight criteria were considered: Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River setback areas (Map 2.5-3), wetland habitats, archaeological resources, hydrology and drainage, topography, minimizing gravel footprint, load weight requirements (road and bridge), and local community interests (information provided by Applicant).

The Alternative A pipeline and road routes are within the Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River setback area, which is a deviation of BMP K-1 which prohibits permanent oil and gas facilities, including gravel roads, pads, airstrips, and pipelines within the setbacks (described in Section 2.1 of this Final SEIS).

As stated in BLM (2004, § 2.1), the BLM (2004a) granted exceptions to the GMT1 access road and pipeline within the Fish Creek setback. The Tiŋmiaqsiġvik (Ublutuoch) River setback (Stipulation K-1[g]) did not exist in 2004. Stipulation K-1(g) was adopted in BLM (2008a) and carried forward in BLM (2013). The Tiŋmiaqsiġvik (Ublutuoch) River setback stipulation in BLM (2013) allows for essential road and pipeline crossings of the main channel, which is part of the GMT1 Project under all action alternatives.

2.5.1 Location

The proposed Alternative A GMT1 pad is located in Section 6 T10N, R3E UM and Section 31 T11N, R3E at latitude 70.2565 and longitude -151.4810. The pipeline corridor crosses through Section 6, T10N, R3E UM; Sections 24 through 29 and 31 through 32, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM. The road corridor crosses through Sections 24 through 28 and 31 through 33, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM.

2.5.2 Infrastructure Development

Under Alternative A, CPAI's permit application calls for a crossing of the CD5 to CD1 pipeline by the GMT1 to CD5 road (just south of the CD5 drill pad). In August 2014, CPAI updated its application with the Corps for its 404 permit. This revision added a second underground pipeline crossing, this time for the GMT1 to CD5 pipeline, which is proposed to cross under the GMT1 to CD5 road about one mile east of the GMT1 pad. To ensure that the existing thermal regime (i.e., permafrost) is maintained, the CD5 pipeline would be buried in the road gravel at the GMT1-CD5 road crossing and would be installed according to Appendix A, Sheet 22 of 33 with an impermeable membrane and rigid insulation installed under the pipelines, between the pipelines and existing ground. The GMT1 road at GMT1 pipeline crossing would be installed according to Appendix A, Sheet 23 of 33.

Under Alternatives A and C, the first 1.3 miles of the GMT1 to CD5 pipeline route is located just south of the proposed access road, then crosses the road and runs parallel to the north, traveling in a roughly straight line to the east-northeast until reaching the Tiŋmiaqsiġvik (Ublutuoch) River. After crossing the Tiŋmiaqsiġvik (Ublutuoch) River on the proposed 350-foot-long bridge, the pipeline would be routed approximately north-northeast in a straight line to CD5, still remaining north of the road. Under Alternative A (as well as C, D1, and D2), the pipeline would cross through the southern portion of the Fish Creek 3-mile setback and cross the Tiŋmiaqsiġvik (Ublutuoch) River 0.5-mile setback for a short distance (river crossing).

The location of the pipeline route north of the proposed access road under Alternatives A and C would allow the road to act as a barrier to protect the lakes (L9820 and L9819) in the event of a potential pipeline spill.

A 7.6-mile-long gravel road (CD5-GMT1 gravel road) is proposed to connect GMT1 with CD5, which will connect to the existing Alpine field road system. The road will include three pullouts along the road to allow local residents to access the area for subsistence use. Each pullout would impact approximately 0.3 acre, for a total of 0.9 acre. The CD5-GMT1 gravel road is designed to maintain the existing thermal regime. The CD5-GMT1 gravel road would be a minimum of 5 feet deep with side slopes of 2:1 (Appendix A, Sheet 24 of 33). The road would be 32 feet across (crown width). The proposed road would be immediately south of the proposed GMT1 to CD5 pipeline and follow a roughly direct route from GMT1 pad to the east-northeast, immediately north of several lakes, until reaching the Tiŋmiaqsiġvik (Ublutuoch) River.

The road crosses the Tiŋmiaqsiġvik (Ublutuoch) River with a proposed 350-foot-long bridge, then runs roughly north and curves to the east, connecting to the CD5 access road. Under Alternative A (as well as B and C), the CD5-GMT1 gravel road would cross through the Fish Creek setback and the Tiŋmiaqsiġvik (Ublutuoch) River setback.

BLM protective and mitigation measures (BMPs) from BLM (2013) apply in select biologically sensitive areas. These measures designate setback areas for many major waterways. The Fish Creek (3-mile setback) and Tiŋmiaqsiġvik (Ublutuoch) River (0.5-mile setback) are the only such waterways recognized as “biologically sensitive” by BLM (2013) in the GMT1 Project vicinity.

As stated above, the CD5-GMT1 road would cross over a section of the CD5 and GMT1 pipelines, where the GMT1 road would connect to the CD5 access road, and near the GMT1 pad.

2.5.2.1 Bridges and Culverts

Bridges are proposed for the two anadromous waterway crossings along the CD5-GMT1 gravel road: a 350-foot-long bridge crossing the Tiŋmiaqsiġvik (Ublutuoch) River and a 40-foot-long bridge crossing Crea Creek (ADF&G 2013a). The State has collaborated with CPAI on the bridge design, which involved extensive data collection and studies as well as modeling for flood events. As a result, the bridge abutments for the currently designed Tiŋmiaqsiġvik (Ublutuoch) River bridge are proposed to be on the banks of the river, as opposed to in the channel (Morris 2014).

Culverts would be placed in the road to maintain natural surface drainage patterns. The typical design of culverts and culvert batteries is shown in Appendix A, Sheets 31 through 33 of 33. Culvert(s) will be installed at Barely Creek, between Crea Creek and the Tiŋmiaqsiġvik (Ublutuoch) River to maintain flow. Preliminary culvert locations for cross-flow will be selected based on aerial photography. CPAI (or its contractor) will then walk the road alignment to optimize final culvert locations, noting low areas where culverts are needed, and review the data with the State of Alaska/ADF&G (permitting agency) for concurrence. Thus, the final design for the size, number, and location of the culverts will be complete after the field survey is completed. ADF&G has noted that some culverts may be closer than the 500 feet spacing used in the SEIS, as is common on roads associated with oil and gas development on the North Slope. The culverts would be installed per the final design prior to breakup of the first construction season, but additional culverts may be placed after breakup as site-specific needs are further assessed with the ADF&G.

Tiŋmiaqsiġvik (Ublutuoch) River Bridge

The proposed crossing of Tiŋmiaqsiġvik (Ublutuoch) River would utilize a bridge constructed of five sets of four 32-inch pilings (for a total of 20) positioned approximately 85 feet apart (Appendix A, Sheets 27 through 29 of 33). The bridge deck would be elevated approximately 26 feet BP Mean Sea Level (BPMSL)[2], made of 31-foot-wide precast concrete slabs, and equipped with removable guardrail. The bridge would be designed to carry a drill rig. The pipelines would be on structural steel supports attached to the bridge girders, below the bridge deck. Sheet pile abutments for erosion protection would be at each end of the bridge.

The 350-foot-long Tiŋmiaqsiġvik (Ublutuoch) River bridge would extend bank to bank, and is designed to avoid impacts to the main channel and be wide enough to span a 50-year flood (approximately 10.9 feet BPMSL). The main channel is on the eastern side and has a typical summer water level of approximately 1 foot BPMSL. No piers will be within the main channel, resulting in a span over this channel of 93 feet. See Appendix A for construction details.

The current bridge design and location has been developed based on input from many entities, including Kuukpik Subsistence Oversight Panel (KSOP), state agencies, and federal agencies. The location was selected based upon CPAI’s best engineering practice, ADF&G review and

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[2] BPMSL vertical datum is the 1968 East Dock Mean Sea Level as established by tidal observations by F.M. Lindsey and Associates.

KSOP input. The current bridge length allows the abutments to be located above the high-water banks and outside of the normal floodplain. Sheet pile abutments are utilized in order to conform to the 2004 ASDP-A ROD stipulations. Span lengths were developed, again with input from KSOP, to balance the technical needs of a drill-rig capable structure while protecting the environment (aquatic species, willows, etc.) and to provide navigational clearance in the summer water channel. The bridge height was also set to provide 15 feet of clearance above the summer water level based upon vessel criteria provided by KSOP. The bridge design itself is modeled after CD5 and is typical of North Slope Bridge design capable of supporting the weight of mobile drill rigs (DeGeorge 2014c).

Additional information about the design of stream and river crossings is presented in Section 4.2.2, *Water Resources*.

Tiŋmiaqsiġvik (Ublutuoch) River Bridge Construction

Construction of the 350-foot Tiŋmiaqsiġvik (Ublutuoch) River bridge is a major component of the GMT1 Project that would occur over one winter construction season. Due to its size and the complexity of construction activities, it may be necessary to temporarily place equipment and materials, and to perform certain construction activities on the river ice. To facilitate this, ice would be thickened across the entire width of the channel for a length of approximately 200 feet upstream and downstream of the bridge (forming an ice bridge). Traction material such as nut plug (traction material made of ground walnut or pecan hulls and sand) may be used on channel ice for safety purposes to prevent slips. Soil cuttings from installation of the piers would be disposed of at the mine site and traction material, if used, would be collected prior to closing out the site at the end of the construction season, before the ice bridge thaws. Thickened ice required for placement of the bridge structure will be slotted or removed prior to breakup.

Due to safety and logistical concerns, CPAI has requested a deviation from BLM BMP A-5 to refuel equipment on the channel ice. Appropriate spill containment and CPAI's BMP would be used for all refueling. Mixing of grout and concrete will be performed on channel ice with containment beneath these operations.

Crea Creek Bridge

Under Alternatives A (and C), the 40-foot-long Crea Creek bridge would be constructed using two sets of four pilings (for a total of eight) positioned approximately 40 feet apart with sheet pile abutments for erosion protection at each end of the bridge. The bridge deck would have a removable guardrail and would be designed to support a drill rig. The opening for water flow would be 25 feet wide. The Crea Creek bridge design is shown in Appendix A, Sheet 30 of 33. The pipeline would cross Crea Creek on VSMs spanning the creek, downstream of the bridge.

Additional information about the design of stream and river crossings is presented in Section 4.2.2, *Water Resources*.

2.5.3 Gravel Requirements

Under Alternative A, a total of approximately 628,050 cubic yards of material required for this project would be used to fill approximately 72.7 acres. Table 2.5-2 lists the amount of material that would be used for project components.

Table 2.5-2. Gravel Use for Alternative A

Facility	Footprint (Acres)	Fill Quantity (Cubic Yards)	Notes/dimensions
GMT1 Pad	11.8	131,000	290 feet to 463 feet wide by 1,200 feet long
Access Road [a]	60.1 [b]	488,000	7.6 miles long; 32 feet crown width and minimum 5 feet thickness
Road Pullouts / VSMs	1.0	2,550	Pullouts are 0.3 acre each (x3) = 0.9 acre VSMs GMT1-CD5 = 0.07 acre VSMs CD4N-CD1 = 0.03 acre
Valve Pads (east and west)	0.7	6,500	Each pad is 100 feet x 100 feet; with 20 feet x 25 feet extension.
Total Gravel Requirement for GMT1	72.7	628,050	Pads and roads

Note:

Values are approximate and may change during final design.

[a] Appendix A, Sheet 5 of 33

[b] Acreage for road pullouts are included in access road footprint.

2.5.4 Water Use

Fresh water would be required for domestic use at remote construction camps and for construction and maintenance of ice roads and ice pads. Potable water requirements are based on a demand of 100 gpd per person (estimated up to 100 people at a remote camp), totaling approximately 10,000 gpd during construction seasons. A total of 305 people or more may be needed during Year 1 for construction activities for Alternative A. If several additional camps were in place approximately 30,000 to 40,000 gpd would be required. Freshwater may be used for hydrostatic testing. Approximately 1.5 MG of water per mile are used for ice road construction and maintenance. Ice roads would typically be available for use 90 days each winter season.

Under Alternative A, approximately 45 miles of ice road would be required (67.5 MG) during Year 1 of construction for the GMT1 Project. During Year 2 of construction, approximately 36 miles of ice road would be required (up to 54 MG), assuming the Tiŋmiaqsiġvik (Ublutuoch) River bridge is completed in 2016. Ice pad footprints for Alternative A would be 130 acres in Year 1 and 55 acres in Year 2 construction seasons, equivalent to 32.5 MG and 13.8 MG, respectively.

Drilling water requirements, including drill rig camp personnel water usage, are 2 MG per well at a rate of eight wells per year, equaling 16 MG per year for four years. Water requirements for the rig camp and miscellaneous water needs are 2.7 MG per year for four years. Water for construction and maintenance of ice roads and pads would be withdrawn from lakes in the vicinity of the GMT1 Project as authorized by State of Alaska temporary water use permits and fish habitat permits where necessary. Table 2.5-3 provides the expected water use for Alternative A.

Table 2.5-3. Water Use for Alternative A, Proposed Action

Construction Phase	Alternative A
Ice Roads (miles) Year 1 Year 2	 45.0 36.0
Ice Roads (MG) [a] Year 1 Year 2	 67.5 54.0
Ice Pads (MG) Year 1 Year 2	 32.5 13.8
Construction Miscellaneous (MG) Year 1 Year 2	 1.0 1.0
Workforce (MG) Year 1 Year 2	 3.6 3.6
Summer Construction Workforce (MG) Year 1 Year 2	 --- 1.35
Construction Total (MG) Year 1 Year 2	 104.6 73.8
Drilling Phase (Years 3-6)	
Drilling Ice Pad [b] (MG)	4.0
Drilling Water [c] (MG)	16.0
Camp Water – Rig Camp and GMT1 Pad Drilling Staff [d] (MG)	2.7
Drilling Miscellaneous (MG)	1.0
Drilling Years	4 years
Drilling Total Per Year (MG)	23.7
Drilling Total MG	**94.8**
Post-Construction Operations (Beginning Year 3)	
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	9.5
Camp Support	--
Number of Post Construction Operation Years [f]	9
Total Per Year (MG)	9.5
Total MG	**88.5**
Alternative A Totals (MG)	
Construction	178.4
Drilling	94.8
Operations	85.5
Total Water Use	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well.

[d] A 75-man drill rig support camp would be required.

[e] In addition to the ice road water use, 0.5 MG per year is included for miscellaneous ice pad use.

[f] Ice roads are assumed to be developed during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

2.5.4.1 Ice Road and Pad Construction

Ice roads would be constructed to access the gravel source and construction areas (e.g., road, bridges, drill pad, and pipelines). Proposed ice road routes for Alternative A (proposed project) are depicted on Map 2.5-4. Separate ice roads are required for pipeline construction, gravel placement, and general traffic.

During Year 1 of construction, ice pads would be built at the gravel source, gravel haul route, slurry plant and laydowns for the two bridges, totaling approximately 130 acres. During Year 2 of construction, ice pads would be built at both ends of the pipeline route, plus an additional pad for construction laydown, totaling about 50 acres. All action alternatives would include a 5-acre ice pad for each year of drilling.

Resupply ice roads will be constructed during the operating period. Ice roads will be constructed annually for the four years of drilling (Years 3 through 6) and once every five years between Years 5 and 30. Resupply ice roads are required to move heavy/wide equipment, which cannot be transported over the CD5 bridges.

2.5.5 Access

Vehicle and aircraft traffic for Alternative A is discussed below. Traffic for Alternatives B and C, for both vehicles and aircraft, are expected to be similar. Table 2.5-4 lists estimated vehicle traffic trips that would be required for Alternative A.

Table 2.5-5 lists estimated aircraft traffic that would be required from construction to the end of project life for Alternative A.

2.5.5.1 Vehicle Traffic

Under Alternative A, personnel, equipment, and materials would be transported overland on snow trails, ice roads, and on the gravel CD5-GMT1 road, once it is constructed.

In 2015, traffic would occur via snow trail only in December and would be associated with pre-construction activity and pre-packing snow in preparation for ice road construction, beginning in Year 1 (2016). Light commercial trucks would make 368 trips (a “trip” is defined as one-way transit) and single unit short-haul trucks would make 1,120 trips in December 2015.

In 2016, Alternative A traffic would be the most intense for the entire project, with construction ongoing for the gravel road and pad. Gravel hauling would occur January through April, with the most single unit short-haul truck trips in January (22,036), and trips over the ice road would decrease through February, March, and April (11,986 trips in April). During the first quarter of 2016, CPAI plans to construct the gravel road and pad, bridge piers substructure and superstructure. In addition, there would be approximately 1,204 to 1,505 trips for single unit short-haul trucks in June through August. Other traffic in 2016 would be via light commercial truck (January through August and again in December), with the most trips in March (4,568 trips). Intercity bus would transport personnel (January through April and June through August) with most trips in February and March via ice road (784 each month).

In 2017, traffic would occur on the ice roads and the CD5-GMT1 gravel road. Vehicles would support pipeline and facilities construction and the beginning of drilling. The most trips would be via single unit short-haul trucks in January (15,414 trips). This type of traffic would continue at somewhat less frequency through April (3,570 trips). Single unit short-haul truck trips would decrease significantly in May (879) and continue at numbers ranging from 942 per month (June and August) to 753 per month (July, September, October and November) to the end of the year. Intercity bus traffic follows a similar pattern with the most trips in January (994), decreasing through April (812) and would decrease again to numbers ranging from 287 (May) to 56 (December). Passenger truck trips would occur January through April with trip numbers ranging from 315 (March) to 126 (April).

In 2018, drilling would be ongoing and vehicle traffic would be at levels greatly reduced from previous years. The numbers of trips for light commercial trucks would range from 1,156 to 1,445 January through December. Single unit short-haul truck trips would vary between 597 and 747 January through December. Post-construction traffic along the annual ice road would consist of intercity buses (224), light commercial trucks (271), and single-unit, short-haul trucks (3,827).

Table 2.5-4. Vehicle Trips [a] Required per Month from 2015-2018 for Alternative A

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Ice Road	Totals
2015														
Intercity Bus												0		0
Light Commercial Truck												368		368
Single Unit Short-Haul Truck												1,120		1,120
Passenger Truck												0		0
Total												**1,488**		**1,488**
2016														
Intercity Bus	616	784	784	504	0	112	112	140	0	0	0	0		3,052
Light Commercial Truck	2,486	3,560	4,568	3,258	420	756	784	980	0	0	0	368		17,180
Single Unit Short-Haul Truck	22,036	15,036	13,524	11,986	0	1,204	1,204	1,505	0	0	0	1,120		67,615
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	**25,138**	**19,380**	**18,876**	**15,748**	**420**	**2,072**	**2,100**	**2,625**	**0**	**0**	**0**	**1,488**		**87,847**
2017														
Intercity Bus	994	980	1,225	812	287	280	224	280	224	224	224	56		5,810
Light Commercial Truck	3,347	3,308	4,135	2,691	2,338	2,450	1,960	2,450	1,960	1,960	1,960	1,655		30,214
Single Unit Short-Haul Truck	15,414	4,872	6,090	3,570	879	942	753	942	753	753	753	789		36,510
Passenger Truck	168	252	315	126	0	0	0	0	0	0	0	0		861
Total	**19,923**	**9,412**	**11,765**	**7,199**	**3,504**	**3,672**	**2,937**	**3,672**	**2,937**	**2,937**	**2,937**	**2,500**		**73,395**
2018														
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	224	224
Light Commercial Truck	1,156	1,156	1,445	1,156	1,445	1,156	1,156	1,445	1,156	1,156	1,156	1,156	271	15,010
Single Unit Short-Haul Truck	597	597	747	597	747	597	597	747	597	597	597	597	3,827	11,441
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,753**	**1,753**	**2,192**	**1,753**	**2,192**	**1,753**	**1,753**	**2,192**	**1,753**	**1,753**	**1,753**	**1,753**	**4,322**	**26,675**

[a] A vehicle “trip” is defined as one-way transit.

2.5.5.2 Aircraft Traffic

Aircraft traffic would support transportation of work crews, materials, and equipment from Fairbanks, Anchorage, or Deadhorse. Under Alternatives A and B, aircraft would utilize the existing APF airstrip. Flights would primarily support personnel and equipment transport required for construction and the start of drilling. Flight estimates for Alternative A in Table 2.5-5 are representative of flight estimates for Alternatives B and C (Table 2.6-4 and Table 2.7-4, respectively). A “flight” is defined as a one-way transit.

Once construction of the GMT1 road and pad are complete, 115 additional flights would consist of six additional fixed-wing flights and 109 helicopter flights to support special studies. Operation and maintenance would be primarily handled by staff at the existing APF (CD1), who would travel by road. Some of the hydrological studies would be conducted using boats launched from the road system.

Fixed-wing flights landing at APF under Alternative A (B and C comparable) would generally originate from Deadhorse (as they currently do), with possible support with flights originating from Fairbanks and Anchorage. An exception would be C-130 flights which may originate in Kotzebue, Anchorage, or Kenai. CPAI also expects that helicopter operations would be based at APF – flights would originate from and return to APF as a home base for operations and maintenance (DeGeorge 2014b). A description of aircraft traffic by project year is provided below.

In 2016, between 5 and 15 Otter/CASA flights would be required each month to support construction. Helicopter flights would occur May through September to support special studies. Most helicopter flights would occur in June (145 flights).

In 2017, aircraft traffic is expected to be similar to that estimated for 2016.

In 2018, six DC-6 flights are anticipated (one each alternate month, starting in January). Helicopter flights supporting special studies would be significantly reduced compared to previous years because some of the special studies would be conducted from access provided by the CD5-GMT1 road. Helicopter flights would occur May through September, with a maximum of 44 flights in June.

For 2019 and beyond, Alternative A (B and C comparable) would have a 4 percent increase in total flights above baseline, including an approximate 7 percent increase in helicopter flights for special studies in the NPR-A which would occur from June through September.

Aircraft would maintain altitude of 1,000 feet or more except during takeoff and landing (within 3.6 miles of the airstrip). Flight paths would depend on prevailing winds, but would generally align with the airstrip orientation.

Table 2.5-5. Flight Requirements for Alternative A [a, b]

	January	February	March	April	May	June	July	August	September	October	November	December	Totals	June – Sept Totals
2016														
Otter/CASA	5	10	10	10	10	15	15	10	10	10	10	10	125	50
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
2017														
Otter/CASA	5	5	5	5	10	10	10	10	10	10	5	5	90	40
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777
2018														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
2019 and Beyond														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564

[a] A, B, and C would be at the same levels (above current baseline): Alternative A drilling needs would be handled by flights that are already part of the ongoing operations. No additional flights are anticipated. Once construction of the CD5-GMT1 gravel road and pad are complete there would be no need for routine additional fixed-wing flights as operation and maintenance would be handled by staff at the existing Alpine Facility (CD1) who would travel by road. The planned order of construction is as follows: January – May 2016, ice roads, bridges, and gravel roads. Summer 2016, gravel work, CD5 pad, and APF work. January – May 2017, ice roads, pipelines, GMT1 pad, and VSM work. Summer (and possibly fall) 2017, GMT1 modules, pipe rack, pipeline hydro-test, and tie-ins. Fall 2017, drilling and well tie-ins. Special studies above the baseline would be primarily in support of environmental studies and surveying. Helicopter visits to spill response equipment related to the GMT1 development have been estimated and included in these values.

[b] A “flight” is defined as a one-way transit.

2.6 Alternative B: BLM Preferred Alternative

In 2004, the Alternative B theme was "Conformance with Stipulations," specifically directed at complying with three stipulations in place in 2004 requiring an exception, as described in Section 2.1. Alternative B for the current SEIS has been updated since 2004 in the following ways:

The current Alternative B is based on keeping all GMT1-related infrastructure out of the Fish Creek setback. BLM's BMP/Lease Stipulation K-1(e) for oil and gas development in the NPR-A, which prohibits permanent oil and gas facilities, including gravel pads, roads, and pipelines, within a three-mile setback in the streambed and adjacent to Fish Creek. In consultation with residents of Nuiqsut and the NSB, the BLM established the three-mile Fish Creek setback in the 1998 Northeast NPR-A ROD to protect important subsistence activities and resources. In 2013, when BLM adopted its new ROD for the NPR-A, BLM maintained the Fish Creek setback.

Alternative B is very similar to Alternative A, as it would involve essentially the same drill site location and facility design – the main difference between the two alternatives is the location of the road and pipeline. Under Alternative B, through the wet thaw basin area, the pipeline would be located south of the road, which would allow the road to act as a barrier to protect the lakes (L9820 and L9819) in the event of a potential pipeline spill.

It is assumed that all other components of construction, drilling, and operations, except for the bridge over Crea Creek and the additional tie-in, described in Section 2.5 for CPAI's proposed Alternative A are the same for Alternative B. Ice roads and pads would support construction of the road and pipeline along the corridor described and shown in Map 2.6-2. Vehicle and aircraft traffic are expected to be the same as Alternative A.

The main aspects of Alternative B which differ from Alternative A are as follows:

- Alternative B GMT1 pad is the same size and configuration as Alternative A, but the pad is flipped, and is located approximately 700 feet to the southwest in comparison to the Alternative A location.
- Alternative B routes the access road and pipeline from GMT1 to CD5 south of the Fish Creek setback
- The GMT1 pipeline would tie in to the CD5 road and pipeline east of the CD5 drill site at a new tie-in pad, as depicted in Map 2.6-1, and described below.
- Alternative B would eliminate the need for a bridge over Crea Creek and a culvert at Barely Creek.
- Alternative B will have a slightly larger footprint and greater fill requirement than the Alternative A route, as summarized in Table 2.6-1.
- The Alternative B route may be more technically challenging for road construction and maintenance (e.g., poor soils, thaw stability) due to the extent of thaw basins along the route.

Table 2.6-1 provides the major infrastructure components of Alternative B. Alternative A, Proposed Action components are provided for comparison purposes.

Table 2.6-1. Infrastructure for Alternative B, BLM Preferred compared to Alternative A, Proposed Action

Component	Alternative B BLM Preferred	Alternative A Proposed Action
Gravel Drill Pad	11.8 acres	11.8 acres
Wells	33	33
Access Roads	8.6 miles	7.6 miles
Road Pullouts	0.9 acre	0.9 acre
Elevated Pipelines on VSMs	8.6 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5 18.2 total miles	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5
Manual Valve Gravel Pads	2 (0.35 acre each)	2 (0.35 acre each)
Bridges	1 Tiŋmiaqsiġvik (Ublutuoch) – 350 ft	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	ASRC Mine site	ASRC Mine site
Total Gravel Footprint	80.4 acres	72.7 acres
Ice Road	36 to 43 miles	36 to 45 miles

The BLM (2004) determined that it is technically infeasible to locate all facilities at least 500 feet from a water body. Thus, Alternative B in the SEIS does not keep all facilities and infrastructure at least 500 feet from a water body, similar to Alternative A. (Note: the term "body of water or water body" is defined in BLM [1998a, p. 29; 2008a, p. 33; and 2013, p.40], as "*a lake, river, stream, creek, or pond that holds water throughout the summer and supports a minimum of aquatic life*.")

The BLM (2004) alternatives did not consider the Fish Creek setback extending into Kuukpik land. Kuukpik land is private land that is not subject to the Fish Creek setback. BLM does not have authority to enforce BMPs on private lands.

2.6.1 Location

The proposed Alternative B GMT1 pad is located in Section 6, T10N, R3E UM at latitude 70.2543 and longitude -151.4835. The pipeline corridor crosses through Sections 4 and 6, T10N, R3E UM; Sections 24 through 26 and 31 through 35, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM. The road corridor crosses through Section 6, T10N, R3E UM; Sections 24 through 26 and 31 through 35, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM.

2.6.2 Infrastructure Development

The CD5-GMT1 road and pipeline would be located south of the Fish Creek setback. After completing additional mapping and GIS analysis, BLM determined that the road and pipeline route proposed for Alternative B would be curvier than shown on maps in the Draft SEIS, to avoid lakes and thaw basins, and as a result would be somewhat longer than the alternatives (A, C, D1, and D2).

Additional analysis also demonstrates that while the separation between the road and pipeline under Alternative B would generally be at least 500 feet for most of the road that lies within BLM-managed lands, certain sections of the road would be closer to the pipeline than 500 feet due to topography. BLM's BMP E-7 (c) requires a 500-foot minimum distance between roads and pipelines to minimize disruption of caribou movement and subsistence use. The route depicted in Map 2.6-1 is based on topographic maps available to BLM at the time of the Final SEIS publication. CPAI has not yet surveyed the Alternative B road route, and will be required to do whatever is technically feasible to maintain a 500-foot separation between the road and pipeline during survey and construction of the road. Similar to Alternative A, the road and pipeline would be closer together than 500 feet when crossing over a bridge.

Alternative B would have pullouts along the road to allow local residents to access the area for subsistence use as discussed in Section 2.5. Pullout locations have not been identified. The configuration of the road under Alternative B also requires the additional approximately 0.7-acre tie-in pad, southeast of the CD5 drill site. The tie-in pad would be required for additional automatic shut-off valves, pipeline pigging capability, and valve maintenance activity with vehicular access. This location was identified to avoid having the pipeline from GMT1 tie-in to CD5 within the Fish Creek setback. However, CD5 is located on Kuukpik-owned lands, thus, BLM does not have jurisdiction to apply the setback to that area.

As a result, Alternative B will have a slightly larger footprint and greater fill requirement than the Alternative A development, as summarized in Table 2.6-1. This route is technically challenging for road construction and maintenance (e.g., poor soils, thaw stability) due to the extent of thaw basins along the route. This route would also be approximately 8.6 miles long (approximately 1 mile longer than Alternative A).

2.6.3 Water Use

Table 2.6-2 provides the expected water use for Alternative B. Alternative A numbers are provided for comparison.

Table 2.6-2. Water Use for Alternative B Compared to Alternative A, Proposed Action

Construction Phase	Alternative B	Alternative A
Ice Roads (miles)		
Year 1	43.0	45.0
Year 2	36.0	36.0
Ice Roads (MG) [a]		
Year 1	64.5	67.5
Year 2	54.0	54.0
Ice Pads (MG)		
Year 1	32.5	32.5
Year 2	13.8	13.8
Construction Miscellaneous (MG)		
Year 1	1.0	1.0
Year 2	1.0	1.0
Workforce (MG)		
Year 1	3.6	3.6
Year 2	3.6	3.6
Summer Construction Workforce (MG)		
Year 1	---	---
Year 2	1.35	1.35
Construction Total (MG)		
Year 1	101.6	104.6
Year 2	73.8	73.8
Drilling Phase (Years 3-6)		
Drilling Ice Pad [b] (MG)	4.0	4.0
Drilling Water [c] (MG)	16.0	16.0
Camp Water – Rig Camp and GMT1 Pad Drilling Staff [d] (MG)	2.7	2.7
Drilling Miscellaneous (MG)	1.0	1.0
Drilling Years	4 years	4 years
Drilling Total Per Year (MG)	23.7	23.7
Drilling Total MG	**94.8**	**94.8**
Post-Construction Operations (Beginning Year 3)		
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	9.5	9.5
Camp Support (MG)	--	--
Number of Post Construction Operation Years [f]	9	9
Total Per Year (MG)	9.5	9.5
Total MG	**88.5**	**88.5**
Alternative B Totals (MG)		
Construction	175.4	178.4
Drilling	94.8	94.8
Operations	85.5	85.5
Total Water Use	**355.7**	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed for all alternatives (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well for Alternatives A and B.

[d] Alternatives A and B would have a 75-man drill rig support camp.

[e] In addition to the ice road water use in this column, each alternative includes 0.5 MG per year for miscellaneous ice pad use.

[f] Ice roads are assumed to be developed for Alternatives A and B during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

2.6.4 Gravel Requirements

Under Alternative B, a total of approximately 684,550 cubic yards of material required for this project would be used to fill approximately 80.4 acres. This would be about 56,500 cubic yards and 7.6 acres more than Alternative A.

2.6.5 Access

Vehicle and aircraft traffic for Alternative B is expected to be similar to that for Alternative A. Alternative B has the CD5-GMT1 road, with aircraft traffic going into the APF airport. Alternative B vehicle traffic is presented in Table 2.6-3. Alternative B aircraft traffic is presented in Table 2.6-4.

Table 2.6-3. Vehicle Trips Required per Month from 2015-2018 for Alternative B (same as Alternative A)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Ice Road	Totals
2015														
Intercity Bus												0		0
Light Commercial Truck												368		368
Single Unit Short-Haul Truck												1,120		1,120
Passenger Truck												0		0
Total												**1,488**		**1,488**
Alternative A Total												*1,488*		*1,488*
2016														
Intercity Bus	616	784	784	504	0	112	112	140	0	0	0	0		3,052
Light Commercial Truck	2,486	3,560	4,568	3,258	420	756	784	980	0	0	0	368		17,180
Single Unit Short-Haul Truck	22,036	15,036	13,524	11,986	0	1,204	1,204	1,505	0	0	0	1,120		67,615
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	**25,138**	**19,380**	**18,876**	**15,748**	**420**	**2,072**	**2,100**	**2,625**	**0**	**0**	**0**	**1,488**		**87,847**
Alternative A Total	*25,138*	*19,380*	*18,876*	*15,748*	*420*	*2,072*	*2,100*	*2,625*	*0*	*0*	*0*	*1,488*		*87,847*
2017														
Intercity Bus	994	980	1,225	812	287	280	224	280	224	224	224	56		5,810
Light Commercial Truck	3,347	3,308	4,135	2,691	2,338	2,450	1,960	2,450	1,960	1,960	1,960	1,655		30,214
Single Unit Short-Haul Truck	15,414	4,872	6,090	3,570	879	942	753	942	753	753	753	789		36,510
Passenger Truck	168	252	315	126	0	0	0	0	0	0	0	0		861
Total	**19,923**	**9,412**	**11,765**	**7,199**	**3,504**	**3,672**	**2,937**	**3,672**	**2,937**	**2,937**	**2,937**	**2,500**		**73,395**
Alternative A Total	*19,923*	*9,412*	*11,765*	*7,199*	*3,504*	*3,672*	*2,937*	*3,672*	*2,937*	*2,937*	*2,937*	*2,500*		*73,395*
2018														
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	224	224
Light Commercial Truck	1,156	1,156	1,445	1,156	1,445	1,156	1,156	1,445	1,156	1,156	1,156	1,156	271	15,010
Single Unit Short-Haul Truck	597	597	747	597	747	597	597	747	597	597	597	597	3,827	11,441
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,753**	**1,753**	**2,192**	**1,753**	**2,192**	**1,753**	**1,753**	**2,192**	**1,753**	**1,753**	**1,753**	**1,753**	**4,322**	**26,675**
Alternative A Total	*1,753*	*1,753*	*2,192*	*1,753*	*2,192*	*1,753*	*1,753*	*2,192*	*1,753*	*1,753*	*1,753*	*1,753*	*4,322*	*26,675*

Table 2.6-4. Flight Requirements for Alternative B [a]

	January	February	March	April	May	June	July	August	September	October	November	December	Totals	June – Sept Totals
2016														
Otter/CASA	5	10	10	10	10	15	15	10	10	10	10	10	125	50
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
2017														
Otter/CASA	5	5	5	5	10	10	10	10	10	10	5	5	90	40
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777
2018														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
2019 and Beyond														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564

[a] A, B, and C would be at the same levels (above current baseline): Drilling needs would be handled by flights that are already part of the ongoing operations. No additional flights are anticipated. Once construction of the CD5-GMT1 gravel road and pad are complete there would be no need for routine additional fixed-wing flights as operation and maintenance would be handled by staff at the existing Alpine Facility (CD1) who would travel by road. The planned order of construction is as follows: January – May 2016, ice roads, bridges, and gravel roads. Summer 2016, gravel work, CD5 pad, and APF work. January – May 2017, ice roads, pipelines, GMT1 pad, and VSM work. Summer (and possibly fall) 2017, GMT1 modules, pipe rack, pipeline hydro-test, and tie-ins. Fall 2017, drilling and well tie-ins. Special studies above the baseline would be primarily in support of environmental studies and surveying. Helicopter visits to spill response equipment related to the GMT1 development have been estimated and included in these values.

2.7 Alternative C

Alternative C is included in the SEIS to evaluate impacts to Nuiqsut in the event the village is used as a hub for industrial activity. Given Nuiqsut's proximity to oil development, BLM determined that it was worthwhile to analyze impacts that may affect the village and its residents, as a result of both GMT1 and future development in the area. Kuukpik Corporation, the land owner of the Nuiqsut Spur Road, stressed in its public comments that it would not allow widening of the Nuiqsut Spur Road to make adoption of this alternative feasible. The NVN, a cooperating agency on this SEIS, encouraged BLM to carry this alternative forward from the 2004 EIS. NVN expressed interest in the economic benefits which could potentially arise as the result of using Nuiqsut as a “hub” for industrial activity. Aside from analyzing social impacts, Alternative C may also provide an environmental benefit by keeping some aircraft and vehicle traffic out of the Colville River delta, where APF is located. As described earlier in Chapter 2, CPAI informed BLM that it intends to use the APF airstrip, regardless of whether Alternative C were selected and the Nuiqsut Airport upgraded.

Alternative C would feature the same GMT1 pad location and facility design, as well as the same route for the access road and pipeline to CD5 as described for Alternative A. Additional features of Alternative C, not required for Alternative A, are shown in Map 2.7-1, and described below:

- Upgrade of the Nuiqsut Spur Road, which is a 5.8-mile, 24-foot-wide road (crown width) between the CD5 access road to the Nuiqsut Dump Road, to a 32-foot-wide road (crown width). The Nuiqsut Spur Road is on land owned by Kuukpik Corporation.
- The upgrade of the Nuiqsut Dump Road is a proposed improvement as part of the Nuiqsut Spur Road Project, which would construct a 24-foot-wide roadway over the existing road surface. Alternative C would further upgrade this road to a 32-foot-wide roadway between the intersection of the Nuiqsut Spur Road and the new airport access road. This upgrade would also require upgrading of culverts along the road.
- Construction of an approximately 1.2-mile new airport access road between the Nuiqsut Dump Road and a new logistics pad at the Nuiqsut Airport. The roadway would be 32-feet wide.
- Construction of a 400-foot x 400-foot (3.7 acres) logistics pad with a 1.4-acre taxiway-apron connecting to the existing airstrip. The logistics pad would include areas for vehicle storage, warehouse, and fuel storage and dispensary.
- Construction of a 500-foot extension of the existing runway on the west end, resulting in an approximately 1.6 acres of footprint and one additional bridge to support the extension.
- Upgrade of the Nuiqsut Airport would allow for its use as a logistics center for the GMT1 Project whereby personnel and certain supplies would be brought to Nuiqsut rather than to APF, then transported to GMT1 by road vehicles. The Nuiqsut Airport has an unattended 4,589-foot gravel runway. For comparison, the APF runway is a 5,000-foot gravel runway.

Table 2.7-1. Infrastructure for Alternative C Compared to Alternative A, Proposed Action

Component	Alternative C	Alternative A Proposed Action
Gravel Drill Pad	11.8 acres	11.8 acres
Wells	33	33
Access Roads **Road Upgrades**	7.6 miles (GMT1 to CD5) Widen 5.8 mile Nuiqsut Spur Road from 44 foot-wide base to 52 foot-wide base Upgrade Nuiqsut Dump Road from 44 foot-wide base to 52 foot base Construct new airport access road of 1.2 miles with 52 foot-wide base	7.6 miles (GMT1 to CD5)
Road Pullouts	0.9 acre	0.9 acre
Elevated Pipelines on VSMs	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5 17.9 total miles	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5
Manual Valve Gravel Pads	2 (0.35 acre each)	2 (0.35 acre each)
Bridges	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	ASRC Mine site	ASRC Mine site
Total Gravel Footprint	105.8 acres [a]	72.7 acres
Ice Roads	30 to 50 miles	36 to 45 miles
Other Upgrades	Construct a 3.7 acre logistics pad with a 1.4 acre taxiway-apron Construct a 500 foot extension (1.6 acre) of existing runway at Nuiqsut Airport	

[a] Acreage for road pullouts are included for Alternatives A and C.

Alternative C would have a larger footprint than Alternative A, therefore requiring additional fill (see Table 2.7-1).

2.7.1 Location

The proposed Alternative C GMT1 pad is located in Section 6, T10N, R3E UM, and Section 31, T11N, R3E, at latitude 70.2565 and longitude -151.4810. The pipeline corridor crosses through Section 6, T10N, R3E UM; Sections 24 through 29 and 31 through 32, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM. The road corridor crosses through Sections 24 through 28 and 31 through 33, T11N, R3E UM, and Sections 18 and 19, T11N, R4E UM.

2.7.2 Infrastructure Development

The Nuiqsut Spur Road was proposed by Kuukpik Corporation to provide better access to oilfield facilities for potential economic gain (e.g., training, jobs, and services) and to increase subsistence user access to resources by providing increased road access (Corps 2013b, pp. 2 and 3). The project consists of both a road and an approximately 11-acre gravel lay down pad. The Nuiqsut municipal boundaries and how it factors into the spur road widening are out of the BLM's purview (since no BLM managed land is affected).

Existing infrastructure at Nuiqsut includes limited lodging and stores; upgrading these facilities is not part of Alternative C. The Nuiqsut runway is lighted and used year-round. Northern Air Cargo (NAC) operates regularly scheduled cargo flights to Deadhorse with connecting flights to Nuiqsut. RAVN Alaska (formerly ERA Aviation) operates regularly-scheduled flights into Nuiqsut originating from Anchorage, Fairbanks, Barrow, and Deadhorse. Daily flights from Barrow and Deadhorse are supplemented with an additional flight on Monday, Wednesday, and Friday (RAVN Alaska 2014). An increase in flight operations at Nuiqsut could be expected under Alternative C, if CPAI uses Nuiqsut airport for the GMT1 Project. Flights into Nuiqsut could be used for transport of personnel, materials, parts, food, camp supplies and to meet other support needs at the GMT1 site. A logical result would be diversion of some flights from APF to Nuiqsut, resulting in reduced air traffic in the area of APF.

2.7.3 Water Use

Table 2.7-2 provides the expected water use for Alternative C. Alternative A numbers are provided for comparison. Resupply ice roads as discussed in Section 2.5.4.1 are not required for Alternative C.

Table 2.7-2. Water Use for Alternative C Compared to Alternative A, Proposed Action

Construction Phase	Alternative C	Alternative A
Ice Roads (miles)		
Year 1	50.0	45.0
Year 2	30.0	36.0
Ice Roads (MG) [a]		
Year 1	75.0	67.5
Year 2	45.0	54.0
Ice Pads (MG)		
Year 1	32.5	32.5
Year 2	13.8	13.8
Construction Miscellaneous (MG)		
Year 1	1.0	1.0
Year 2	1.0	1.0
Workforce (MG)		
Year 1	3.6	3.6
Year 2	3.6	3.6
Summer Construction Workforce (MG)		
Year 1	---	---
Year 2	1.35	1.35
Construction Total (MG)		
Year 1	112.1	104.6
Year 2	64.8	73.8
Drilling Phase (Years 3-6)		
Drilling Ice Pad [b] (MG)	4.0	4.0
Drilling Water [c] (MG)	16.0	16.0
Camp Water – Rig Camp and GMT1 Pad Drilling Staff [d] (MG)	2.7	2.7
Drilling Miscellaneous (MG)	1.0	1.0
Drilling Years	4 years	4 years

Table 2.7-2. Water Use for Alternative C Compared to Alternative A, Proposed Action (Continued)

Drilling Total Per Year (MG)	23.7	23.7
Drilling Total MG	**94.8**	**94.8**
Post-Construction Operations (Beginning Year 3)		
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	3.5	9.5
Camp Support (MG)	---	---
Number of Post Construction Operation Years [f]	30	9
Total Per Year (MG)	3.5	9.5
Total MG	**105.0**	**88.5**
Alternative C Totals (MG)		
Construction Totals	176.9	178.4
Drilling	94.8	94.8
Operations	105.0	85.5
Total Water Use	**376.7**	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed for all alternatives (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well for Alternatives A and C.

[d] Alternatives A and C would have a 75-man drill rig support camp.

[e] In addition to the ice road water use in this column, each alternative includes 0.5 MG per year for miscellaneous ice pad use.

[f] Ice roads are assumed to be developed for Alternative A during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

2.7.4 Gravel Requirements

Under Alternative C, a total of approximately 862,250 cubic yards of material required for this project would be used to fill approximately 105.7 acres. This would be about 234,200 cubic yards and 33 acres more than Alternative A.

2.7.5 Access

Vehicle and aircraft traffic for Alternative C is expected to be similar to that for Alternative A. Under Alternative C, CPAI would be required to upgrade the Nuiqsut Airport; however, CPAI informed BLM that it would continue to use the APF airport as its base of operations because personnel and equipment are transported to the APF for all of the Alpine Satellites, and housed there and distributed as needed. It would be logistically and financially impractical for CPAI to use separate flights into Nuiqsut, which would solely serve to provide equipment and personnel to the GMT1 pad. For that reason, traffic numbers under Alternative C are the same as those for Alternatives A and B. Alternative C vehicle traffic is presented in Table 2.7-3. Alternative C aircraft traffic is presented in Table 2.7-4. Alternative A numbers are provided for comparison in both tables.

Table 2.7-3. Vehicle Trips Required per Month from 2015-2018 for Alternative C (same as Alternative A)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Ice Road	Totals
2015														
Intercity Bus												0		0
Light Commercial Truck												368		368
Single Unit Short-Haul Truck												1,120		1,120
Passenger Truck												0		0
Total												**1,488**		**1,488**
Alternative A Total												*1,488*		*1,488*
2016														
Intercity Bus	616	784	784	504	0	112	112	140	0	0	0	0		3,052
Light Commercial Truck	2,486	3,560	4,568	3,258	420	756	784	980	0	0	0	368		17,180
Single Unit Short-Haul Truck	22,036	15,036	13,524	11,986	0	1,204	1,204	1,505	0	0	0	1,120		67,615
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	**25,138**	**19,380**	**18,876**	**15,748**	**420**	**2,072**	**2,100**	**2,625**	**0**	**0**	**0**	**1,488**		**87,847**
Alternative A Total	*25,138*	*19,380*	*18,876*	*15,748*	*420*	*2,072*	*2,100*	*2,625*	*0*	*0*	*0*	*1,488*		*87,847*
2017														
Intercity Bus	994	980	1,225	812	287	280	224	280	224	224	224	56		5,810
Light Commercial Truck	3,347	3,308	4,135	2,691	2,338	2,450	1,960	2,450	1,960	1,960	1,960	1,655		30,214
Single Unit Short-Haul Truck	15,414	4,872	6,090	3,570	879	942	753	942	753	753	753	789		36,510
Passenger Truck	168	252	315	126	0	0	0	0	0	0	0	0		861
Total	**19,923**	**9,412**	**11,765**	**7,199**	**3,504**	**3,672**	**2,937**	**3,672**	**2,937**	**2,937**	**2,937**	**2,500**		**73,395**
Alternative A Total	*19,923*	*9,412*	*11,765*	*7,199*	*3,504*	*3,672*	*2,937*	*3,672*	*2,937*	*2,937*	*2,937*	*2,500*		*73,395*
2018														
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	224	224
Light Commercial Truck	1,156	1,156	1,445	1,156	1,445	1,156	1,156	1,445	1,156	1,156	1,156	1,156	271	15,010
Single Unit Short-Haul Truck	597	597	747	597	747	597	597	747	597	597	597	597	3,827	11,441
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,753**	**1,753**	**2,192**	**1,753**	**2,192**	**1,753**	**1,753**	**2,192**	**1,753**	**1,753**	**1,753**	**1,753**	**4,322**	**26,675**
Alternative A Total	*1,753*	*1,753*	*2,192*	*1,753*	*2,192*	*1,753*	*1,753*	*2,192*	*1,753*	*1,753*	*1,753*	*1,753*	*4,322*	*26,675*

Table 2.7-4. Flight Requirements for Alternative C [a]

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Totals**	**June – Sept Totals**
2016														
Otter/CASA	5	10	10	10	10	15	15	10	10	10	10	10	125	50
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
2017														
Otter/CASA	5	5	5	5	10	10	10	10	10	10	5	5	90	40
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777
2018														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
2019 and Beyond														
Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564

[a] Alternatives A, B, and C would be at the same levels (above current baseline): Drilling needs would be handled by flights that are already part of the ongoing operations. No additional flights are anticipated. Once construction of the CD5-GMT1 gravel road and pad are complete there would be no need for routine additional fixed-wing flights as operation and maintenance would be handled by staff at the existing Alpine Facility (CD1) who would travel by road. The planned order of construction is as follows: January – May 2016, ice roads, bridges, and gravel roads. Summer 2016, gravel work, CD5 pad, and APF work. January – May 2017, ice roads, pipelines, GMT1 pad, and VSM work. Summer (and possibly fall) 2017, GMT1 modules, pipe rack, pipeline hydro-test, and tie-ins. Fall 2017, drilling and well tie-ins. Special studies above the baseline would be primarily in support of environmental studies and surveying. Helicopter visits to spill response equipment related to the GMT1 development have been estimated and included in these values.

Under Alternative C, the Nuiqsut Airport would be primarily used instead of the APF to support fixed-wing aircraft, for both existing (baseline) and additional (GMT1 Project) flights. This would potentially reduce air traffic disturbance to subsistence resources and activities in the Colville River delta around APF. Helicopter operations would remain based at APF. A reduction in air traffic at APF is not certain under Alternative C because the Applicant has stated their intention to continue using APF as the primary location for air logistics for the GMT1 Project regardless of alternative. BLM does not have jurisdiction over the Nuiqsut Airport.

Extension of the Nuiqsut Airport runway to the west would cross a small stream that may be problematic due to the culvert length that would be necessary to maintain drainage at that site. Therefore, a bridge is proposed. The stream is not identified as anadromous by the ADF&G, but may be fish-bearing.

Equipment, supplies, and personnel destined for GMT1 would be flown or trucked directly into Nuiqsut, and then transported via the Nuiqsut Spur/GMT1 road system to the drill site. Alternative C would include a road connection to the Nuiqsut Airport that would bypass the village to the west. The 3.7-acre logistics pad would provide vehicle storage and a repair warehouse to shelter and service vehicles. The vehicles could include pickup trucks, road graders, water trucks, and front-end loaders. The pad would also have cold storage and warm storage. Electrical power supplied from the Nuiqsut grid would be connected to vehicle storage area facilities. The pad would have a water storage tank and a waste accumulation tank. Water would be supplied from Nuiqsut. Wastewater would be hauled by tank truck to existing approved treatment and disposal facilities at Nuiqsut.

Utility services in Nuiqsut are limited; however, they do provide a potential source of electricity, water, sewer, and trash disposal. Electrical power at Nuiqsut is provided by the NSB Nuiqsut Utility power plant. The Nuiqsut Landfill is a Class III (village) landfill authorized for disposal of septage, inert, municipal, ash, sludge, construction debris, fish waste, and animal waste. The landfill is operated by the NSB. The Nuiqsut Wastewater Treatment Plant allows disposal of secondary treated domestic wastewater. Interior water piping and sewage connections to all buildings in Nuiqsut were made in 2002; these utilities may be available for connection at the logistics pad. Nuiqsut drinking water is derived from a nearby lake then treated and stored in a holding tank. Some residents also have individual water tanks with water delivery service, and use “honey buckets” to dispose of sewage. Sewage hauling services are provided.

Except for access and logistical differences described above, it is assumed that all other components of construction, drilling, and operations described in Section 2.5 for Alternative A are the same for Alternative C. Ice roads and pads would support construction of the road and pipeline along the corridor described in Alternative C and shown in Map 2.7-3.

2.8 Alternative D1

Alternative D1 defines development in which there is no year-round road access between GMT1 and the existing APF (i.e., no CD5-GMT1 gravel road). Project components of Alternative D1 are depicted in Map 2.8-1. As in other action alternatives, construction is expected to take two years. During the second year of construction, crews would be based at a 70-man construction support camp on an ice pad, which would move to the occupied structure pad (once completed) in May 2017 until construction is complete.

Drilling is expected to begin in May 2017 and would be supported by a crew based in a 120-man camp (workers to support drilling and well tie-in) on the occupied structure pad. In addition, a 25-man operation support camp would also be on the occupied structure pad.

Drilling would continue year-round to achieve economic and production goals, unlike the seasonal drilling activity at the roadless CD3 pad. Movement of the drill rig to and from other drill sites would be limited to the ice-road season (one mobilization/demobilization for the Alternative D1 drilling program) each time the rig works at another drill site, unlike Alternatives A, B, and C.

2.8.1 Project Components and On-Site Facilities

In addition to the facilities and features required for the GMT1 pad in all action alternatives, Alternative D1 would require that certain facilities, services, equipment, and supplies (otherwise provided at APF) would need to be duplicated at or near the drill pad. Major differences and (or) additional project components and facilities (as compared to Alternative A) include:

- 5,000-foot gravel airstrip and parking apron – capable of supporting Hercules C-130 aircraft to transport a relief well drill rig in the event of a well blowout or other emergency
- Occupied structure pad (14.9 acres) to house additional infrastructure
- 1.3-mile gravel access road between GMT1 pad and the occupied structure pad
- Diesel and water supply pipelines (2-inch diameter) from APF
- 70-man construction camp based on occupied structure pad
- 120-man drilling (and well tie-in) camp based at the occupied structure pad (Alternative A requires 75-man camp, based at GMT1 pad during drilling)
- Class 1 disposal well and injection facility
- Additional storage and facilities for equipment associated with spill and emergency response, airstrip maintenance, vehicle fleet maintenance, waste storage
- Additional storage (e.g., water, cement, drilling mud)
- Seasonal ice road through life of project

Table 2.8-1 provides the major infrastructure components of Alternative D1. Alternative A, Proposed Action components are provided for comparison purposes.

Table 2.8-1. Infrastructure for Alternative D1 compared with Alternative A, Proposed Action

Component	Alternative D1	Alternative A Proposed Action
Gravel Drill Pad	15.7 acres	11.8 acres
Wells	33	33
Access Road	1.3 mile (Airstrip to GMT1 Pad)	7.6 miles (GMT1 to CD5)
Elevated Pipelines on VSMs	8.4 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5
Manual Valve Gravel Pads	2 (0.35 acre each)	2 (0.35 acre each)
Bridges	0	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	ASRC Mine site	ASRC Mine site
Air Access Facilities	70.5 acres (airstrip, apron, access road, occupied pad)	0
Total Gravel Footprint	87.4 acres	72.7 acres
Ice Roads	15 to 36 miles	36 to 45 miles

Alternative D1 would require significantly greater power consumption than the development proposed in Alternative A, because of the necessary additional project components and facilities. Table 2.8-2 lists power requirements for Alternative A and Alternative D1, to provide for comparison between action alternatives.

Table 2.8-2. Comparison of Power Requirements between Alternative A and Alternative D1

Alternative	Summary of Power Requirements	Megawatts
A	Total power required for the GMT1 Project: Alternative A, development including remote electrical module, pigging module, test separator module, fuel gas module, production heater, chemical injection module, emergency shutdown module, pad lighting, heat trace and other drill site power requirements (shown in Appendix A on Sheet 16 of 33).	1.0 - 2.0 MWe (depending on season)
D1 (Additional)	Major additional elements required for Alternative D1 (as compared to Alternative A): • Class I disposal well injection facility • Mud plant and bulk cement facility • Drilling and mud plant raw water pump module • 70-man construction support • 120-man drilling and well tie-in support camp • 25-man post-drilling operation support camp • Waste water treatment plant • Potable water supply pump module • Diesel supply pump module • On-site solid waste facility • Permanent tank farm and piping (chemical storage) • Warm and cold storage facilities • Fleet maintenance shop • Emergency response facility • Flight operations storage facilities	2.5 MWe
D1	Total for Alternative D1	3.5 – 4.5 MWe (depending on season)

2.8.2 Location

The proposed Alternative D1 GMT1 pad is located in Section 6, T10N, R3E UM, at latitude 70.2543 and longitude -151.4835. The pipeline corridor crosses through Section 6, T10N, R3E UM; Sections 24 through 29 and 31 through 32, T11N, R3E UM; and Sections 18 and 19, T11N, R4E UM. The air access facilities (airstrip, apron, and facilities pad), the occupied pad, and the access road between the occupied pad and the GMT1 pad are located in Sections 4 through 6 and 8, T10N, R3E UM; and Section 31, T11N, R3E UM.

Alternative D1 GMT1 pad would be slightly southwest of that proposed for Alternatives A and C, overlapping with much of the pad location selected for B. The orientation of the GMT1 pad is larger by 3.9 acres and would be flipped when compared to that for Alternatives A, B, and C.

2.8.3 Infrastructure Development

GMT1 pad would be re-supplied during the ice road season to support the required long-term storage of drilling and operating fluid and supplies. A tank farm would be needed to provide appropriate storage volumes for all operating fluids such as methanol and anti-corrosion chemicals. A new mud plant and bulk cement facility would be required for drilling because the existing plant at APF must remain in place to service drilling operations at the other satellites. Diesel fuel for powering drilling support equipment, well work operations and freeze protect of wells would be transported via a new 2-inch diesel pipeline from APF. Water would be supplied via a 2-inch water pipeline from APF. On-site wastewater and solid waste treatment or management would be required. Waste fluids from drilling would not be transported for disposal at APF; therefore, a new Class 1 disposal well with injection facilities would be required at GMT1.

Alternative D1 would have a larger footprint than Alternative A, requiring additional fill (Table 2.3-2).

2.8.4 Water Use and Ice Roads

Water for use at the site (e.g., personal water use) would be provided via a 2-inch water pipeline from the APF. Water use from local lakes would be required for ice pads, road, and bridges (estimated at 1.5 million gallons per mile of ice road). Table 2.8-3 lists water use for Alternative D1. Alternative A numbers are provided for comparison.

An annual resupply ice road would be constructed every year for 30 years to support drilling and operations. As part of the annual ice road, an ice bridge would be constructed across the Tiŋmiaqsiġvik (Ublutuoch) River. Map 2.7-3 depicts the seasonal ice road route for Alternatives D1 and D2.

Table 2.8-3. Water Use for Alternative D1 Compared to Alternative A, Proposed Action

Construction Phase	Alternative D1	Alternative A
Ice Roads (miles)		
Year 1	33	45
Year 2	36	36
Ice Roads (MG) [a]		
Year 1	49.5	67.5
Year 2	54.0	54.0
Ice Pads (MG)		
Year 1	22.5	32.5
Year 2	12.5	13.8
Construction Miscellaneous (MG)		
Year 1	1.0	1.0
Year 2	1.0	1.0
Workforce (MG)		
Year 1	3.6	3.6
Year 2	4.4	3.6
Summer Construction Workforce (MG)		
Year 1	---	---
Year 2	1.85	1.35
Construction Total (MG)		
Year 1	76.6	104.6
Year 2	73.8	73.8
Drilling Phase (Years 3-6)		
Drilling Ice Pad [b] (MG)	4.0	4.0
Drilling Water [c] (MG)	16.0	16.0
Camp Water – Rig Camp and GMT1 Occupied Pad Drilling Staff [d] (MG)	4.2	2.7
Drilling Miscellaneous (MG)	1.0	1.0
Drilling Years	4 years	4 years
Drilling Total Per Year (MG)	25.2	23.7
Drilling Total MG	**91.2**	**94.8**
Post-Construction Operations (Beginning Year 3)		
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	25.0	9.5
Camp Support (MG)	0.9	---
Number of Post Construction Operation Years [f]	30	9
Total Per Year (MG)	25.9	9.5
Total MG	**777.0**	**88.5**
Alternative D1 Totals (MG)	**Alternative D1**	**Alternative A**
Construction Totals	150.4	178.4
Drilling	91.2	94.8
Operations	777.0	85.5
Total Water Use	**1,018.6**	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed for all alternatives (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well for Alternatives A and D1.

[d] Alternative A would have a 75-man drill rig support camp. Alternative D1 would have a 115-man drill crew. Alternative D1 would have a 25-man permanent man camp to support year-round operation.

[e] In addition to the ice road water use in this column, each alternative includes 0.5 MG per year for miscellaneous ice pad use. For Alternative D1, 2 MG per year is required for an ice bridge across the Tiŋmiaqsiġvik (Ublutuoch) River.

[f] Ice roads are assumed to be developed for Alternative A during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

2.8.5 Gravel Requirements

Under Alternative D1, a total of approximately 845,600 cubic yards of material required for this project would be used to fill approximately 87 acres. This would require about 220,000 cubic yards and 14.3 acres more than Alternative A.

2.8.6 Access

Vehicle and aircraft traffic for Alternative D1 is discussed below. Alternative D1 vehicle traffic is presented in Table 2.8-4. Alternative D1 aircraft traffic is presented in Table 2.8-5. Alternative A numbers are provided for comparison in both tables.

Transportation to GMT1 pad from the existing APF would be via aircraft approximately nine months of the year (May through January), and primarily via ice road approximately three months of the year (February through April). After construction, to access the drill site by vehicle, a 15-mile ice road would be constructed each year from the seasonal APF ice road to the airstrip, crossing the Tiŋmiaqsiġvik (Ublutuoch) River and Nigliq Channel with ice bridges. Map 2.8-2 depicts the seasonal ice road route for Alternatives D1 and D2 (Section 2.8).

2.8.6.1 Vehicle Traffic

The design of components in Alternative D1 separates the GMT1 pad from occupied structure pad (e.g., man camp) to comply with aircraft safety regulations. A 1.3-mile gravel access road would connect the GMT1 pad with the occupied structure pad. Estimated vehicle traffic for Alternative D1 is presented in Table 2.8-4 and includes potential traffic on the 1.3-mile access road between pads.

In December 2015, vehicle traffic would be the same as that for Alternative A – supporting pre-construction for ice road construction in 2016. Light commercial trucks would make 368 trips, and single unit short-haul trucks would make 1,120 trips.

In 2016, vehicle traffic in Alternative D1 would be the most intense in January, with 23,562 trips by single unit short-haul trucks. Gravel haul would continue through April (15,148 per month). Intercity buses and light commercial trucks would be used January through April (most trips in January). Intercity buses would make 504 trips in January and 336 each month February through April. Light commercial trucks would make 1,940 trips in January and 1,376 trips each month February through April. In December, vehicle trips return to the same levels as in December 2015 to support ice road construction. In 2016, vehicle traffic would be limited to the ice road January through April (i.e., no 1.3-mile access road between pads) and December.

In 2017, the 1.3-mile access road would be ready for vehicle traffic. Table 2.8-4 reflects traffic on the ice road and the access road between the pads. Most intense traffic would be on the ice road

January through April to support construction. Intercity buses would be used January through May (trip numbers ranging from 1,470 in April to 126 in May). From June through December, there would be no intercity bus traffic on ice roads. From January through April, passenger trucks would travel the 1.3-mile gravel road, with trips ranging from 105 in January to 252 (February through April). There would be no traffic associated with passenger trucks during the months of May through December. Light commercial trucks and single unit short-haul trucks would be used year-round. Heaviest traffic for these vehicles would be in January through April. The highest number of vehicle trips would be with single unit short-haul trucks in January (18,844 trips). Traffic associated with these vehicles during May through December would be on the 1.3-mile gravel road between the GMT1 pad and the occupied structure pad.

In 2018, light commercial truck trips would comprise most of the traffic from January through December, with numbers ranging from 2,940 trips (March) to 2,016 trips (May, July, August, October and November). Single unit short-haul trucks would be used year-round also, with number of trips ranging from 1,379 (March, June, September, and December) to 1,103 (April, May, July, and August). Traffic associated with these vehicles during May through December would be on the 1.3-mile gravel road between the GMT1 pad and the occupied structure pad. Post-construction ice road traffic to support resupply consists of intercity buses (224), passenger trucks (271), and single-unit, short-haul trucks (10,024).

With year-round drilling and year-round operations, traffic levels are expected to maintain the same levels as year 2018 for the remainder of the project, but may decrease somewhat when drilling is completed and fewer personnel and support supplies are required.

Table 2.8-4. Vehicle Trips Required per Month from 2015-2018 for Alternative D1

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Ice Road	Totals
2015														
Intercity Bus												0		0
Light Commercial Truck												368		368
Single Unit Short-Haul Truck												1,120		1,120
Passenger Truck												0		0
Total												**1,488**		**1,488**
Alternative A Total												*1,488*		*1,488*
2016														
Intercity Bus	504	336	336	336	0	0	0	0	0	0	0	0		1,512
Light Commercial Truck	1,940	1,376	1,376	1,376	0	0	0	0	0	0	0	368		6,436
Single Unit Short-Haul Truck	23,562	15,148	15,148	15,148	0	0	0	0	0	0	0	1,120		70,126
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	**26,006**	**16,860**	**16,860**	**16,860**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,488**		**78,074**
Alternative A Total	*25,138*	*19,380*	*18,876*	*15,748*	*420*	*2,072*	*2,100*	*2,625*	*0*	*0*	*0*	*1,488*		*87,847*
2017														
Intercity Bus	798	1,176	1,470	1,176	126	0	0	0	0	0	0	0		4,746
Light Commercial Truck	3,444	5,996	5,996	7,277	1,708	784	980	784	980	784	784	2,940		32,457
Single Unit Short-Haul Truck	18,844	8,232	8,232	9,842	2,066	1,142	1,428	1,142	1,428	1,142	1,142	1,379		56,019
Passenger Truck	105	252	252	252	0	0	0	0	0	0	0	0		861
Total	**23,191**	**15,656**	**15,656**	**18,841**	**3,900**	**1,926**	**2,408**	**1,926**	**2,408**	**1,926**	**1,926**	**4,319**		**94,083**
Alternative A Total	*19,923*	*9,412*	*11,765*	*7,199*	*3,504*	*3,672*	*2,937*	*3,672*	*2,937*	*2,937*	*2,937*	*2,500*		*73,395*
2018														
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	224	224
Light Commercial Truck	2,352	2,352	2,940	2,268	2,016	2,520	2,016	2,016	2,520	2,016	2,016	2,520	271	27,823
Single Unit Short-Haul Truck	1,103	1,103	1,379	1,103	1,103	1,379	1,103	1,103	1,379	1,103	1,103	1,379	10,024	24,364
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**3,455**	**3,455**	**4,319**	**3,371**	**3,119**	**3,899**	**3,119**	**3,119**	**3,899**	**3,119**	**3,119**	**3,899**	**10,519**	**52,411**
Alternative A Total	*1,753*	*1,753*	*2,192*	*1,753*	*2,192*	*1,753*	*1,753*	*2,192*	*1,753*	*1,753*	*1,753*	*1,753*	*4,322*	*26,675*

2.8.6.2 Aircraft Traffic

Fixed-wing flights landing at GMT1 airstrip under Alternative D1 (and D2) would originate from both Deadhorse and APF. CPAI anticipates that cargo and personnel would be sent on a path dictated by logistics (such as load the aircraft to “stop and drop” at APF or GMT1 first, weather, etc.) but would often have to land at both places when ice roads are not available. During the first winter (2016), there would be no airstrip or camp at GMT1. Construction crews would stage out of Nuiqsut Hotel, Nuiqsut 10-acre, and APF. Construction Otter/CASA flights during the winter of 2016 would land at APF. From mid May to October 2016, two helicopter flights per day would support a small gravel-working crew at GMT1 (no GMT1 camp or airstrip available). During the second summer (2017), GMT1 facilities installation would continue with workers based at GMT1 construction man camp.

In 2016, during the first year of construction, between 5 and 15 Otter/CASA flights would be required each month under Alternative D1. Helicopters would transport crews (15 flights per month) for ice road cleanup inspection and gravel working from June through September. Once per month (July through October), a DC-6 would provide transport of equipment, materials, and supplies. Helicopter flights supporting special studies would be most frequent in May (68 trips) and June (86 trips) and decrease to 8 trips in September.

In 2017, between 5 and 111 Otter/CASA flights would be required each month to support construction, operations, and year-round drilling: 5 flights each month in January, February and March; 30 flights in April; and between 100 and 111 flights each month from May through December. A DC-6 would also support drilling with 5 trips in April and 20 trips each month from May through December. Helicopters would transport crews (15 trips per month, June through September for ice road inspection and cleanup). A C-130 large cargo transport would transport equipment, materials, and supplies twice per month in September and December. Helicopter flights supporting special studies would be most frequent in May (68 trips) and June (86 trips) and decrease to 8 trips in September (the same as for 2016).

Alternative D1 drilling (Otter/CASA) and drilling cargo (DC-6) flights would occur from April 2017 through May 2021. May of 2021 begins the routine operations phase for Alternative D1.

Beginning in 2018, Otter/CASA aircraft would support transport of operations personnel and year-round drilling (74 per month January through May, then 90 in May through December). In addition, Otter/CASA aircraft would support year-round pipeline inspections, these flights are spread evenly (4 or 5 flights each month) January through December, but would likely occur over a several-week period chosen to avoid subsistence conflicts. DC-6 aircraft would support transport of drilling cargo in January, May, and April. DC-6 aircraft would also support transport of operations cargo, with three flights per month throughout the year. A C-130 large cargo transport would support transport of equipment, materials, and supplies during June, September, and December (two trips per each of these months).

Helicopter flights would support for special studies in May through September, with most helicopter flights occurring in June (104).

Due to prevailing wind patterns, the Alternative D1 airstrip would be orientated similarly to the CD5 airstrip (BLM 2004) (Map 2.8-1). As with other alternatives, GMT1 could be accessed year-round from APF, weather permitting.

In May 2021, flights are no longer required to support drilling. From 2022 and beyond, flights supporting operations (Otter/CASA), operation cargo transport (DC-6), large cargo transport (C-130), and pipeline inspections (Otter/CASA) are the same as for 2021.

Table 2.8-5. Flight Requirements for Alternative D1 Compared to Alternative A, Proposed Action

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual Total**	**Jun – Sept Total**
2016														
Alternative A **Total New**	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
Alternative D1 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction to APF (Otter/CASA)	10	5	5	5	5	5	5	5	5	10	15	15	90	20
Drilling (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operations Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Cargo (DC-6)	0	0	0	0	0	0	1	1	1	1	0	0	4	3
Drilling Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Cargo (C-130)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Inspection Overflights (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Working Crew (Helicopter Landings in the NPR-A)	0	0	0	0	10	60	60	60	60	60	0	0	310	240
Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	68	86	18	37	8	0	0	0	217	149
Total New	**10**	**5**	**5**	**5**	**83**	**166**	**99**	**118**	**89**	**71**	**15**	**15**	**681**	**472**
Total New Construction Flights	10	5	5	5	15	65	66	66	66	71	15	15	404	263
Total New Operations Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Including Baseline	158	135	194	201	322	570	603	381	375	290	234	215	3,678	1,929
2017														
Alternative A **Total New**	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777

Table 2.8-5. Flight Requirements for Alternative D1 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
Alternative D1 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	0	0	0	5	20	20	20	26	26	26	26	26	195	92
Construction to APF (Otter/CASA)	5	5	5	5	10	10	10	10	10	10	15	15	110	40
Drilling (Otter/CASA)	0	0	0	20	70	70	70	70	70	70	70	70	580	280
Operations Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	0	0	0	5	20	20	20	20	20	20	20	20	165	80
Large Cargo (C-130)	0	0	0	0	0	0	0	0	2	0	0	2	4	2
Pipeline Inspection Overflights (Otter/CASA)	0	0	0	5	4	4	5	4	4	5	4	5	40	17
Working Crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	68	86	18	37	8	0	0	0	217	149
Total New	**5**	**5**	**5**	**40**	**192**	**225**	**158**	**182**	**155**	**131**	**135**	**138**	**1,371**	**720**
Total New Construction Flights	5	5	5	5	10	10	10	10	10	10	15	15	110	40
Total New Operations Flights	0	0	0	5	20	20	20	26	26	26	26	26	195	92
Total Including Baseline	153	135	194	236	431	629	662	445	441	350	354	338	4,368	2,177
2018 through 2020														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D1 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	4	4	4	4	20	20	20	20	20	20	20	20	176	80
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	70	70	70	70	70	70	70	70	70	70	70	70	840	280
Operations Cargo (DC-6)	3	3	3	3	3	3	3	3	3	3	3	3	36	12

Table 2.8-5. Flight Requirements for Alternative D1 Compared to Alternative A, Proposed Action (Continued)

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual Total**	**Jun – Sept Total**
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	20	0	0	5	20	20	20	20	20	20	20	20	185	80
Large Cargo (C-130)	0	0	0	0	0	2	0	0	2	0	0	2	6	4
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	4	4	5	4	4	5	4	5	52	17
Flights to GMT1 for gravel working crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flights for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**101**	**81**	**81**	**87**	**183**	**238**	**154**	**166**	**158**	**118**	**117**	**120**	**1,604**	**716**
Total New Constructions Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	7	7	7	7	23	23	23	23	23	23	23	23	212	92
Total Including Baseline	249	211	270	283	422	642	658	429	444	337	336	320	4,601	2,173
2021														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D1 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	4	4	4	4	20	20	20	20	20	20	20	20	176	80
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	70	70	70	70	70	0	0	0	0	0	0	0	350	0
Operations Cargo (DC-6)	3	3	3	3	3	3	3	3	3	3	3	3	36	12
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	20	0	0	5	20	0	0	0	0	0	0	0	45	0
Large Cargo (C-130)	0	0	0	0	0	2	0	0	2	0	0	2	6	4
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	4	4	5	4	4	5	4	5	52	17

Table 2.8-5. Flight Requirements for Alternative D1 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
Flights to GMT1 for gravel working crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flights for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**101**	**81**	**81**	**87**	**183**	**148**	**64**	**76**	**68**	**28**	**27**	**30**	**974**	**356**
Total New Constructions Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	7	7	7	7	23	23	23	23	23	23	23	23	212	92
Total Including Baseline	249	211	270	283	422	552	568	339	354	247	246	230	3,971	1,813
2022 +														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D1 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	4	4	4	4	20	20	20	20	20	20	20	20	176	80
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operations Cargo (DC-6)	3	3	3	3	3	3	3	3	3	3	3	3	36	12
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Cargo (C-130)	0	0	0	0	0	2	0	0	2	0	0	2	6	4
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	4	4	5	4	4	5	4	5	52	17
Flights to GMT1 for gravel working crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flights for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60

Table 2.8-5. Flight Requirements for Alternative D1 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**11**	**11**	**11**	**12**	**93**	**148**	**64**	**76**	**68**	**28**	**27**	**30**	**579**	**356**
Total New Constructions Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	7	7	7	7	23	23	23	23	23	23	23	23	212	92
Total Including Baseline	159	141	200	208	332	552	568	339	354	247	246	230	3,576	1,813

[a] Alternate D1: First winter (2016), no runway or camp at GMT1. Construction crews will stage out of Nuiqsut Hotel, Nuiqsut 10-Acre, and Alpine. Construction Otter/CASA flights during the winter of 2016 will land at Alpine. May to October 2016, two helicopter flights a day for small gravel-working crew at GMT1- no GMT1 camp or runway availability. Second summer (2017) - GMT1 facilities install contractors working from GMT1 camp. Special Studies will peak during breakup (May and June). All of the special studies will be conducted using helicopter in the absence of a road. Helicopter visits to spill response equipment related to the GMT1 development have been estimated and included in these values. Drilling is estimated to progress at a rate of 53 days needed per well. In a year-round drilling scenario in order to complete all 33 wells the required Drilling (Otter/CASA) and Drilling Cargo (DC-6) flights (shown under April 2017-Aprl 2018) will be carried out for an additional four years before the “Typical Routine Operations” Phase can begin. (33 wells*53 days per well=1,749 days needed. There are 1,749 days needed/365 days per year=5 years total). Pipeline Inspection Overflights (Otter/CASA) flights during facility operations are estimated at a frequency of once per week. If regulations dictate a different inspection frequency then these number could significantly change. Pipeline overflights by fixed wing would be replaced by road-based inspections for Alternatives A, B, and C. Flights for ice road Cleanup/Inspections are based on an estimated five landings per mile along the 12-mile ice road, based on past experience. They are spread evenly across the June-September months, but would likely occur over a several-week period chosen to avoid subsistence conflicts.

2.8.7 Spill Prevention and Response

Alternative D1 would require redundant emergency response equipment stored at the occupied structure pad. Outside the ice road season, any equipment that is not available locally (at the GMT1 or occupied structure pad) would be brought in by aircraft to the GMT1 airstrip. For additional discussion of spill response, see Section 4.5.

Pipeline inspections and maintenance and emergency response activities (including training and drills) would depend on aircraft logistics and weather restrictions for up to nine months per year. Mobilization of emergency response equipment, supplies, and personnel housed at the APF would require dependency on aircraft support and thus could be challenging, particularly during periods of adverse weather. Safety response time could also be compromised when aircraft support is restricted by adverse weather. Due to adverse weather, air travel has been restricted at APF 13 to 22 percent each year for years 2009-2013 (CPAI 2014a). In the event of bad weather at Alpine, a response effort could be staged out of Nuiqsut, as often the weather is different in both locations. Therefore, the same would be true if the weather was bad in Nuiqsut, a response effort could be staged out of Alpine. Alpine would be the primary location to stage a response.

Under Alternative D1, the incremental challenges associated with responding in a timely manner to emergency life-saving and spill events would increase safety and environmental risks throughout the life of the project. Dedicated response resources are available at APF including full-service medical, fire, and spill response personnel, facilities, and equipment. Lists of dedicated medical and emergency response equipment available at APF were included in Appendix 1 of ConocoPhillips April 22, 2014 comment response letter on the Draft SEIS.

2.9 Alternative D2

Alternative D2 was not analyzed in the Draft SEIS, but has been included in the Final SEIS as a result of public comments to include a seasonal drilling alternative. Alternative D2 is very similar to Alternative D1, except that Alternative D2 allows only seasonal drilling (February – April) when an ice road is available between GMT1 and CD5. Operation (i.e., production) (after first oil) would be year-round, as in Alternative D1. The restriction to seasonal drilling would extend the project life.

As in Alternative D1, construction of the GMT1 pad, occupied structure pad, airstrip/apron, on-site facilities and pipelines is expected to take two years. During the second year of construction, crews would be based at a 70-man construction support camp on the occupied structure pad after May 2017 (same as Alternative D1), in addition to the remote camp on ice pad during the second winter construction season. The start of drilling would be delayed one additional season, past that for Alternative D1.

For Alternative D2, drilling is expected to begin February 2018 and would be supported by a 75-man drill rig support camp at GMT1 pad for 24 years of infill drilling. With seasonal drilling, the drill rig would be mobilized and demobilized from the GMT1 pad each year via ice road. No additional drilling or well tie-in support is required for Alternative D2 (as compare to Alternative D1). As in Alternative D1, a 25-man operation support camp would be on the occupied structure pad. Operation (i.e., production) would be concurrent with drilling for 19 years and post-drilling operation (i.e., production) would continue for 11 years to 2053.

Once construction is completed ice roads would be constructed annually along the same route for 35 years to support vehicle access for drilling and operation. Once production begins, vehicle traffic and the level of activity on the GMT1 pad would be less under Alternative D2 than Alternative D1.

2.9.1 Infrastructure Development

Alternative D2 would have the same project components as Alternative D1 (Map 2.8-1), except that the occupied structure pad would be smaller (13.4 acres) than in Alternative D1 (14.7 acres) and thus would have a smaller footprint and require less fill than Alternative D1 (Table 2.3-2). The occupied structure pad would be smaller under seasonal operations as a result of reduced scope of support facilities located at the occupied structure pad.

Table 2.9-1 provides the major infrastructure components of Alternative D2. Alternative A, Proposed Action components are provided for comparison purposes.

Table 2.9-1. Infrastructure for Alternative D2 Compared to Alternative A, Proposed Action

Component	Alternative D2	Alternative A Proposed Action
Gravel Drill Pad	15.7 acres	11.8 acres
Wells	33	33
Access Road	1.3 mile (Airstrip to GMT1 Pad)	7.8 miles (GMT1 to CD5)
Elevated Pipelines on VSMs	8.4 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5
Manual Valve Gravel Pads	2 (0.35 acre each)	2 (0.35 acre each)
Bridges	0	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	ASRC Mine site	ASRC Mine site
Air Access Facilities	69.2 acres (airstrip, apron, occupied pad)	0
Total Gravel Footprint	85.8 acres	72.7 acres
Ice Roads	15 to 36 miles	36 to 45 miles

The proposed Alternative D2 GMT1 pad, pipeline corridor, air access facilities, occupied pad, and the access road between the occupied pad are in the same locations as Alternative D1. The occupied pad is 1.3 acres smaller.

Power requirements for Alternative D2 would be on the order of that required for Alternative D1 (Table 2.8-2); however, the power need would be extended over the longer life of the project.

2.9.2 Water Use

As in Alternative D1, water for use at the site (e.g., potable water for personal use) would be provided at the site via 2-inch water line from the APF. Water from local lakes would be extracted for construction of ice pads, roads, and bridges. Alternative D2 would require more years of the 15-mile ice road and thus more water would be extracted from local lakes over the life of the project. Table 2.9-2 lists water use for Alternative D2. Alternative A numbers are provided for comparison.

An annual resupply ice road would be constructed every year for 35 years to support drilling and operations. As part of the annual ice road, an ice bridge would be constructed across the Tiŋmiaqsiġvik (Ublutuoch) River. Map 2.7-3 depicts the seasonal ice road route for Alternatives D1 and D2.

On an annual basis (for four years), water use for drilling would be higher for Alternative D1 than for Alternative D2 because of the allowance for year-round drilling. Annual water use in the drill rig support camp would be higher in Alternative D1 (more workers in camp that in Alternative D2). However, because of the need for additional years (seasons) of drilling, Alternative D2 would require more water over the life of the project.

Table 2.9-2. Water Use for Alternative D2 Compared to Alternative A, Proposed Action

Construction Phase	Alternative D2	Alternative A
Ice Roads (miles)		
Year 1	33	45
Year 2	36	36
Ice Roads (MG) [a]		
Year 1	49.5	67.5
Year 2	54.0	54.0
Ice Pads (MG)		
Year 1	22.5	32.5
Year 2	12.5	13.8
Construction Miscellaneous (MG)		
Year 1	1.0	1.0
Year 2	1.0	1.0
Workforce (MG)		
Year 1	3.6	3.6
Year 2	4.4	3.6
Summer Construction Workforce (MG)		
Year 1	---	---
Year 2	1.85	1.35
Construction Total (MG)		
Year 1	76.6	104.6
Year 2	73.8	73.8
Drilling Phase (Years 3-26)		
Drilling Ice Pad [b] (MG)	4.0	4.0
Drilling Water [c] (MG)	3.5	16.0
Camp Water – Rig Camp and GMT1 Occupied Pad Drilling Staff [d] (MG)	0.8	2.7
Drilling Miscellaneous (MG)	0.2	1.0
Drilling Years	24 years	4 years
Drilling Total Per Year (MG)	8.3	23.7
Drilling Total MG	**199.2**	**94.8**
Post-Construction Operations (Beginning Year 3)		
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	25.0	9.5
Camp Support (MG)	0.9	---
Number of Post Construction Operation Years [f]	35	9
Total Per Year (MG)	25.9	9.5
Total MG	**906.5**	**85.5**
Alternative D2 Totals (MG)		
Construction Totals	150.4	178.4
Drilling	199.2	94.8
Operations	906.5	85.5
Total Water Use	**1,256.1**	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed for all alternatives (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well for Alternative A. Drilling water for Alternative D2 is 3.5 MG (total of 16 MG times 80 days per year) to account for the seasonal drilling period.

[d] Alternative A would have a 75-man drill rig support camp. Alternative D2 would have a 75-man drill rig support camp (no well tie-in crew). The drill support camp for Alternative D2 would operate for 80 days of every year and would be mobilized and demobilized with the drill rig each year of seasonal drilling. Alternative D2 would have a 25-man permanent man camp to support year-round operation.

[e] In addition to the ice road water use in this column, each alternative includes 0.5 MG per year for miscellaneous ice pad use. For Alternative D2, 2 MG per year is required for an ice bridge across the Tiŋmiaqsiġvik (Ublutuoch) River.

[f] Ice roads are assumed to be developed for Alternative A during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

2.9.3 Gravel Requirements

Under Alternative D2, a total of approximately 830,800 cubic yards of material required for this project would be used to fill approximately 85.7 acres. This would require about 205,300 cubic yards and 13 acres more than Alternative A.

2.9.4 Access

Vehicle and aircraft traffic for Alternative D2 is discussed below. Access to GMT1 from the existing APF would be the same as for Alternative D1 – with the same restrictions of vehicle traffic to ice road and reliance on aircraft support for nine months of the year. Alternative D2 vehicle traffic is presented in Table 2.9-3 and includes traffic on the 1.3-mile access road. Alternative D2 aircraft traffic is presented in Table 2.9-4. Alternative A numbers are provided for comparison in both tables.

As in Alternative D1, the design of Alternative D2 separates the GMT1 pad from occupied structure pad (e.g., man camp) to comply with aircraft safety regulations. A 1.3-mile gravel access road would connect the GMT1 pad with the occupied structure pad. A summary of vehicle traffic for Alternative D2 is presented below.

2.9.4.1 Vehicle Traffic

In December 2015 and all of 2016, vehicle traffic would be the same as for Alternative D1.

In 2017, traffic levels are generally similar to those for Alternative D1 for January and February, the GMT1 facilities installation would continue and workers would be based at the GMT1 construction man camp. In March through April, there is less traffic in Alternative D2 than Alternative D1 and vehicle traffic decreases markedly in May (end of the ice road for the season and no year-round drilling in Alternative D2). In addition, there would be no vehicle traffic from June through November in Alternative D2 – drilling has not begun, so there is no traffic on the 1.3 -mile access road between pads. In December, vehicles would support initial work for the ice roads (construction beginning the following year).

In 2018, there would be no traffic from May through November. Light commercial trucks and single unit short-haul trucks would use the ice road between January and April. Drilling would begin in 2018. Post-construction ice road traffic to support resupply consists of intercity buses (224), passenger trucks (271), and single-unit, short-haul trucks (10,024).

After 2023 (first oil production), operations would be conducted year-round, but drilling would continue only seasonally through 2042. Any year-round traffic (outside of the ice road season) would be associated with vehicle use on the 1.3-mile access road between pads to support operation.

Table 2.9-3. Vehicle Trips Required per Month from 2015-2018 for Alternative D2

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Ice Road	Totals
2015														
Intercity Bus												0		0
Light Commercial Truck												368		368
Single Unit Short-Haul Truck												1,120		1,120
Passenger Truck												0		0
Total												**1,488**		**1,488**
Alternative A Total												*1,488*		*1,488*
2016														
Intercity Bus	504	336	336	336	0	0	0	0	0	0	0	0		1,512
Light Commercial Truck	1,940	1,376	1,376	1,376	0	0	0	0	0	0	0	368		6,436
Single Unit Short-Haul Truck	23,562	15,148	15,148	15,148	0	0	0	0	0	0	0	1,120		70,126
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0		0
Total	**26,006**	**16,860**	**16,860**	**16,860**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,488**		**78,074**
Alternative A Total	*25,138*	*19,380*	*18,876*	*15,748*	*420*	*2,072*	*2,100*	*2,625*	*0*	*0*	*0*	*1,488*		*87,847*
2017														
Intercity Bus	798	1,176	1,470	1,176	126	0	0	0	0	0	0	0		4,746
Light Commercial Truck	3,200	5,660	7,075	5,526	924	0	0	0	0	0	0	420		22,805
Single Unit Short-Haul Truck	19,124	8,232	10,290	7,784	924	0	0	0	0	0	0			46,354
Passenger Truck	105	252	315	189	0	0	0	0	0	0	0	0		861
Total	**23,227**	**15,320**	**19,150**	**14,675**	**1,974**	**0**	**0**	**0**	**0**	**0**	**0**	**420**		**74,766**
Alternative A Total	*19,923*	*9,412*	*11,765*	*7,199*	*3,504*	*3,672*	*2,937*	*3,672*	*2,937*	*2,937*	*2,937*	*2,500*		*73,395*
2018														
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	224	224
Light Commercial Truck	336	1,120	1,400	840	0	0	0	0	0	0	0	0	271	3,967
Single Unit Short-Haul Truck	0	591	739	443	0	0	0	0	0	0	0	0	10,024	11,797
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**336**	**1,711**	**2,139**	**1,283**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10,519**	**15,988**
Alternative A Total	*1,753*	*1,753*	*2,192*	*1,753*	*2,192*	*1,753*	*1,753*	*2,192*	*1,753*	*1,753*	*1,753*	*0*	*4,322*	*24,922*

2.9.4.2 Ice Roads

In general, the drilling season in Alternative D2 depends on dates of opening and closing of the ice road. Earliest opening dates and latest closure dates for ice roads between drill site 2L (in Kuparuk Field) to APF and between drill sites CD2 and CD3 for the 11-year period 2004 through 2014 were provided by the Applicant. Based on these data, Table 2.9-4 lists the earliest opening and closing dates for these ice roads and the range in number of “open” days. For the GMT1 development project, the ice road season is defined as February 1 through April 20 of each year.

Table 2.9-4. Summary of Historical Ice Road Opening/Closure, 2004-2014

Drill Site 2L – APF					Drill Sites CD2 – CD3				
Opening		Closure		Range of number of open days	Opening		Closure		Range of number of open days
Earliest	Latest	Earliest	Latest		Earliest	Latest	Earliest	Latest	
Jan. 16	Feb. 2	April 27	May 7	91 to 107	Jan. 4	Jan. 26	April 27	May 7	104 to 121

Source: Historical data provided by CPAI (2014b); Traffic data tables and notes provided by CPAI in response to request for information from SLR for Alternative D2.

Because of the ice road length (15 miles) and the required ice bridges (Nigliq Channel and Ublutuoch River), the GMT1 usable ice road season is expected to be about 20 percent shorter than for CD3 (83 to 97 days). In addition, other considerations specific to the GMT1 development project would limit the amount of time available each year for seasonal drilling (e.g., mobilizing the drill rig off/onto the GMT1 pad each season, securing or reactivation of partial wells). Therefore, for Alternative D2, a maximum 80-day ice road window is anticipated for mobilization, demobilization, and drilling each season.

2.9.4.3 Aircraft Traffic

The airstrip for Alternative D2 would be the same size and location as in Alternative D1. Estimated aircraft traffic for Alternative D2 is listed in Table 2.9-5. Once drilling is completed, aircraft would support production, maintenance, well work-over, pipeline inspections, and special studies for the life of the project.

In 2016, for the first full year of construction, Alternative D2 is similar to Alternative D1. Between 5 and 15 Otter/CASA flights would be required each month under Alternative D2 to transport personnel. Helicopters would transport crews (between 10 and 75 trips per month) to support ice road cleanup inspection and gravel working from May through October. DC-6 flights would support transport of equipment, materials, and supplies with flights once per month in July through October. Helicopter flights would support special studies from May through September with the most flights in June (86) and least flights in September (8).

In 2017, between 5 and 15 Otter/CASA flights would support construction each month year round. C-130 flights would support transport of large cargo with two flights each in September and December. Helicopters would transport crews for ice road cleanup inspection in June through September (15 trips per month). Helicopters would support special studies in May through September with the most flights in June (86) and least flights in September (8).

From January 2018 through April 2039 (end of drilling), flights would support transport of drilling personnel and cargo. The drilling Otter/CASA flights would consist of 70 flights per month January through April. The drilling cargo DC-6 would consist of 20 flights in January and 5 flights in April. Helicopter flights would support ice road cleanup and inspection with 15 flights per month June through September. Pipeline inspection overflights would occur March through April during drilling. In non-drilling months the pipelines would be de-inventoried, eliminating the need for inspection overflights.

In 2023 through life of the project, aircraft would also support year-round operations. Flight activity would include transport of operations personnel and cargo (activity occurring year-round) as well as transport of crews continuing to drill (seasonal) (see paragraph above). Otter/CASA flights would support transport of operations personnel (four flights per month in January through April; 20 flights per month May through December). In addition, Otter/CASA flights would support pipeline inspection with 4 or 5 flights per month year round. DC-6 flights would support transport of operations cargo with 3 flights per month year-round.

Table 2.9-5. Flight Requirements for Alternative D2 Compared to Alternative A, Proposed Action

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual Total**	**Jun – Sept Total**
2016														
Alternative A **Total New**	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
Alternative D2 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction to APF (Otter/CASA)	10	5	5	5	5	5	5	5	5	10	15	15	90	20
Drilling (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operations Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Cargo (DC-6)	0	0	0	0	0	0	1	1	1	1	0	0	4	3
Drilling Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Cargo (C-130)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Inspection Overflights (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Working Crew (Helicopter Landings in the NPR-A)	0	0	0	0	10	60	60	60	60	60	0	0	310	240
Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	68	86	18	37	8	0	0	0	217	149
Total New	**10**	**5**	**5**	**5**	**83**	**166**	**99**	**118**	**89**	**71**	**15**	**15**	**681**	**472**
Total New Construction Flights	10	5	5	5	15	65	66	66	66	71	15	15	404	263
Total New Operations Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Including Baseline	158	135	194	201	322	570	603	381	375	290	234	215	3,678	1,929

Table 2.9-5. Flight Requirements for Alternative D2 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
2017														
Alternative A **Total New**	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777
Alternative D2 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction to APF (Otter/CASA)	5	5	5	5	10	10	10	10	10	10	15	15	110	40
Drilling (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operations Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Cargo (C-130)	0	0	0	0	0	0	0	0	2	0	0	2	4	2
Pipeline Inspection Overflights (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Working Crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	68	86	18	37	8	0	0	0	217	149
Total New	**5**	**5**	**5**	**5**	**78**	**111**	**43**	**62**	**35**	**10**	**15**	**17**	**391**	**251**
Total New Construction Flights	5	5	5	5	10	10	10	10	10	10	15	15	110	40
Total New Operations Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Including Baseline	153	135	194	206	317	515	547	325	321	242	247	247	3,449	1,708
2018 – 2022														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D2 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	70	70	70	70	0	0	0	0	0	0	0	0	280	0
Operations Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	20	0	0	5	0	0	0	0	0	0	0	0	25	0
Large Cargo (C-130)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	0	0	0	0	0	0	0	0	17	0
Flights to GMT1 for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60

Table 2.9-5. Flight Requirements for Alternative D2 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**94**	**74**	**74**	**80**	**66**	**119**	**36**	**49**	**39**	**0**	**0**	**0**	**631**	**243**
Total New Construction Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Including Baseline	242	204	263	276	305	523	540	312	325	219	219	200	3,628	1,700
2023-2039														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D2 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	4	4	4	4	20	20	20	20	20	20	20	20	176	80
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	70	70	70	70	0	0	0	0	0	0	0	0	280	0
Operations Cargo (DC-6)	3	3	3	3	3	3	3	3	3	3	3	3	36	12
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	20	0	0	5	0	0	0	0	0	0	0	0	25	0
Large Cargo (C-130)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	4	4	5	4	4	5	4	5	52	17
Flights to GMT1 for gravel working crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flights for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**101**	**81**	**81**	**87**	**93**	**146**	**64**	**76**	**66**	**28**	**27**	**28**	**878**	**352**
Total New Constructions Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	7	7	7	7	23	23	23	23	23	23	23	23	212	92
Total Including Baseline	249	211	270	283	332	550	568	339	352	247	246	228	3,875	1,809
2040 +														
Alternative A **Total New**	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative D2 [a] Flights for Operations Personnel at GMT1 (Otter/CASA)	4	4	4	4	20	20	20	20	20	20	20	20	176	80
Construction to APF (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling (Otter/CASA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.9-5. Flight Requirements for Alternative D2 Compared to Alternative A, Proposed Action (Continued)

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
Operations Cargo (DC-6)	3	3	3	3	3	3	3	3	3	3	3	3	36	12
Construction Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drilling Cargo (DC-6)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Cargo (C-130)	0	0	0	0	0	2	0	0	2	0	0	2	6	4
Pipeline Inspection Overflights (Otter/CASA)	4	4	4	5	4	4	5	4	4	5	4	5	52	17
Flights to GMT1 for gravel working crew (Helicopter Landings in the NPR-A)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flights for Ice Road Cleanup/Inspections (Helicopter Landings in the NPR-A)	0	0	0	0	0	15	15	15	15	0	0	0	60	60
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	66	104	21	34	24	0	0	0	249	183
Total New	**11**	**11**	**11**	**12**	**93**	**148**	**64**	**76**	**68**	**28**	**27**	**30**	**579**	**356**
Total New Constructions Flights	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Operations Flights	7	7	7	7	23	23	23	23	23	23	23	23	212	92
Total Including Baseline	159	141	200	208	332	552	568	339	354	247	246	230	3,576	1,813

[a] Alternate D2: First winter (2016), no runway or camp at GMT1. Construction crews will stage out of Nuiqsut Hotel, Nuiqsut 10-Acre, and Alpine. Construction Otter/CASA flights during the winter of 2016 will land at Alpine. May to October 2016, two helicopter flights a day for small gravel-working crew at GMT1- no GMT1 camp or runway availability. Second summer (2017) - GMT1 facilities install contractors working from GMT1 camp. Special Studies will peak during breakup (May and June). All of the special studies will be conducted using helicopter in the absence of a road. Helicopter visits to spill response equipment related to the GMT1 development have been estimated and included in these values. While drilling is occurring in the D2 scenario, there will be pipeline inspection overflights. During the non-drilling months CPAI will de-inventory the pipelines so no liquid is in them, eliminating the need for overflights. Pressure monitoring of the lines can be done with nitrogen, if necessary, to ensure there are no leaks. Pipeline Inspection Overflights (Otter/CASA) flights during facility operations are estimated at a frequency of once per week. If regulations dictate a different inspection frequency then these numbers could significantly change. Pipeline overflights by fixed wing would be replaced by road-based inspections for Alternatives A, B, and C. Drilling is estimated to progress at a rate of 53 days needed per well. In a seasonal drilling scenario in order to complete all 33 wells the required Drilling (Otter/CASA) and Drilling Cargo (DC-6) flights (shown under April 2017-Aprl 2018) will be carried out for an additional 21 years before the “Typical Routine Operations” Phase can begin. (33 wells*53 days per well=1,749 days needed. The seasonal drilling season is 80 days long annually, so 1749 days needed/80 days available per year=22 years total). Flights for ice road Cleanup/Inspections are based on an estimated five landings per mile along the 12-mile ice road, based on past experience. They are spread evenly across the June-September months, but would likely occur over a several week period chosen to avoid subsistence conflicts.

2.9.5 Spill Prevention and Response

As in Alternative D1, Alternative D2 would require redundant emergency spill response equipment to be stored and maintained. Outside the ice road season, any equipment that is not available locally would need to be brought in via aircraft.

Mobilization of emergency response equipment, supplies, and personnel from the APF could be restricted by adverse weather. Adverse weather has restricted air travel at APF 13 to 22 percent of each year for the past four years (CPAI 2014a). In the event of bad weather at Alpine, a response effort could be staged out of Nuiqsut, as often the weather is different in both locations. Therefore, the same would be true if the weather was bad in Nuiqsut, a response effort could be staged out of Alpine. Alpine would be the primary location to stage a response.

Under Alternative D2, the incremental challenges associated with being able to timely respond to emergency spill or life-saving events increases safety and environmental risks throughout the project life.

2.9.6 Comparison of Alternatives D1 and D2

Major project components and on-site facilities and schedules are listed in Table 2.9-6 to facilitate comparison between Alternative D1 and Alternative D2. Differences between the two Alternatives are indicated with an asterisk (*).

Table 2.9-6. Project Components, Facilities, and Access – Comparison of Alternative D1 and Alternative D2

Alternative D1		Alternative D2
Major Project Components		
Drill Pad	15.7 acres	15.7 acres
* Occupied Structure Pad	14.7 acres	13.4 acres
Gravel airstrip length	5,000 feet	5,000 feet
Gravel airstrip /apron	46.1 acres	46.1 acres
Gravel access road	9.7 acres/1.3 miles	9.7 acres/1.3 miles
Pipeline System GMT1 to CD5[a]	8.4 miles	8.4 miles
Water injection Pipeline CD1 to GMT1	18 miles (also for drill site water and diesel supply line)	18 miles (also for drill site water and diesel supply line)
Ancillary Pad(s) east and west	East and west valve pads = 0.7 acres	East and west valve pads = 0.7 acres
* Ice Roads	33 miles - Year 1 36 miles - Year 2 15 miles - Year 3 through 30 (includes operation life)	33 miles - Year 1 36 miles - Year 2 15 miles - Year 3 through 38 (36 years of ice roads) (2018 – 2053) (includes operation life)
* Total fill	845,600 cubic yards	830,800 cubic yards
* Total gravel footprint	87.4 acres	85.8 acres
On-Site Facilities		
Airstrip maintenance and equipment storage building		Airstrip maintenance and equipment storage building
* Mud plant and bulk cement facilities		Mixing facility (smaller than mud plant/bulk cement facilities)
* Storage silos for cement and mud (24)		Storage silos for cement and mud (3)

Table 2.9-6. Project Components, Facilities, and Access – Comparison of Alternative D1 and Alternative D2 (Continued)

Alternative D1	Alternative D2
* Tanks for mineral oil, diesel and brine	Tanks for brine
* Storage tank (diesel)	Diesel storage tanks
Diesel supply pump module	Diesel supply pump module
Disposal tanks and piping	Disposal tanks and piping
Water storage tanks	Water storage tanks
Potable water storage	Potable water storage
Potable water supply pump module	Potable water supply pump module
Injection pump module	Injection pump module
Drilling and mud plant water supply	Drilling and mud plant water supply
* Drilling mud and raw water pumping module	None
Water and wastewater treatment plant	Water and wastewater treatment plant
2-inch potable water supply pipeline CD1 to GMT1	2-inch potable water supply pipeline CD1 to GMT1
2-inch diesel supply pipeline CD1 to GMT1	2-inch diesel supply pipeline CD1 to GMT1
Mineral oil pipeline to GMT1 mud plant	None
Fueling station	Fueling station
* On-site solid waste processing	None
Waste staging area	Waste staging area
Permanent tank farm and piping (chemical storage)	Permanent tank farm piping (chemical storage)
Pad space for ten-month supply of drilling tubular and tools	Pad space for tubulars and tools
Pad space for redundant equipment storage/parking	Pad space for redundant equipment storage/parking
Bullrails for vehicle block heaters	Bullrails for vehicle block heaters
Class 1 disposal well and injection facility	Class 1 disposal well and injection facility
CONSTRUCTION SUPPORT CAMP: 70-man camp would be staged on seasonal ice pad	CONSTRUCTION SUPPORT CAMP: 70-man camp would be staged on seasonal ice pad.
* DRILLING SUPPORT CAMP: 120-man camp (drilling & well-tie-in workers) (support three years of year-round drilling); camp to be placed on occupied structure pad year-round.	DRILLING SUPPORT CAMP: 75-man camp for 25 years (first season drilling + 24 seasons of infill drilling) - which would be moved in and out seasonally with the drill rig on the ice road; camp to be placed on the gravel occupied structure pad.
OPERATIONS CAMP – 25-man permanent full-service operations camp – including kitchen, dining facility, recreation area, office, and storage space. Supports year-round operations and maintenance.	OPERATION CAMP – Same.
Warm and cold storage facilities	Warm and cold storage facilities
Equipment and fleet maintenance shop	Equipment and fleet maintenance shop
Emergency response facility	Emergency response facility
Emergency generator	Emergency generator
Pad space for redundant emergency response equipment	Pad space for redundant emergency response equipment

Table 2.9-6. Project Components, Facilities, and Access – Comparison of Alternative D1 and Alternative D2 (Continued)

Alternative D1	Alternative D2
Access	
Gravel Road: No year-round road access to GMT1 - no gravel road between GMT1 pad and APF. A gravel access road would be constructed between GMT1 pad and occupied structure pad/airstrip.	Gravel Road: No year-round road access to GMT1 - no gravel road between GMT1 pad and APF. A gravel access road would be constructed between GMT1 pad and occupied structure pad/airstrip.
Ice Road: Seasonal ice road from seasonal APF ice road to GMT1 pad. Ice roads would be constructed to provide vehicle access during construction, drilling, operation including annual re-supply.	Ice Road: Seasonal ice road from seasonal APF ice road to GMT1 pad. Ice roads would be constructed to provide seasonal access during construction, drilling and operation including annual resupply.
* Vehicle Traffic: Seasonal ice road traffic supporting construction, drilling, and operation. Seasonal ice road traffic to support 30 years of post-drilling operation. Year-round traffic on 1.2-mile gravel access road to support year-round drilling and operation. Operation traffic supports production, well workovers, maintenance, and resupply.	Vehicle Traffic: Seasonal ice road traffic supporting construction, drilling, and operation (drilling and production simultaneous for 19 years) and post-drilling production (11 years). Seasonal traffic on gravel 1.2-mile access road to support seasonal drilling and year-round traffic on access road to support operation. Operation traffic supports well workovers, maintenance, and resupply.
* Aircraft Traffic: Aircraft is the only means of access to GMT1 for nine months per year (outside ice road season). Aircraft would support year-round construction (two years), drilling, and operation. In addition, aircraft would be used to support ice road inspection, pipeline inspection, special studies, and emergency response.	Aircraft Traffic: Aircraft is the only means of access to GMT1 for nine months per year (outside ice road season). Aircraft would support year-round construction (two years), seasonal drilling, and year-round operation. In addition, aircraft would be used to support ice road inspection, pipeline inspection, special studies, and emergency response.
Drilling and Operation Periods	
* Year-round drilling and year-round post-drilling operation over four years of drilling, then 30 years of operation.	Seasonal drilling; drilling and operation (seasonally simultaneous for 19 years); post-drilling year-round operation (11 years)

2.10 Alternative E

Under Alternative E (No Action), the current conditions and expected future condition in the absence of the project are evaluated. CPAI's right-of-way application, application for permit to drill, and related authorizations would not be approved by BLM.

Alternative E assumes continuing exploration work as required under the GMTU Agreement. For NEPA purposes, BLM does not assume that if CPAI's GMT1 applications are denied that exploratory drilling will cease. Alternative E also assumes permitted studies in the NPR-A would continue, with continued use of aircraft in the project vicinity (See Section 3.4.5.2, *Local Transportation*, and Map 2.10-1). The No Action Alternative further assumes that the Nuiqsut Spur Road and CD5 would be constructed, as those authorizations are independent of CPAI's proposed project.

Table 2.10-1. Infrastructure for Alternative E Compared to Alternative A, Proposed Action

Component	Alternative E	Alternative A Proposed Action
Gravel Drill Pad	0	11.8 acres
Wells	None	33
Access Road	0	7.6 miles (GMT1 to CD5)
Elevated Pipelines on VSMs	None	8.3 miles from GMT1 to CD5 3.1 miles from CD1 to CD4N 6.5 miles from CD4N to CD5
Manual Valve Gravel Pads	None	2 (0.35 acres each)
Bridges	None	2 Crea Creek – 40 ft Tiŋmiaqsiġvik (Ublutuoch) – 350 ft
Gravel Supply	Not needed	ASRC Mine site
Air Access Facilities	None	0
Total Gravel Footprint	No additional footprint from Proposed Action or Alternatives	72.7 acres
Ice Road	No New Ice Roads	36 to 43 miles

No water use beyond what is currently required is expected to occur as a result of Alternative E. Table 2.10-2 lists water use for Alternative E. Alternative A numbers are provided for comparison. There would be no additional gravel use or footprint.

Vehicle traffic for Alternative E is expected to be the same as currently expected from current and expected future conditions: no vehicle traffic is expected due to the lack of gravel or ice road to support the GMT1 project.

Alternative E aircraft traffic represents baseline (current) conditions without GMT1 development. Historic flight information within the eastern NPR-A is shown in Map 2.5-5.

The baseline flights for special studies in Table 2.10-4 (Alternative E) include biological and hydrological studies. Hydrological studies generally peak during breakup (May and June). Helicopter flight frequency supporting biological studies would be at consistent levels from May through August.

Table 2.10-2. Water Use for Alternative E Compared to Alternative A, Proposed Action

Construction Phase	Alternative E	Alternative A
Ice Roads (miles)		
Year 1	0	45.0
Year 2	0	36.0
Ice Roads (MG) [a]		
Year 1	0	67.5
Year 2	0	54.0
Ice Pads (MG) [b]		
Year 1	0	32.5
Year 2	0	13.8
Construction Miscellaneous (MG)		
Year 1	0	1.0
Year 2	0	1.0
Workforce (MG)		
Year 1	0	3.6
Year 2	0	3.6
Summer Construction Workforce (MG)		
Year 1	0	---
Year 2	0	1.35
Construction Total (MG)		
Year 1	0	104.6
Year 2	0	73.8
Drilling Phase (Years 3-6)		
Drilling Ice Pad [b] (MG)	0	4.0
Drilling Water [c] (MG)	0	16.0
Camp Water – Rig Camp and GMT1 Pad Drilling Staff [d] (MG)	0	2.7
Drilling Miscellaneous (MG)	0	1.0
Drilling Years	0	4 years
Drilling Total Per Year (MG)	0	23.7
Drilling Total MG	**0**	**94.8**
Post-Construction Operations (Beginning Year 3)		
Ice Road, Bridge, Pad, Miscellaneous [b, e] (MG)	0	9.5
Camp Support (MG)	0	---
Number of Post Construction Operation Years [f]	0	9
Total Per Year (MG)	0	9.5
Total MG	**0**	**88.5**
Alternative E Totals (MG)		
Construction Totals	0	178.4
Drilling	0	94.8
Operations	0	85.5
Total Water Use	**0**	**358.7**

Notes:

Camp water usage for all locations and alternatives is 100 gallons per person per day.

Ice road water requirement is 1.5 MG per mile.

[a] Ice roads supporting drilling are included in post-construction period.

[b] An ice pad of 16 acres would be needed for all action alternatives (2.5 MG per 10 acres) to support drilling.

[c] Drilling water requirement is based on 2 MG per well for Alternative A. No drilling water would be required for Alternative E.

[d] A 75-man drill rig support camp would be required for Alternative A.

[e] In addition to the ice road water use, 0.5 MG per year is included for miscellaneous ice pad use for Alternative A.

[f] Ice roads are assumed to be developed for Alternative A during the operating period at the following rate: four years of drilling ice roads plus every five years between Years 5 and 30. Ice roads are required to move heavy/wide equipment which is not feasible for all CD5 bridges.

Table 2.10-3. Vehicle Trips Required per Month from 2015-2018 for Alternative E

	January	February	March	April	May	June	July	August	September	October	November	December	Totals
2015													
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Commercial Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Unit Short-Haul Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alternative A Total	---	---	---	---	---	---	---	---	---	---	---	*1,488*	*1,488*
2016													
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Commercial Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Unit Short-Haul Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alternative A Total	*25,138*	*19,380*	*18,876*	*15,748*	*420*	*2,072*	*2,100*	*2,625*	*0*	*0*	*0*	*1,488*	*87,847*
2017													
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Commercial Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Unit Short-Haul Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alternative A Total	*19,923*	*9,412*	*11,765*	*7,199*	*3,504*	*3,672*	*2,937*	*3,672*	*2,937*	*2,937*	*2,937*	*2,500*	*73,395*
2018													
Intercity Bus	0	0	0	0	0	0	0	0	0	0	0	0	0
Light Commercial Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Unit Short-Haul Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Passenger Truck	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alternative A Total	*1,753*	*2,192*	*1,753*	*2,192*	*1,753*	*1,753*	*2,192*	*1,753*	*1,753*	*1,753*	*0*	*4,322*	*24,922*

Table 2.10-4. Flight Requirements for Alternative E Compared to Alternative A, Proposed Action

	January	February	March	April	May	June	July	August	September	October	November	December	Annual Total	Jun – Sept Total
2016														
Alternative A Otter/CASA	5	10	10	10	10	15	15	10	10	10	10	10	125	50
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**10**	**10**	**10**	**144**	**160**	**67**	**81**	**22**	**10**	**10**	**10**	**539**	**330**
Total Including Baseline	153	140	199	206	383	564	571	344	308	229	229	210	3,536	1,787
Alternative E [a] Otter/CASA	118	100	159	166	175	179	179	187	170	189	189	170	1,981	715
DC-6	30	30	30	30	30	30	30	30	30	30	30	30	360	120
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	34	195	295	46	86	0	0	0	656	622
Total	**148**	**130**	**189**	**196**	**239**	**404**	**504**	**263**	**286**	**219**	**219**	**200**	**2,997**	**1,457**
2017														
Alternative A Otter/CASA	5	5	5	5	10	10	10	10	10	10	5	5	90	40
DC-6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helicopter (Flights for Special Studies)	0	0	0	0	134	145	52	71	12	0	0	0	414	280
Total New	**5**	**5**	**5**	**5**	**144**	**155**	**62**	**81**	**22**	**10**	**5**	**5**	**504**	**320**
Total Including Baseline	153	135	194	201	383	559	566	344	308	229	224	205	3,501	1,777
Alternative E Otter/CASA	118	100	159	166	175	179	179	187	170	189	189	170	1981	715
DC-6	30	30	30	30	30	30	30	30	30	30	30	30	360	120
Flights for Special Studies Helicopter Landings in the NPR-A)	0	0	0	0	34	195	295	46	86	0	0	0	656	622
Total	**148**	**130**	**189**	**196**	**239**	**404**	**504**	**263**	**286**	**219**	**219**	**200**	**2,997**	**1,457**
2018														
Alternative A Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative E Otter/CASA	118	100	159	166	175	179	179	187	170	189	189	170	1,981	715
DC-6	30	30	30	30	30	30	30	30	30	30	30	30	360	120
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	34	195	295	46	86	0	0	0	656	622
Total	**148**	**130**	**189**	**196**	**239**	**404**	**504**	**263**	**286**	**219**	**219**	**200**	**2,997**	**1,457**

Table 2.10-4. Flight Requirements for Alternative E Compared to Alternative A, Proposed Action (Continued)

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual Total**	**Jun – Sept Total**
2019 and Beyond														
Alternative A Otter/CASA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DC-6	1	0	1	0	1	0	1	0	1	0	1	0	6	2
Helicopter (Flights for Special Studies)	0	0	0	0	4	44	21	16	24	0	0	0	109	105
Total New	**1**	**0**	**1**	**0**	**5**	**44**	**22**	**16**	**25**	**0**	**1**	**0**	**115**	**107**
Total Including Baseline	149	130	190	196	244	448	526	279	311	219	220	200	3,112	1,564
Alternative E Otter/CASA	118	100	159	166	175	179	179	187	170	189	189	170	1,981	715
DC-6	30	30	30	30	30	30	30	30	30	30	30	30	360	120
Flights for Special Studies (Helicopter Landings in the NPR-A)	0	0	0	0	34	195	295	46	86	0	0	0	656	622
Total	**148**	**130**	**189**	**196**	**239**	**404**	**504**	**263**	**286**	**219**	**219**	**200**	**2,997**	**1,457**

[a] Current (baseline): Otter/CASA flight counts are monthly averages from the years 2011-2013. The number of DC-6 flights may vary by month but are equally distributed based on the expected number of annual flights for estimation purposes. Special studies include biological and hydrological work. Hydrological studies peak during breakup (May and June), biological studies remain constant. Helicopter visits to spill response equipment related to the CD5 development have been estimated and included in these values.

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CHAPTER 3: AFFECTED ENVIRONMENT

A comprehensive description of the affected environment in and around the Alpine Field, including the proposed GMT1 development, was provided in BLM (2004). The BLM (2012) provided updates of some aspects of the affected environment. The summaries of the existing environment provided in Chapter 3 are tiered to, and incorporate by reference BLM (2004, § 3) and BLM (2012, § 3), with specific references cited below.

3.1 Introduction

The objective of this section of the SEIS is to summarize the affected environment, as described in BLM (2004), and supplement it with new information to determine whether the impacts of the proposed project are still within the range of impacts analyzed in BLM (2004). In some cases, the 2004 information has not changed (e.g., vegetation), but the description presented herein is based on new site-specific monitoring of the GMT1 pad. Where more recent information is available, including CPAI studies undertaken to comply with stipulations of BLM (2004a) and to support final GMT1 Project site location(s) and design, this information is included to provide a more robust description of the affected environment.

3.1.1 Project Study Area

The GMT1 Project facilities and proposed drill site are located entirely within the Northeast NPR-A, on the North Slope of Alaska, immediately west of the Colville River delta. The water injection pipeline component from CD4N to APF/CD1, as described above in Section 2.4.3, will be located within an existing pipeline ROW and parallel to two existing pipe racks in the Colville River delta. New pipeline VSMs will be located to match existing VSMs to avoid a "picket-fence" effect that could impede caribou movement.

The project study area defined for this SEIS is depicted on Map 3.1-1. The study area extends approximately 2.5 miles in radius from proposed project facilities and covers 116,447.7 acres. Resources have a varied geographic scope, depending on each individual resource (details regarding specific area of impact analysis for each resource are provided within the discussion for each resource addressed in this SEIS). For example, the geographic scope of air quality analysis is broader than the scope used for soil analysis.

3.1.2 Existing and Planned Infrastructure

The proposed GMT1 pad lies approximately 12 miles northwest of Nuiqsut, a community of about 400 people (see Section 3.4.1 for more information). An approximately 4,500-foot airstrip, owned and operated by the NSB, serves Nuiqsut year-round. Seasonal ice roads to Alpine facilities are typically extended to Nuiqsut, allowing access to the Prudhoe Bay road system during the winter.

In March 2014, Kuukpik Corporation (the Nuiqsut Village Corporation), received a Corps permit (Permit Number POA-2013-68) to widen the Nuiqsut Landfill Road and to construct a 5.8-mile gravel road (Nuiqsut Spur Road) from Nuiqsut to the CPAI CD-5 access road (Map 2.7-1), including a new 11-acre gravel storage pad (Nuiqsut Laydown Pad) near the juncture. The Nuiqsut Landfill Road is part of the Nuiqsut Spur Road. The Nuiqsut Spur Road is intended to increase access to subsistence resources; provide access for training and employment of local residents at the Alpine oilfield; improve access from Alpine to Nuiqsut to facilitate local business opportunities (e.g., camp facilities); and provide year-round transportation for life/safety/health response, spill response (e.g., mutual aid), and medical emergencies. The Nuiqsut Spur Road is under construction and is expected to be completed with addition of fill this winter (2014-2015). The storage pad is completed.

The main Alpine development complex at CD1/APF is approximately 14 miles northeast of the proposed GMT1 pad, as shown in Map 2.5-1. At this time, the gravel CD5-APF access road is finished, except for the bridges. APF is not connected by gravel road to any existing North Slope road system, and is only accessed by seasonal ice road and by air.

There are several cabins in the area. A number of federal and industry exploration wells are in the project study area, but no development has occurred. Several small weather stations are located west of the project study area.

3.1.3 Hazardous and Solid Waste Sites

This section tiers to information provided in BLM (2004, §§ 3.1.2 and 4.3); BLM (2008, § 3.2.10); and BLM (2012, § 3.2.11), and updates spill data through October 2013 from the ADEC Spills Database (ADEC 2013).

3.1.3.1 Existing Sites

Inside the NPR-A, hazardous and solid waste locations have been identified and mapped including landfills, reserve pits, formerly used defense sites, and privately owned sites. One contaminated site has been identified within the project study area (BLM 2008, § 3.2.11; Map 3.1-1). Other sites with potential for hazardous materials and solid waste inside and outside of the NPR-A (e.g., Nuiqsut community sources, winter travel routes, recreational trails, and oil and gas exploration sites) are described by BLM (2004, § 3.1.2.3).

The one contaminated site identified within the project study area is in Nuiqsut (ADEC 2014a; Nuiqsut Power Plant Hazard ID 25937). Other potential sources include more recent oil industry exploration sites, three production pads (CD1, CD2, and CD4), and associated pipelines in the vicinity of the proposed pipeline alignment between CD4 and CD1/APF. No unregulated hazardous or solid waste sites are known to exist in these areas.

The EPA (2013a) Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) at http://www.epa.gov/enviro/facts/cerclis/search.html was also researched for any sites identified within the Alpine Field Development Area. CERCLIS consolidates facility information from multiple EPA systems. No sites were listed within the Alpine Field Development Area. The records review is based on data extracted October 2013.

3.1.3.2 Alpine Spill History

Oil and gas exploratory and production wells exist in the Alpine Field region and produce a large amount of crude oil (daily oil production in 2011 averaged 80,100 barrels of oil per day [bopd], falling to an average of 62,100 bopd in 2013). Pipelines within the Alpine Field consist of a gathering line that transports unprocessed oil and water from CD2, CD3, and CD4 to the APF/CD1 and a 34-mile long oil sales pipeline that connects the processing facility to the Kuparuk River oil field. VSMs elevate the pipelines above the tundra, except at the Colville River main channel crossing where the pipeline is underground (ARRT 2012). The transportation, storage, and use of petroleum products create the potential for spills, leaks, and contamination. Industry facilities with potential to create spills include onshore wellheads, crude oil production facilities, major crude oil and non-crude oil storage, and pipeline facilities.

A review of the ADEC Spills Database, for State-registered spills, showed 195 entries for spills reported within the Alpine Field for the entire operating period, 1998 through October 2013. The largest volume of spilled product was from seawater spills (45 percent or 5,340 gallons) making up nearly half of all spills recorded for the Alpine Field since inception. This was followed by spills from non-crude oil (e.g., diesel, hydraulic oil, engine lube oil, aviation fuel) at 33 percent (or 3,920 gallons). Non-crude spills accounted for the greatest number of spills occurring during this time period, making up 142 recorded spills out of the 195 entries. Of this total, diesel makes up more than 60 percent (or 2,525 gallons) of the non-crude spills. Produced water contributed about 18 percent (or 2,138 gallons) of the total volume of spills from the Alpine Field.

There is a generally decreasing trend in spill occurrences since 2006 following construction and startup of production at CD3 and CD4, which had the highest number of spills (27) for the period of analysis. Spill volume by source showed leaks to be the greatest source of spills occurring at Alpine (5,098 gallons), followed by equipment failure (2,222 gallons), human error (1,113 gallons), and valve failure (940 gallons). Spills of unknown origin accounted for 795 gallons of the total volume spilled.

Further analysis revealed a seasonal increase in the number of spills during the January through April timeframe. This could be the result of increased exploration activities during the winter months. This is also consistent with the spills analysis and trends reported in the Alaska Regional Response Team's *North Slope Subarea Contingency Plan* (ARRT 2012) for spills occurring in the entire North Slope subarea (North Slope Borough). The *North Slope Subarea Contingency Plan* supplements the *Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (Unified Plan)*, and provides information specific to the NSB area, including emergency response phone numbers, available response equipment and other resources, specific response guidelines, and information on hazardous substance presence and sensitive areas protection. Additional spill information and analysis is described in Section 4.5.

3.2 Physical Characteristics

The following description of physical characteristics of the project study area is structured and organized to match BLM (2004).

3.2.1 Terrestrial Environment

The terrestrial environment remains essentially the same as described in BLM (2004), but there is an increased understanding of the role of climate change in the Arctic.

3.2.1.1 Physiography

The physiography (physical geography) of the project study area is described in BLM (2004, § 3.2.1) and BLM (2012, §§ 3.2.4 - 3.2.5) following Wahrhaftig (1965).

The project study area is on the Arctic Coastal Plain (ACP), an area characterized by low topographic relief, numerous lakes, meandering stream channels, and polygonal patterned ground. The geomorphic classification of the project study area is shown in Map 3.2-1. The areal extent of each geomorphic unit occurring with the project study area is listed in Table 3.2-1.

Table 3.2-1. Geomorphic Units in the Project Study Area

Geomorphic Unit [a]	Acres	Project Study Area (%)
Thaw Basin, Ice-rich Margin	16,950	15%
Delta Inactive Overbank Deposit	16,881.0	15%
Alluvial-Marine Deposit	14,644.4	13%
Thaw Basin, Ice-rich Center	8,305.9	8%
Deep Isolated Thaw Lake	7,190.8	7%
Old Alluvial Terrace	7,004.4	6%
Delta Abandoned Overbank Deposit	5,324.6	5%
Delta Active Channel Deposit	4,017.6	4%
Tidal River	3,783.5	3%
Delta Thaw Basin, Ice-poor	3,721.9	3%
Deep Tapped Riverine Lake, High-water Connection	3,292.2	3%
Deep Isolated Lake	2,837.2	3%
Shallow Isolated Thaw Lake	1,987.0	2%
Eolian Inactive Sand Deposit	1,612.3	1%
Meander Inactive Overbank Deposit	1,471.1	1%
Deep Connected Lake	1,448.8	1%
Delta Active Overbank Deposit	1,345.6	1%
Brackish Deep Tapped Lake, Connected	1,314.0	1%
Thaw Basin, Ice-poor Margin	1,221.6	1%
Delta Inactive Channel Deposit	901.3	1%
Deep Riverine Thaw Lake, Connected	879.9	1%
Eolian Active Sand Deposit	508.2	<1%
Thaw Basin, Ice-rich Undifferentiated	485.1	<1%
Delta Thaw Basin, Ice-rich	448.0	<1%
Deep Isolated Riverine Lake	337.0	<1%
Lowland Headwater Floodplain	332.9	<1%
Shallow Tapped Riverine Lake, High-water Connection	318.1	<1%
Shallow Isolated Lake	305.5	<1%
Lower Perennial River, non-glacial	292.0	<1%
Fill and Embankments	225.8	<1%
Thaw Basin, Ice-poor Undifferentiated	222.5	<1%
Deep Isolated Riverine Thaw Lake	174.8	<1%
Thaw Basin Pingo	149.6	<1%
Gravel Fill	128	<1%

Table 3.2-1. Geomorphic Units in the Project Study Area (Continued)

Geomorphic Unit [a]	Acres	Project Study Area (%)
Meander Abandoned Overbank Deposit	100.7	<1%
Meander Fine Inactive Channel Deposit	96.6	<1%
Thaw Basin, Ice-poor Center	72.3	<1%
Shallow Isolated Riverine Lake	45.4	<1%
Solifluction Deposit	44.4	<1%
Inactive Tidal Flat	37.2	<1%
Shallow Connected Lake	25.1	<1%
Deep Connected Riverine Lake	24.0	<1%
Lowland Headwater Stream	21.2	<1%
Meander Active Overbank Deposit	18.7	<1%
Tidal Lake	11.2	<1%
Brackish Shallow Tapped Lake, Connected	10.7	<1%
Shallow Isolated Riverine Thaw Lake	8.1	<1%
Brackish Deep Lake, Isolated	8.0	<1%
Shallow Connected Thaw Lake	5.3	<1%
Shallow Isolated Dune Lake	5.2	<1%
Meander Fine Active Channel Deposit	4.5	<1%
Sewage Lagoon	3.1	<1%
Total	110,604.9	100%

[a] Data from Jorgenson et al. (2004)

3.2.1.2 Geology and Minerals

The proposed project is in the NPR-A, where the geology has been studied by the USGS for more than 100 years. Information on geology of the project study area is presented by BLM (2004, § 3.2.1.2), BLM (2008, § 3.2.4) and BLM (2012, § 3.2.5).

Supplemental site-specific information relevant to the evaluation of geology and mineral resources within the project study area was not identified.

3.2.1.3 Petroleum Resources

The petroleum geology of the NPR-A, historical and recent exploration efforts, leasing activity, and oil and gas potential is described in BLM (2008, § 3.2.5) and BLM (2012, § 3.2.6).

Geologists assess oil and gas potential of the area by defined geologic plays, each with unique characteristics. In 2010, the USGS assessed the undiscovered technically recoverable oil resource in the NPR-A at 896 million barrels (MMbbl) (BLM 2012, § 3.2.6.3). Based on data from industry exploration, the USGS estimated that 120 to 200 MMbbl of discovered oil (oil and condensate) may also be technically recoverable in the NPR-A (USGS 2010). Other information on geology is provided in BLM (2004, § 3.2.1.2) and BLM (2012, § 3.2.5).

3.2.1.4 Soils and Permafrost

Soils and permafrost in the Northeast NPR-A within the project study area are described in BLM (2004, §§ 3.2.1.3-3.2.1.4), with additional information provided in BLM (2008, § 3.2.7) and BLM (2012, § 3.2.8).

The soils in the region are shallow and wet, with deep permafrost beneath. In the project study area, vegetation covers much of the surface, with an associated layer of ice-rich organic silt, silt, and sandy silt. Detailed results of soil samples collected around the general project study area are reported in *Geomorphology of the Northeast Planning Area, National Petroleum Reserve–Alaska,* by Jorgenson, et al. 2003a. The project study area is underlain by continuous permafrost, which on the North Slope, ranges from depths of about 650 feet to more than 2,000 feet. During the Arctic summer, solar radiation thaws a shallow layer of soil at the surface, creating a seasonally unfrozen zone termed the active layer. Beneath the active layer, almost all material remains frozen; segregated and massive ice formations are common. A continuing supply of available water is required to maintain many of these features and without new water they may degrade rapidly, resulting in a change of vegetation and ecosystems. Permafrost impedes the infiltration of surface water, resulting in saturated surface soils. Vegetation insulates the permafrost, and disturbance of surface vegetation can increase melting of permafrost and result in subsidence. The potential for subsidence varies with ice content of the soils. As noted above, the alluvial-marine deposits in the project study area contain fairly high mean ice volumes. These same deposits are typically found out of the active floodplain, yielding a lower potential to impound water which would promote permafrost degradation (BLM 2004, § 3.2.1.3). Information is provided in BLM (2004, § 3.2.1.3) and BLM (2012, § 3.2.8.2).

Climate change and the impacts on the terrestrial environment in the project study area are discussed in Section 3.2.4.

3.2.1.5 Sand and Gravel Resources

Sand and gravel resources in the project study area and the region are discussed in BLM (2004, § 3.2.1.5), BLM (2008, § 3.2.8) and BLM (2012, § 3.2.9). The sand and gravel material sites identified within the project study area include the existing ASRC Mine site located east of the Colville River and the proposed Clover site on the west side of the river described in BLM (2004, p. 160). The ASRC Mine site is the gravel source proposed for the GMT1 Project. The location of this site is identified in Map 3.1-1.

The area west of the Colville River is characterized by an apparent scarcity of suitable gravel for construction (BLM 2012, § 3.2.9).

On federal lands in the NPR-A, subsurface sand and gravel are owned by the federal government, and the Secretary of the Interior can dispose of these resources for use in permitted activities within the NPR-A, including energy production and development.

3.2.1.6 Paleontological Resources

Paleontological resources occur in many parts of the NPR-A, with important known localities associated with bluffs and banks of the northern Colville River, notably around Ocean Point. Previous surveys were performed and included documentation of paleontological resources in the project study area. Because of the sensitive nature of this information and laws limiting its dissemination, the specific locations of identified sites are not included herein. These studies were reviewed and no paleontological resources were documented that would be directly affected by the project. Other information on paleontological resources is provided in BLM (2004, § 3.2.1.6) and BLM (2012, § 3.2.7).

3.2.1.7 Renewable Energy

The renewable energy resources within the NPR-A are discussed in BLM (2012, § 3.2.3). The existing and potential development areas for renewable energy projects, including wind, solar, and biomass are evaluated by BLM as part of land use planning.

The potential for commercial wind energy generation facilities in the project study area is likely to be low. Generation sites need to be close to end-users (communities). Most of the land around villages is owned by Native corporations; the BLM manages very little land adjacent to communities (BLM 2012, p. 152). The potential for commercial solar or biomass energy operations is very low in the NPR-A (BLM 2012, p. 152).

3.2.1.8 Wildland Fire

Wildland fire in the NPR-A is discussed in BLM (2004, § 3.3.3) and includes both wildfires and prescribed fires. Wildfires are unplanned fires that occur in wildlands and are caused by human or natural means (e.g., lightning strikes), whereas prescribed fires are naturally or manually ignited fires that occur in areas where burning is planned. Prescribed fires have not been used as a management tool within the NPR-A and are not proposed (BLM 2012, p. 222).

Large wildfires are rare in the tundra; most are small and although fires larger than 10,000 acres have occurred, the 256,000-acre Anaktuvuk River Fire in 2007 was unprecedented. Palynological (pollen) investigation of two foothills lakes shows little evidence of large, extensive fires in the past 5,000 years and analysis of deeper lake cores have revealed only a few large fires in the past 9,000 years or so. The number of recorded fires on the North Slope has increased over the past 40 years, although this may be attributed to increased detection (BLM 2012, p. 222).

Previous occurrence of wildfire in the project study area is unknown.

3.2.2 Water Resources

The aquatic environment, including the project study area is described in BLM (2004 § 3.2.2.1) and BLM (2012 § 3.2.10.1).

Water resources in the project study area consist mainly of rivers, shallow discontinuous streams, lakes, and ponds. Springs are absent, deep groundwater is saline, and shallow groundwater is limited to shallow areas below rivers and lakes. Streams in the ACP typically freeze relatively early and thaw relatively late (e.g., September and June). Wetlands are described in Section 3.3.1, *Vegetation and Wetlands*.

Hydrology in the project study area is predominantly a function of climate and permafrost, which limits water availability. More than half the annual precipitation occurs as snow, and snowmelt contributes the majority of annual runoff and helps maintain a saturated layer of surface soils.

This section summarizes relevant information originally presented in the BLM reports cited above and includes supplemental information regarding hydrology in the proposed project area and project study area obtained from studies conducted in 2009 through 2011 by Michael Baker Jr., Inc. (MBJ 2009b, 2010, and 2011).

3.2.2.1 Rivers, Streams, and Drainage Basins

The following discussion is drawn from BLM (2012, § 3.2.10.1). While hydrologic data for the proposed project study area is limited, streams and rivers for which data are available share flow characteristics that are unique to the region (Brabets 1996). In the winter, flow is generally nonexistent or so low as to not be measurable. River flow begins during breakup in late May or early June as rapid flooding and when combined with ice and snow, can inundate extremely large areas in a matter of days. More than half of the annual discharge for a stream can occur during a period of several days to a few weeks (Sloan 1987). Most streams continue to flow throughout the summer, but at substantially lower discharges. Rainstorms can increase stream flow, but they are seldom sufficient to cause flooding within the ACP. Stream flow rapidly declines in most streams shortly after freezeup in September and ceases in most rivers by December. Streams on the North Slope are generally divided into three types, based on the physiographic province of their origin: those that originate: (1) on the ACP, (2) in the Arctic foothills, or (3) in the Brooks Range.

The ACP is a mosaic of tundra wetlands with extremely low relief. Because the permafrost prevents water from entering the ground and the low relief limits runoff, the ACP is covered with lakes, ponds, and generally slow-moving streams. Streams originating in the ACP generally have the latest breakup and earliest freeze up. The Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek both originate in the ACP.

Streams originating in the Arctic foothills have a steeper gradient and consequently more gravel bar and cut bank features than those on the ACP. These streams tend to break up earlier, freeze up later, and have a slightly higher average unit runoff than streams of the ACP. Judy Creek, located within the project study area, has its origin in the Arctic foothills.

The Colville River is the largest river on the North Slope originating in the Brooks Range. As the only river that includes mountainous and glacial drainage, the Colville River carries the highest sediment load and exhibits the greatest range of geomorphic features of any river in the area. Breakup and freezeup are more complex along the Colville River because of the extreme length and range of elevation. Flow persists later in the year on the Colville River than on other North Slope rivers in the region.

More than half the project study area is located within the Colville River drainage basin, although the project study area is also located within the Fish Creek drainage basin, Judy Creek drainage basin, and the Tiŋmiaqsiġvik (Ublutuoch) River drainage basin. The project study area is located primarily within the eastern portion of the Fish Creek drainage basin (MBJ 2009b; BLM 2004, 2012).

A summary of general hydrologic data for the major drainages within the project study area is provided in Table 3.2-2 and shown on Map 3.2-2.

Table 3.2-2. Summary of Drainage Basins within the Project Study Area

Drainage Basin	Water Body	Headwater Origin	Receiving Water	Drainage Area (MI^2)	Lake Coverage (%)
Colville River	Colville River (Nigliq Channel and East Channel)	Brooks Range	Harrison Bay	20,920	Unknown
Fish Creek	Fish Creek	Arctic Foothills and Arctic Coastal Plain	Harrison Bay	1,827	22%
Judy Creek	Judy Creek	Arctic Foothills	Fish Creek	666	18%
Tiŋmiaqsiġvik (Ublutuoch) River	Tiŋmiaqsiġvik (Ublutuoch) River	Arctic Coastal Plain	Fish Creek	248	15%

Adapted from BLM (2004,Table 3.2.2-2) with additional information from BLM (2012, Table 3-12).

Colville River and Colville River Delta

The Colville River is the longest river (370 miles) and has the largest drainage basin (20,920 mi^2) on the North Slope of Alaska, extending from the Brooks Range to the Arctic Ocean (Jorgenson et al. 1997). The Colville River delta is more than 25 miles long and covers approximately 250 square miles (Jorgenson et al. 1994). The head of the Colville River delta is the downstream-most point where the river flows in a single channel. No new information regarding the Colville River or Colville River delta are presented herein; the information remains unchanged from BLM (2004, § 3.2.2.1).

Fish Creek Basin Streams

The general Fish Creek drainage basin and stream information is described in BLM (2004, § 3.2.2.1) and BLM (2012, § 3.2.10.1).

The Fish Creek drainage basin is relatively large (1,827 mi^2) with portions of its headwaters in the Arctic foothills, as well as the ACP. The Fish Creek basin consists of three significant tributary basins: Inigok Creek drainage basin, Judy Creek drainage basin, and Tiŋmiaqsiġvik (Ublutuoch) River drainage basin (URS Corporation 2003). Only the Judy Creek drainage basin has a significant portion of its headwaters in the Arctic foothills (BLM 1998a).

Supplemental information relative to the project study area and more recent studies are presented below.

The Fish Creek drainage basin has two significant streams affected by the proposed project plan, Fish Creek and its tributary, the Tiŋmiaqsiġvik (Ublutuoch) River. Fish Creek flows northeast and enters Harrison Bay just west of the Colville River delta. The Tiŋmiaqsiġvik (Ublutuoch) River (as well as the Nigliq Channel of the Colville River) is used by residents of Nuiqsut for access to hunting and fishing areas (BLM 2004, § 3.4.9.4).

The hydrology of the project study area, including the Tiŋmiaqsiġvik (Ublutuoch) River sub-drainage has been studied from 2001 through 2011 to support GMT1 Project design. The Tiŋmiaqsiġvik (Ublutuoch) River is a tributary of Fish Creek that flows north approximately 7 river miles, connecting to Fish Creek approximately 10 river miles upstream from Harrison Bay. It is characterized by numerous meander bends, often with undercut banks (MBJ 2009a) which are vegetated with dense brush (Dietzmann et al. 2002).

Eight drainage and sub-drainage basins, including the Tiŋmiaqsiġvik (Ublutuoch) River drainage, are crossed along the proposed route to GMT1. Delineation of sub-drainage basins that contribute to the flow at various points along the proposed corridor for the GMT1 Project show that water flow along the road corridor is typically from the south to north. In general, the sub-drainage basins are relatively small (4.1 mi^2 or less) and water flow across the proposed access route would be limited (MBJ 2009a).

The Tiŋmiaqsiġvik (Ublutuoch) River is the largest and only perennial stream along the GMT1 proposed corridor ROW. Two other small streams are crossed by the proposed GMT1 access road. Barely Creek is a channel of beaded streams that drain to a small sub-basin of ponds and marshes located just to the west of the Tiŋmiaqsiġvik (Ublutuoch) River. The proposed access road crosses Crea Creek approximately 0.75 mile west of Barely Creek. At this location, Crea Creek flows between two smaller lakes and has a firm channel bed with underlying sedge and banks dominated by willows. Streamflow collected at this site (S5) is present within this report (MBJ 2009a).

Flooding Regime

Flooding of North Slope rivers is influenced by the type of physiographic region drained, the size of the drainage area, and the frequency of the event. Snowmelt flooding occurs annually in all North Slope rivers. For rivers in the project study area, snowmelt flooding nearly always produces the annual peak discharge. On some of the larger rivers, summer precipitation or late summer/fall snowmelt events have been observed to produce low magnitude floods. Ice jams during breakup can also influence or result in flooding as described in the sections below.

As spring breakup flooding is normally the largest annual flooding event each year on the North Slope, monitoring of this event is integral to understanding regional hydrology. The breakup cycle is the result of several factors including snow pack, sustained cold or warm temperatures, ice thickness, wind speed and direction, precipitation, and solar radiation (MBJ 2009a).

Colville River and Colville River Delta

The flooding regime for the Colville River and Colville River delta remain essentially as described in BLM (2004, § 3.2.2.1).

Fish Creek Basin

The hydrologic conditions on Fish Creek, Judy Creek, and the Tiŋmiaqsiġvik (Ublutuoch) River were investigated during breakup in 2001, 2002 and 2003 (URS Corporation 2001 and 2003; MBJ 2003). These studies were presented in BLM (2004, § 3.2.2.1) and included monitoring sites at six locations along Fish Creek, four locations along Judy Creek, and two locations along the Tiŋmiaqsiġvik (Ublutuoch) River.

The hydrologic conditions within the Fish Creek drainage basin were further studied in 2009, 2010, and 2011 to support the proposed GMT1 Project (MBJ 2009a, 2010, 2011). These findings are summarized below and peak discharge, stage, and date information obtained for the Tiŋmiaqsiġvik (Ublutuoch) River, location 6.8, from 2003 through 2011 is summarized on Table 3.2-3.

In 2009 nine locations were monitored during the breakup including seven small drainages along the proposed access road corridor, the proposed pad site, and the Tiŋmiaqsiġvik (Ublutuoch) River at the proposed road crossing. The nine locations represented sub-drainage basins within the Fish Creek drainage basin ranging in size from 0.4 mi^2 to 4.1 mi^2. The 2009 breakup was slightly earlier than the historical average (a period of unseasonably warm weather preceded breakup), characterized by relatively low water surface elevation, small stream flooding resulting from local melt, and slightly lower peak discharge readings. Peak stages within the eight sub-drainage basins were observed between May 29 and June 3, 2009 (MBJ 2009a).

In 2010, seven locations were monitored during the breakup, including one small drainage near conceptual GMT2, a small stream crossing the proposed CD5-GMT1 road route, and the Tiŋmiaqsiġvik (Ublutuoch) River at the proposed CD5-GMT1 road crossing. The Clover site monitoring data is discussed in Section 3.2.2.4. The 2010 breakup was slightly later than the historical average, characterized by relatively lower peak water surface elevations and lower peak discharges. In fact, breakup on the Tiŋmiaqsiġvik (Ublutuoch) River occurred approximately five days later than the historical average on June 8 with some ice jamming present at the time of peak flow (MBJ 2010).

In 2011, observations and measurements were collected from locations along the proposed GMT1 and conceptual GMT2 access road corridor. The 2011 breakup was characterized by relatively low surface water locations, and slightly earlier peak discharge (MBJ 2011).

Table 3.2-3. Tiŋmiaqsiġvik (Ublutuoch) River Historical Peak Discharge, Stage, and Date

	Peak Discharge		Peak stage	
Year	Volume (cfs)	Date Observed	Stage (ft BPMSL)	Date Observed
2011	2,350	June 2	9.39	June 2
2010	5,360	June 8	10.38	June 8
2009	1,990	May 30	8.45	May 29
2006	1,290	June 6	6.19	June 7
2005	1,680	June 9	10.01	June 7
2004	2,800	June 5	10.50	June 6
2003	1,300	June 9	10.14	June 6

Adapted from Table 1.1 in MBJ 2011. Data only includes location 6.8.

cfs – cubic feet per second

BPMSL – BP (British Petroleum) mean sea level

Flood Frequency Predictions

The flood-peak discharge estimates for head of the Colville River, Fish Creek, Judy Creek, and the Tiŋmiaqsiġvik (Ublutuoch) River were presented in BLM (2004, § 3.2.2.1, Table 3.2.2-7).

Michael Baker Jr., Inc. (2009a) noted that the proposed CD5-GMT1 road bridge crossing at the Tiŋmiaqsiġvik (Ublutuoch) River will be the largest drainage structure between CD5 and GMT1 and calculated flood frequency predictions and peak stage estimates as shown in Table 3.2-4.

Table 3.2-4. Tiŋmiaqsiġvik (Ublutuoch) River Flood Frequency and Peak Discharge and Stage Estimates

Recurrence Interval (yr)	Peak Discharge (cfs)	Peak annual stage estimates (ft BPMSL)
2	3,600	9.2
5	5,300	10.5
10	6,500	11.1
25	7,900	Not Presented
50	8,800	11.9
100	9,800	12.1

Adapted from Tables 5.1 and 5.3 in MBJ 2009a. Data only includes location 6.8.

cfs – cubic feet per second

BPMSL – BP (British Petroleum) mean sea level

3.2.2.2 Lakes and Ponds

The characterization of lakes and ponds within the project study area, remains essentially as described in BLM (2004, § 3.2.2.1) and BLM (2012, § 3.2.10.1), as summarized in the sections below.

Lakes and ponds are the most common hydrologic feature on the ACP, including the project study area, with most of the lakes and ponds in this region originating from the thawing of ice-rich sediments (Sellman et al. 1975). Surface water sources located in close proximity to proposed GMT1 Project facilities include a lake immediately south of the proposed GMT1 pad, as well as several lakes, drainages, and creeks along the access road.

Unlike streams, lakes store water year-round and are the most readily available water source on the North Slope (Sloan 1987), with availability of year-round water determined by the depth of the lake. Lakes are generally classified by depth, as either shallow (less than 6 feet) or deep (greater than 6 feet) lakes.

Recharge of lakes in the project study area occurs through three mechanisms: (1) melting of winter snow accumulations within the lake's drainage basin, (2) overbank flooding from nearby streams, and (3) precipitation in the form of rainfall (MBJ 2002). Smaller lakes may also be recharged by other lakes within the project study area if they are connected by a channel.

Shallow Lakes and Ponds

Seasonally flooded wetlands, ponds, and shallow lakes dominate the ACP in the project study area. The shallow lakes and ponds generally begin to freeze in September, freeze to the bottom by mid-winter, and become ice-free between mid-June and early July, about a month earlier than the deeper lakes (Walker 1983, Hobbie 1984).

While ponds and shallow lakes generally lack fish because they usually freeze to the bottom, they can provide important summer rearing fish habitat if they are connected to a stream by a channel or intermittently flooded by a nearby stream. They also provide important habitat to emergent vegetation, invertebrates, and migratory birds due to the earlier availability of ice-free areas.

Deep Lakes

Deep lakes (greater than 6 feet deep) with relatively large areas are present in the southern and western areas of the ACP. Some deep lakes are present within the project study area. Because deep lakes do not freeze to the bottom, they provide an overwintering area for fish and aquatic invertebrates and are the most readily available supply of water during the winter. Deep lakes also have a larger thermal mass, thus the deeper lakes may remain covered by ice into early July, much later than the shallow lakes (Walker et al. 1978).

Lake Water Use

Ongoing and future oilfield activities within the project study area would utilize ice roads and pads during the winter for access and transportation. Each winter season, millions of gallons of fresh water and ice chips are withdrawn from regional lakes for the construction of ice roads and pads. Water withdrawals for construction can begin as early as December and continue through April. Ice roads are usually completed mid-winter; however, water withdrawals for ice road and pad maintenance continue throughout the season. Freshwater lakes are also used as a potable water source and as sources of make-up water for exploratory drilling operations (MBJ 2002). Between 1999 and 2006, approximately 513 million gallons (MG) of water from 126 lakes were used for exploration and construction of ice roads and pads (BLM 2006). Generally, water withdrawals during winter occur from lakes 7 feet deep or deeper and are limited to 15 percent of the estimated free-water volume remaining below the ice.

During the construction phase of the project, fresh water would be required for domestic use at remote construction camps and for the construction and maintenance of ice roads and ice pads. Potable water requirements are estimated at 10,000 gallons per day (gpd) during construction seasons. A total of 305 people or more may be needed during Year 1 for construction activities for Alternative A. If several additional camps were in place approximately 30,000 to 40,000 gpd would be required. Approximately 1.5 MG of water per mile would be needed for ice road construction and maintenance (90 days). The estimated miles of ice roads, area of ice pads, and associated water use for the action alternatives is summarized in Table 2.3-2 and Section 2.5.4.1. Water for construction and maintenance of ice roads will be withdrawn from lakes in the vicinity of the project as authorized by temporary water use permits and fish habitat permits where necessary.

The proposed project will require fresh water for domestic use and for drilling activities during the drilling and production phase. Potable water requirements during drilling are estimated at 7,500 gpd during drilling. Drilling water requirements are estimated at 20,000 to 38,000 gpd. Water for drilling will be withdrawn from lakes in the vicinity of the project as authorized by temporary water use permits and fish habitat permits where necessary.

Lake Studies

The BLM (2004, § 3.2.2.1) described several lake studies conducted between 2000 and 2003 that are located within the project study area. Key findings from these studies are summarized briefly below.

- Over a five-year study period, water withdrawals generally did not affect water chemistry, nor did they directly affect fish populations (MJM Research 2003e). With respect to the lakes' water quality, pumping did not appear to affect temperature, pH, turbidity, sulfate, or nitrate levels (MBJ 2002).
- Lake water quality changed little as a result of pumping (for water withdrawal), water surface elevation changes in pumped lakes were within the range of changes seen in reference lakes, and changes in water surface elevations were correlated with changes in ice thickness (Oasis 2001).
- Water withdrawal rates were typically well below the maximum allowable. The water level decreases caused by pumping did not advance the freezing rate of the study lakes, and water levels depressed by pumping returned to pre-pump levels before freezeup (MBJ 2002).
- Water surface elevations in the majority of pumped lakes were lowered more than in reference lakes. The dominant mechanism for recharge of the lakes was melting winter snow accumulations. Data from 2001 and 2002 studies as well as anecdotal information at seven North Slope communities (including Nuiqsut) indicated that the magnitude of spring recharge has always been sufficient to compensate for withdrawals (MBJ 2002).

3.2.2.3 Subsurface Water (Groundwater)

The characterization of groundwater within the project study area remains essentially as described in BLM (2004, § 3.2.2.1) and BLM (2012, § 3.2.10.1), as summarized in the sections below.

In general, usable subsurface water in the project study area is limited to distinct and unconnected shallow zones due to the presence of permafrost, which is almost continuous across the North Slope (BLM 2004, § 3.2.2.1). The frozen state of the soils combined with their fine-grained characteristics and saturated conditions form a confining layer that prevents percolation and recharge from surface water sources, and prohibits the movement of groundwater. Because percolation and recharge are restricted, the formation of usable subsurface water resources is limited to unfrozen material on top of the permafrost or taliks (thawed zones) beneath relatively deep lakes, or zones in thawed sediments below major rivers and streams. In general, while these shallow groundwater zones do exist, they are typically very small and the water is likely unsuitable for drinking and potentially harmful to vegetation when discharged on the tundra surface (BLM 2004, § 3.2.2.1).

In the project study area, shallow supra-permafrost water also occurs seasonally within the active zone above the impervious permafrost; the thickness of the active layer is typically 1.5 feet, but ranges from 1 feet to 4 feet (BLM 2004, § 3.2.2.1).

Groundwater within permafrost or intra-permafrost water occurs in discontinuous confined locations, where often the presence of dissolved salts depresses the freezing point of the water. Like shallow groundwater, the saline quality of the intra-permafrost groundwater makes it unsuitable for drinking water and potentially harmful to vegetation if discharged to the tundra surface. The usability of this type of groundwater source is likely to be limited because of the nature of its formation.

Deep wells drilled through the permafrost have encountered highly mineralized groundwater at depths of 3,000 feet to more than 5,000 feet in the vicinity of Prudhoe Bay and at depths of 1,600 feet to 2,500 feet near Barrow, but little data on deep water sources in the project study area exist (Sloan 1987, BLM 1998a, Kharaka and Carothers 1988). Available data suggest that deep groundwater in the NPR-A would probably be similar to that found at Barrow and Prudhoe Bay, and would be too saline for domestic use.

Recharge

Snowmelt provides the major source of water for recharge to the shallow water-bearing zones that occur below large lakes and major streams and to the annual thaw zones that occur beneath ponds and marshy areas (BLM 2004, § 3.2.2.1). However, deeper groundwater zones beneath the permafrost are not as readily recharged. Sub-permafrost water may be recharged from areas to the south in the Arctic foothills and the Brooks Range by infiltration of meltwater. It is also possible that the sub-permafrost water could represent stagnant and/or isolated water zones that were cut off from recharge and groundwater movement as a result of the formation of permafrost during the Pleistocene, or that were isolated by orogenic events associated with the formation of the Brooks Range.

Springs

Landsat imagery analysis was used to locate numerous groundwater springs on the North Slope by identifying the large overflow icings (aufeis) created downstream during the winter. However, none of these springs were located in the project study area (BLM 2004, § 3.2.2.1).

3.2.2.4 Surface Water Quality

A summary of surface water chemistry by analyte in the project study area is contained in the ASDP Final EIS as cited in BLM (2004, § 3.2.2.2) and in BLM (2012, § 3.2.10.2). Results for water quality that are relevant to the project study area are summarized below.

It is important to have knowledge of existing water quality conditions in determining potential impacts of proposed actions. Surface water is used by fish and wildlife in the project study area and could be a source of potable water for humans. The State of Alaska water quality standards are published in 18 AAC 70. The State of Alaska drinking water regulations prescribe treatment for potable use. Drinking water regulations for the State of Alaska are published in 18 AAC 80. Drinking water is obtained from lakes near the Alpine development (lakes L9313 and L9312) and Nuiqsut. A discussion regarding drinking water for these sources is included in Section 3.4.1, *Community Health and Welfare*.

Most freshwaters in the project study area are considered pristine as stated in BLM (2012, § 3.2.10.2); however, fecal contamination above State of Alaska water quality standards may occur in areas with dense avian, caribou, and lemming populations. Cold water temperatures tend to prolong the viability of fecal coliform. Ponds and local streams are highly colored from dissolved organic matter and iron, and most freshwater bodies in the NPR-A have low turbidity and dissolved oxygen (DO) near saturation. According to ADEC, no freshwater in the proposed project area is impaired by pollutants (BLM 2004a, § 3.2.2.2, p. 184).

Water quality data specific to the lakes in the vicinity of GMT1, CD1, and CD4 were collected in 2002, 2004, and 2009-2012 as described in MJM Research (2004), MBJ (2009b), North Slope Science Initiative Alaska (NSSI 2009), MBJ (2010), and Derry et al. (2012). Surface water features, including named lakes, are included in Map 3.2-3.

These data can be used to evaluate the potential impact to water quality from roads and pads associated with CD1 and CD4 and provide background water quality data for the proposed project area. Turbidity measured was variable between lakes and during monitoring years but, in all cases, was well below the levels that affect aquatic organisms. DO measured during the summer was typically near 100 percent saturation in the lakes sampled as discussed in MJM Research (2006), MBJ (2009b), and MBJ (2010). DO concentrations for lakes approximately 10 feet deep remained high during the March 2011 sampling event but were about half for lakes 6 feet deep as discussed in Derry et al. (2012). Winter DO concentrations are highly variable between individual lakes (deep and shallow) and stratified within the water column under the ice and cannot be regionalized, which makes it extremely difficult to compare lakes across a region.

In one study, lakes M9924 and M9925 (see Maps 3.2-3 and 3.3-4), located north and south of the proposed project area, respectively, were sampled four times in August 2002. Results from the samples analyzed for each lake met the water quality standards for DO, pH, and turbidity (MJM Research 2004). In 2006 and 2008, water chemistry results from lake samples collected within 10 miles of the proposed project area, also met the water quality standards for DO, pH, and turbidity (NSSI 2009).

Information available for alkalinity and pH, with respect to freshwater bodies within the proposed project area, remain essentially as described in BLM (2004, § 3.2.2.2) and in BLM (2012, § 3.2.10.2).

3.2.3 Atmospheric Environment

The general nature of the atmospheric environment is essentially as described in BLM (2004). Emerging trends in climate change that were described in 2004 have continued, with more recent information provided in BLM (2012).

3.2.3.1 Climate and Meteorology

The Project is in the Arctic climate zone. Weather is typical of the North Slope, with long, cold winters and short, cool summers. The annual mean temperature in the NPR-A is about 10°F, with subfreezing temperatures from mid-October into May. Summaries of temperature and precipitation data collected at Umiat, Fish Creek, and Barrow (within the NPR-A), Kuparuk Oil Field (east of NPR-A), and Nuiqsut (the community closest to the NPR-A) are presented in Table 3.2-5. Temperature data collected from 1998 through 2008 at the National Oceanic and Atmospheric Administration (NOAA) Automated Surface Observing System (ASOS) meteorological monitoring station in Nuiqsut are summarized below.

- Maximum monthly mean temperature = 57°F (July); maximum temperature 84°F (August).
- Minimum monthly mean temperature = -24.1°F (February); minimum temperature -53°F (March).
- Mean temperature = 12.9°F.

Snowfall is greatest in October, but can occur during any month of the year. Snow cover is common from October through May. Average snow depth (December through April) ranges from 10 inches in Barrow to 15 inches in Umiat (BLM 2012, § 3.2.1). Snow depth is not monitored in Nuiqsut. Additional data are provided in BLM (2004, § 3.2.3.1).

Table 3.2-5. Monthly Weather Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Umiat [a. b]													
Average Max Temperature (F)	-12.7	-13.8	-6.7	11.5	32.4	57.5	66.2	57.7	41.4	18.2	-0.7	-11.9	19.9
Average Min Temperature (F)	-28.9	-31.2	-26.8	-11	15.7	37	42.5	37.2	26.1	2.4	-16.8	-28	1.5
Average Total Precipitation (in)	0.38	0.26	0.16	0.21	0.07	0.68	0.79	1.06	0.47	0.68	0.38	0.33	5.46
Average Total Snowfall (in)	4.5	2.4	2.3	1.9	1.2	0.2	0	0.2	2.6	8.5	5.2	4.2	33.2
Average Total Snow Depth (in)	14	16	17	17	9	0	0	0	0	5	9	12	8
Kuparuk [a, b]													
Average Max Temperature (F)	-11.1	-11.6	-8.2	8.5	28.3	47.4	55.9	50.6	39	21.3	3.5	-4.8	18.2
Average Min Temperature (F)	-23.6	-24.4	-22.5	-6.5	16.9	33	38.8	36.7	28.8	10.6	-9.6	-17.8	5
Average Total Precipitation (in)	0.12	0.17	0.08	0.15	0.07	0.34	0.88	1.05	0.49	0.35	0.15	0.13	3.98
Average Total Snowfall (in)	2.5	2.5	2.2	2.8	1.8	0.5	0	0.3	3.1	8.3	4.2	3.5	31.8
Average Total Snow Depth (in)	8	8	9	9	5	0	0	0	0	3	6	7	5
Barrow WSO Airport [a, b]													
Average Max Temperature (F)	-7.4	-11	-8	6.9	24.7	38.9	45.7	43.1	34.7	20.5	5.6	-4.6	15.8
Average Min Temperature (F)	-19.8	-23	-20.6	-7	15.2	30	34	33.7	27.9	11.4	-5.6	-16.3	5
Average Total Precipitation (in)	0.18	0.15	0.13	0.18	0.16	0.35	0.9	1.03	0.66	0.48	0.24	0.16	4.61
Average Total Snowfall (in)	2.3	2.4	1.9	2.6	2.2	0.6	0.3	0.7	3.9	7.4	4	2.4	30.8
Average Total Snow Depth (in)	9	10	11	11	6	1	0	0	1	4	7	8	6
Nuiqsut [c, d]													
Average Max Temperature (F)	-8.4	-10	-9.4	8.7	27.1	50.2	57	51.2	40.9	23.1	7.8	-1.1	19.8
Average Min Temperature (F)	-23	-23.6	-24.1	-7.1	16.5	34.6	40.2	37.5	30.3	12.5	-6.9	-15.3	6
Average Total Precipitation (in)	0.15	0.07	0.01	0.21	0.02	0.16	0.59	0.51	0.18	0.02	0.02	0.19	2.12
Fish Creek [e]													
Average Max Temperature (F)	17.8	13.4	14.4	30.2	43.5	69.1	74.4	69.5	57.6	35.3	23.2	20.7	75.8
Average Min Temperature (F)	-45.4	-46.4	-42.0	-28.3	-3.3	26.8	32.3	29.5	19.8	-6.5	-30.1	-40.4	-48.4
Average Total Precipitation (in)	NA	NA	NA	NA	NA	0.24	1.12	0.89	0.45	NA	NA	NA	2.7

[a] Source: BLM 2012, Table 3-1

[b] Period of Record: Umiat (1949-2001); Kuparuk (1983-2009); Barrow (1949-2009)

[c] Source: Nuiqsut (PAQT) FAA ASOS data (7/1998-12/2008)

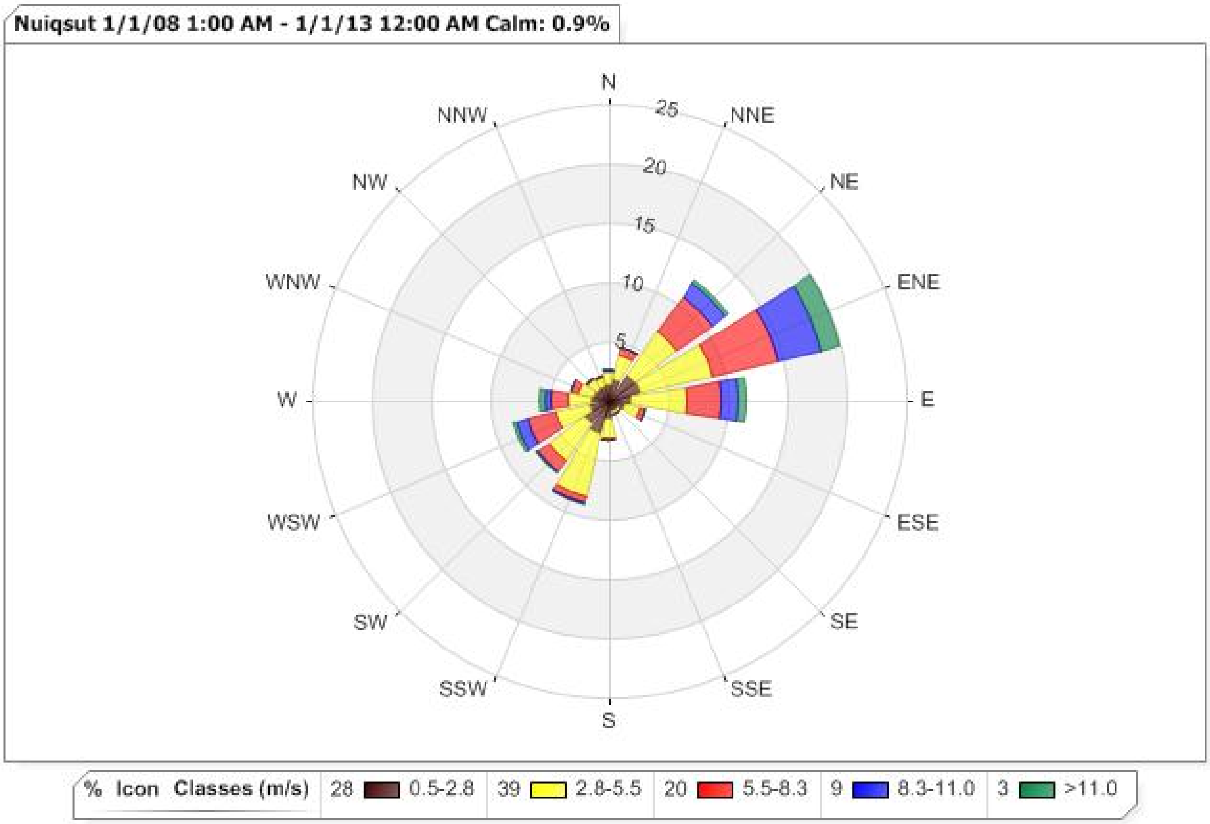
[d] Total snowfall and snow depth are not monitored in Nuiqsut.

[e] Source: UAF WERC Fish Creek data (6/2003 – 10/2003). Note the precipitation gauge appears to be seasonally operated.

Wind speed data are collected at a private meteorological monitoring station in Nuiqsut, operated by CPAI. The wind rose shown in Figure 3.2-1 depicts wind speed and direction measured at the CPAI station from 2008 through 2012. The mean hourly wind speed averaged 10 miles per hour (mph), and the maximum hourly wind speed recorded was 51 mph on January 23, 2008 (CPAI 2008).

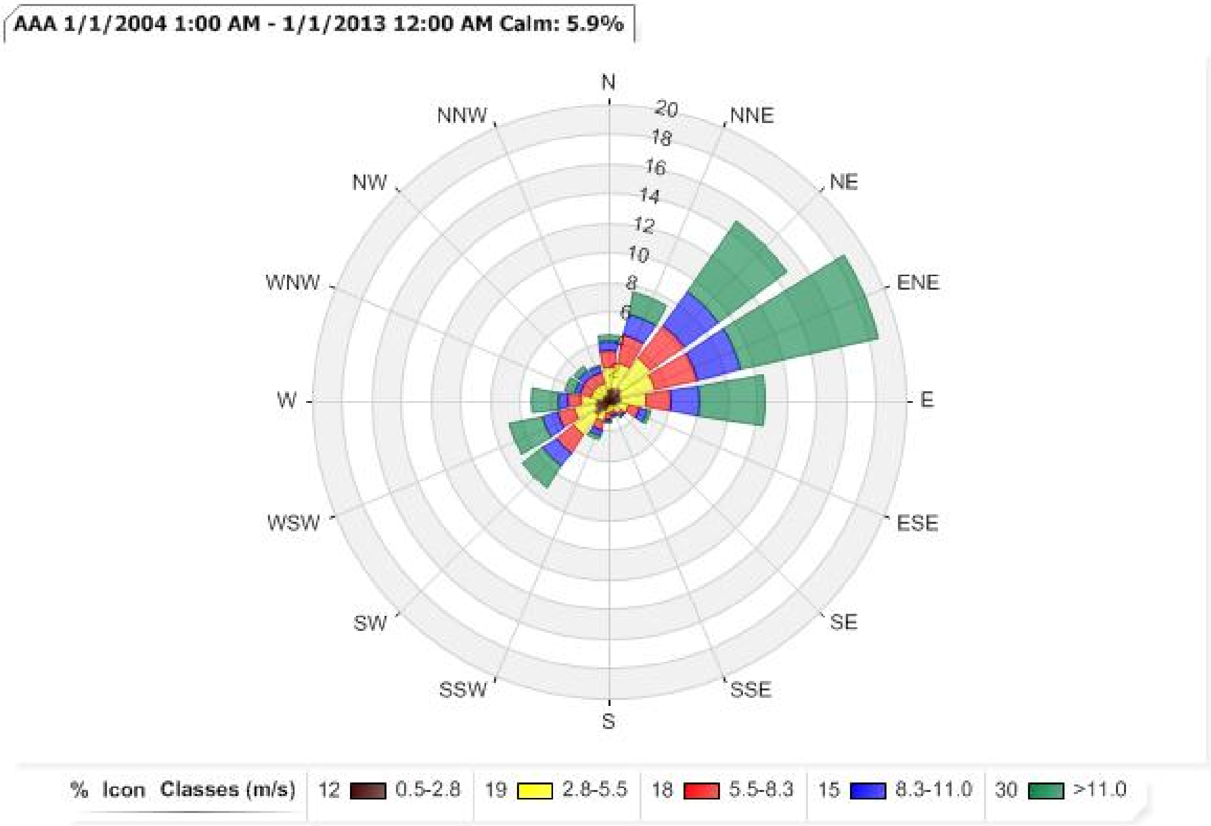
Air temperature, wind speed, and wind direction data are collected by the USDOI at 12 weather stations in the NPR-A – one at Fish Creek, operating since 1998 (CPAI 2013c). The wind rose shown in Figure 3.2-2 depicts wind speed and direction measured at Fish Creek, which is located 21 miles east of Nuiqsut in the NPR-A. The Fish Creek wind rose shows a similar distribution of wind speeds and directions to the Nuiqsut data.

The wind flow in the project area is dominated by a bimodal pattern. The primary wind flow is from the northeast to east sector. The secondary wind flow node is from the south-southwest through west-southwest sector. Calm conditions are infrequent with calm conditions being measured at Nuiqsut and Fish Creek only 0.3 and 3.0 percent of the time, respectively. This wind flow pattern is expected to increase dispersion of air pollutants in the atmosphere. The cool to cold ambient temperatures relative to warm to hot exhaust flows will generally increase exhaust gas momentum flux, which will also increase atmospheric dispersion.



Source: Meteorological data from the CPAI Monitoring Station provided by AECOM December 21, 2013

Figure 3.2-1. Nuiqsut Wind Rose (2008-2012)



Source: UAF WERC Fish Creek Monitoring Station

Figure 3.2-2. Fish Creek Wind Rose (2010-2011)

3.2.3.2 Air Quality

A comprehensive discussion of air quality is provided in BLM (2012, § 3.2.2) and BLM (2004, § 3.2.3), including classification areas, existing emissions, air pollutant concentrations, and air quality-related values and issues. These sections are incorporated by reference, with additional analysis of local air quality performed for this GMT1 SEIS.

The NPR-A is attainment/unclassified for current National Ambient Air Quality Standards (NAAQS) and the Alaska Ambient Air Quality Standards (AAAQS). This classification indicates that the concentration of criteria pollutants in the ambient air is below the NAAQS/AAAQS, or that adequate air monitoring data are not available to determine attainment. The NAAQS and AAAQS are generally the same for all criteria pollutants. The State has updated regulation 18 AAC 50 to revise the annual standard for fine particulates ($PM_{2.5}$) to be consistent with the federal standard. There is general agreement the NPR-A is in attainment of the $PM_{2.5}$ standards.

Air quality in the project area is generally good, due to the few sources of both man-made and naturally occurring emissions and the dispersion by prevailing winds. Naturally occurring windblown particulate matter emissions occur from river banks, sandbars, dirt and gravel roads, and occasional tundra fires.

The BLM (2012 § 3.2.2.3) discusses the existing emissions sources in the project area. Emission sources in the area consist mainly of diesel-fired generators in small villages, residential heating, snow machines, all-terrain vehicles, occasional small aircraft, limited local vehicle traffic, and occasional open burning. The majority of homes in Nuiqsut are heated by natural gas. Regional sources of emissions consist of oil and gas production facilities east of the NPR-A, including Kuparuk, Milne Point, Prudhoe Bay, North Star, Endicott, and Alpine Fields. Emissions sources at the Alpine field production and drilling areas just to the east of the planning area in the Colville River delta include gas-fired turbines and heaters, incinerators and flaring, diesel-fired power generators, storage tanks, fugitive hydrocarbon emissions, and mobile sources (vehicle traffic and aircraft).

Arctic haze is periodically observed. Atmospheric deposition and visibility monitoring in this region are in the early stages of study, with no data available for the North Slope. However, both visibility and wet deposition are monitored for Gates of the Arctic National Park and Preserve in Bettles, located approximately 200 miles south of GMT1 (BLM 2012, §3.2.2.4). Visibility is monitored through optical and chemical analyses at Integrated Monitoring of Protected Visual Environments (IMPROVE) network sites, such as the one located in Bettles, which has been in operation since 2008. Pollutant wet deposition is monitored at National Atmospheric Deposition Program (NADP) network sites. A NADP site has been in operation in Bettles since 2008. The Bettles site measures chemical constitutes in precipitation including free acidity (H^+ as pH), conductance, calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate ($SO_4{}^{2-}$), nitrate ($NO_3{}^-$), chloride (Cl^-), and ammonium ($NH_4{}^+$), and mercury deposition through the Mercury Deposition Network (part of the NADP program).

Criteria pollutant ambient monitoring data have been collected by CPAI in Nuiqsut since 1999. The Nuiqsut Monitoring Program operates in accordance with an ADEC-approved Quality Assurance Project Plan (QAPP). During permitting actions for a modification to the Alpine CDF and the CD5 well site, ADEC reviewed the Nuiqsut Monitoring Program data for the years 2000 through 2004 (ADEC 2003a, 2005). Nuiqsut data are reviewed by ADEC as needed to support permitting activities.

For the GMT1 Air Quality Impact Analysis, background concentrations were selected to represent emission contributions from existing stationary sources, mobile source activity, urban, biogenic and non-industrial emission sources, and from transport into the region. Values were developed from the most recent three years of measurements collected at the Nuiqsut Ambient Air Quality and Meteorological Monitoring station (calendar years 2010 through 2012), consistent with recommendations of the air quality working group formed for this project. Given that the Nuiqsut Station is downwind from and nearer to major Alaskan North Slope stationary sources than the GMT1 Project area, these measurements are conservatively representative of background concentrations in the GMT1 Project impact area.

Data from the Nuiqsut Monitoring Station are representative of the ambient air pollutant impacts caused by existing emissions from the Alpine Development area, broader oil and gas development at units such as Kuparuk and Prudhoe Bay, surrounding natural emissions sources, Nuiqsut community sources, and globally transported emissions. Because the dataset is current, data from 2010 to 2012 capture the effects of the recent local and regional oil and gas development activities on the North Slope.

Ambient particle-phase data from the Nuiqsut Monitoring Station are not as representative of background ambient conditions for GMT1. The Nuiqsut Monitoring Station and community of Nuiqsut are located near large exposed areas comprised of fine sediments along the Nigliq

Channel in the Colville River delta. Based on analysis of the air pollutant and meteorological data, the evidence indicates that the elevated PM_{10} values are due to the proximity of the monitoring station to the exposed silt banks of the Nigliq Channel and to anthropogenic sources, such as unpaved roads, in the town of Nuiqsut. For the analysis of GMT1, these local and anthropogenic PM_{10} sources are not representative of ambient conditions in the impact area because no similar nearby sources are nearby to GMT1 and because the fugitive particulate matter is unlikely to be transported over such distances. Therefore, background concentrations for modeled impacts should not be determined based on elevated particulate matter values from unique wind events at the Nuiqsut Monitoring Station.

To obtain more representative ambient PM_{10} values for the GMT1 impact area, anomalously high values of the 24-hour average PM_{10} values were examined and the highest value for a July 7, 2011, event was removed. This removal of the highest values is supported by calculating the true PM_{10} design value which is the fourth-highest 24-hour average over the entire three-year period analyzed. The true design value tends to eliminate the anomalous wind events that lead to elevated PM_{10} values. Between 2010 and 2012, the fourth-highest 24-hour average ambient PM_{10} value was 48 $\mu g/m^3$, indicating a similar background PM_{10} value to the value calculated once the July 7, 2011, concentration is removed.

The background ambient air quality concentrations selected for the Nuiqsut area are shown in Table 3.2-6.

Table 3.2-6. Background Ambient Air Quality Concentrations in the Nuiqsut Area

Pollutant	Averaging Period	Measured Background Concentration[1]	
		(ppm)	($\mu g/m^3$)
Carbon Monoxide (**CO**)	1-hour	1.3	1,488
	8-hour	1.1	1,259
Nitrogen Dioxide (**NO_2**)	1-hour	0.020	38
	Annual	0.002	2.9
Particulate Matter <10 microns[1] **(PM_{10})**	24-hour	-	48
Particulate Matter <2.5 microns (**$PM_{2.5}$**)	24-hour	-	7.1
	Annual	-	2.2
Sulfur Dioxide (**SO_2**)	1-hour	0.003	7.7
	3-hour	0.007	18
	24-hour	0.003	6.8
	Annual	0.000	0.3

[1] From measurements collected at the Nuiqsut ambient air quality monitoring station during calendar years 2010 through 2012.

$\mu g/m^3$ – micrograms/cubic meter

ppm – parts per million

3.2.3.3 Noise

Noise in the project study area is discussed in BLM (2004, § 3.2.3.3, p. 197) and summarized in the following discussion.

Sound is defined as a particular auditory effect produced by a given source, for example the sound of rain on a rooftop. Noise, in the context of potential impacts, is generally described as unwanted sound. The ambient noise level can be defined as the cumulative effect from all noise-generating sources in an area and constitutes the normal or existing level of environmental noise at a given location.

Discussions regarding environmental noise do not focus on pure tones because commonly heard sounds have complex frequency and pressure characteristics. Accordingly, sound measurement equipment has been designed to account for the sensitivity of human hearing to different frequencies. Correction factors for adjusting actual sound pressure levels to correspond with human hearing have been determined experimentally. For measuring noise in ordinary environments, correction factors are employed. The correction factors de-emphasize the very low and very high frequencies of sound in a manner similar to the response of the human ear. The resulting A-weighted decibel (dBA) correlates well to the subjective reaction to noise by a human (Harris 1991).

Although the discussion of noise is largely correlated to human receptors, it is also known that noise may cause disturbances to birds, mammals, and fish. In general, the level of disturbance will be the result of several factors including the species of bird, mammal, or fish; the time of year in which the disturbance occurs; the nature of the disturbance; the location of the disturbance; and the distance of the receptor from the disturbance. Resource-specific noise-related impacts are discussed in Chapter 4 of this SEIS.

The propagation of noise is a function of several environmental factors that might enhance or attenuate sound propagation, the most important being the distance from the noise source, the presence or absence of terrain that may inhibit sound propagation, and wind. The distance between a noise source and a receiver influences the perceived noise intensity. As the distance between a source and a receiver doubles, noise intensity decreases by a factor of four (Harris 1991). Terrain features, such as hills and dense vegetation, may attenuate sound propagation. Alternately, sound may be enhanced by reflection from natural features such as valleys. Sound is best propagated in the same direction the wind is blowing. Stable air conditions and calm winds between 2 and 11 miles per hour (1 and 5 meters per second) are most conducive for sound propagation (Harris 1991).

The following is a discussion of noise levels common to most people in small communities and rural areas. For a comparison to a normal human activity, the noise level experienced during a normal conversation between two people 5 feet apart is 60 dBA. Table 3.2-7 shows examples of commonly experienced noise levels and the relative strength (loudness) compared to normal conversation.

Table 3.2-7. Common Noise Levels

Noise Source	Average Noise (dBA)	Loudness[1]	Range of Noise (dBA)
Ambulance siren at 100 feet	100	16	95-105
Motorcycle at 25 feet	90	8	85-95
On a typical construction site	85	6	80-90
Single truck passing at 25 feet	80	4	75-85
Compressor station at 50 feet	75	3	70-80
Urban shopping center	70	2	65-75
Single car passing at 25 feet	65	1.5	60-70
Average highway noise at 100 feet	60	1	55-65
Normal conversation 5 feet apart	60	1	57-63
Residential area during day	50	50%	47-53
Recreational area	45	37%	40-50
Residential area at night	40	25%	37-43
Rural area during day	40	25%	37-43
Rural area at night	35	18%	32-37
Quiet whisper	30	12%	27-33
Threshold of hearing	20	6%	17-23

Source: Harris 1991

Notes:

[1] Compared to normal conversation.

dBA = A-weighted decibel(s)

There are two primary types of noise-generating activities in the project study area: stationary and mobile. Within the GMT1 project study area, the operation of equipment during exploration, drilling, facility construction (including mining activities), and production and the use of aircraft for transportation of personnel and materials would contribute noise to the environment. The area is remote and sparsely populated with few existing sources of man-made noise. Existing sources of noise include (BLM 2004, § 3.2.3.3, p. 197, as updated):

- Vehicle operations (vehicles, off-road vehicles [ORVs], and snowmobiles) and community noise (e.g., generators and other small equipment motors) within Nuiqsut;
- Vehicles, ORVs, and snowmobiles used for subsistence hunting and travel among villages and between villages and hunting camps;
- Boat operations (outboard motors);
- Aircraft operations at Nuiqsut;
- Vehicle operations at CD1, CD2, and CD4;
- Equipment operations at CD1, CD2, CD3, and CD4;
- Aircraft operations into CD1;
- Incidental aircraft and boat operations into the regional by recreationists and scientific researchers;
- Incidental aircraft operations transiting the project study area;
- Equipment operations and vehicle traffic at the ASRC Mine site; and
- Winter exploration activities (e.g., seismic, ice road/pad construction, drilling).

Additional noise will be generated by construction activity at CD5 and the Nuiqsut Spur Road during completion of placement of fill winter 2014-2015.

Background noise in Nuiqsut, the only community located within the project study area, is limited to general community noise (including power generation and other utilities), vehicle operations, and aircraft. The primary non-manmade noise source is wind (BLM 2004, § 3.2.3.3, p. 197). Nuiqsut is approximately 9.5 miles from CD1 (which includes the processing facility, APF, and Alpine airstrip). See Section 2.5.5.2 for aircraft traffic.

Table 3.2-8 lists typical noise emissions from a variety of equipment typically found in North Slope oil field operations. These noise levels are attenuated as distance from the noise source increases. Equipment noise emission of 85 to 110 dBA are likely to be 70 dBA or less at 1,000 feet away and would attenuate to background levels within the 9.5 miles to Nuiqsut.

Residents of Nuiqsut are periodically exposed to aircraft noise both from aircraft operations at the Nuiqsut airstrip and from overflights of the community. A passing fixed-wing aircraft (single-engine) emits a noise level of 66 to 76 dBA (flying at 1,000 feet elevation). Twin-engine planes, typically used in the region, at 1,000 feet elevation would emit a noise level of 69 to 81 dBA. Helicopters typically have noise emissions between 68 and 78 dBA (flying at 1,300 feet elevation). During takeoff and landing aircraft, especially jet aircraft, have much higher noise emissions; however, these higher noise levels occur for a shorter period of time (BLM 2004, § 3.2.3.3, p. 198).

While there is little ambient noise in areas away from oil production facilities and population centers, residents of Nuiqsut and other North Slope communities who undertake subsistence harvest activities have expressed concern about the disturbance of subsistence resources (e.g., caribou and birds) in response to noise generated by construction activities, facility operations, and aircraft operations. As noted previously, noise emissions from fixed-place facilities attenuate rapidly with distance from the facility.

Noise from aircraft operations may occur anywhere in the project study area, but is concentrated near Nuiqsut, APF, and CD1 where airstrips are located.

Table 3.2-8. Typical Oil Field Noise Sources

Source	Noise Level (dBA)	Distance from Source (ft)
Drill Rig	82–92	82
Production Module	88–105	0
Pickup truck	67–75	0
Semi truck	73–85	0
Gravel truck	93–102	0
Helicopter (206B)	115	33

Source: BLM 2004, § 3.2.3.3, p. 200

In summary, the only community receptor of noise within the project study area is remote and the primary source of naturally occurring noise is wind. Subsistence resources used by the residents of Nuiqsut, such as caribou and birds, could be disturbed by noise related to the GMT1 Project; these resources occur throughout the project study area. There are few existing sources of manmade noise, including community operations (e.g., generators) at Nuiqsut and industrial sources at existing Alpine facilities, vehicles, boat traffic, and aircraft traffic (BLM 2004, § 3.2.3.3, p. 198).

3.2.4 Climate Change

Climate change is discussed in BLM (2004, § 3.2.3.1) and BLM (2012, § 3.2.1.1). Supplemental information is taken from recent reviews of this subject including the USGS Circular 1379, *The United States National Climate Assessment – Alaska Technical Regional Report* (Markon et al. 2012) and *Arctic Report Card: Update 2012* (Jeffries et al. 2012).

3.2.4.1 Climate Change in the Arctic

Climate change momentum has developed in the Arctic environmental system due to the effects of a persistent warming trend that began more than 30 years ago (Jeffries et al. 2012). A major source of this momentum is the change in sea ice cover, snow cover, glaciers, and the Greenland ice sheet that have reduced the overall surface reflectivity of the Arctic region in the summer, when the sun is ever-present. In other words, bright, white surfaces that reflect summer sunlight are being replaced by darker surfaces (e.g., ocean and land) which absorb sunlight. These conditions increase the capacity to store heat within the Arctic system, which enables more melting - a positive feedback. Changes are predicted to continue to occur in the Arctic in years to come, particularly in the face of projections that indicate continued warming effects (Jeffries et al. 2012).

Changes in the Arctic marine environment are affecting the foundation of the food web in both terrestrial and marine ecosystems (Epstein et al. 2012). An example is the direct link between increases in Arctic tundra vegetation productivity and earlier peak productivity in many parts of the Arctic on one hand, and the increasing duration of the open water season and decreasing summer sea ice extent in the Arctic Ocean on the other (Svoboda 2012). Information from long-term, ground-based observations indicates that, in addition to increasing air temperatures and loss of summer sea ice, widespread greening is also occurring in response to other factors. Over the past 30 years (1982-2011), the Normalized Difference Vegetation Index (NDVI), an index of green vegetation, has increased 15.5 percent in the North American Arctic and 8.2 percent in the Eurasian Arctic. In the more southern regions of Arctic tundra, the estimated aboveground plant biomass has increased 20 percent to 26 percent (Epstein et al. 2012).

During 2012, a number of record or near-record events occurred in relation to the Arctic terrestrial snow cover. Snow cover duration was the second shortest on record and new minima were set for snow cover extent in May over Eurasia and in June (when snow still covers most of the Arctic region) over the Northern Hemisphere. The rate of loss of June snow cover extent between 1979 and 2012 (the period of satellite observation) set a new record of -17.6 percent per decade, relative to the 1979-2000 mean (Jeffries et al. 2012).

3.2.4.2 Climate Change on the North Slope

According to the USGS, *"Alaska's climate appears to be in a state of flux. Some patterns of change and associated consequences may be clear, such as the losses in sea ice, glaciers, and permafrost, whereas others are more subtle, such as the foothold that some invasive species have found in various parts of the State. … Of principal importance is 'Arctic Amplification' whereby surface temperatures in the Arctic are increasing faster than elsewhere in the world."* (Markon et al. 2012, pp. 3, 73)

In 2011, the Scenarios Network for Alaska Planning (SNAP) predicted increases in average summer temperatures in the NPR-A by 3 ^{0}F by the 2040s and 6 ^{0}F by the 2090s, and increases in average winter temperatures by 11 ^{0}F by the 2040s and as much as 18 ^{0}F by the 2090s (BLM 2012, § 3.2.1.1, p. 143).

Increased temperature on the North Slope is resulting in a decreased period of frozen ground conditions. Historical trends in tundra travel open season on the North Slope were depicted in *Managing for the Future in a Rapidly Changing Arctic: A Report to the President* (Clement et al. 2013) showing that average tundra travel season has decreased from approximately 200 days in 1969 to approximately 120 days in 2004 (Clement et al. 2013, p.12). During the last 10 years in the northern NPR-A, the average tundra travel winter season was approximately 134 days (BLM 2012, § 4.2.1.2, p. 22). The decreased availability of ice roads may lead to increased reliance on aircraft for travel on the North Slope.

Trends in precipitation show more variability than temperature. There was an approximately 10 percent increase in statewide average precipitation in Alaska during the period 1949 through 2005. Throughout much of the state, greater increases in precipitation were recorded during winter. An exception to the increasing annual winter precipitation trend is the Arctic (Markon et al. 2012, p. 12-13). Climate model projections vary. SNAP predictions for the NPR-A include summer precipitation increasing 1.2 inches by the 2040s and 1.6 inches by the 2090s, and winter precipitation increasing 1.6 inches by the 2040s and 2.7 inches by the 2090s (BLM 2012, § 3.2.1.1). In Alaska, the snow cover duration dropped by 15 days from 1980 to 2009. Projections for Alaska include a shift in snowfall patterns to a later date of first snowfall and an earlier snowmelt (Clement et al. 2013, p. 9). Rising river levels from climate change could also result in increased frequency and intensity of flooding (BLM 2004, § 3.2.3.1, p. 193).

Substantial amounts of organic carbon are stored in permafrost due to the slow rate of plant material decomposition under frozen conditions. Approximately 1700 petagram[3] of soil carbon are stored in the northern circumpolar permafrost zone, more than twice as much carbon than in the atmosphere (Schuur et al. 2013). As permafrost thaws, this organic carbon is released to the atmosphere as carbon dioxide (CO_2) or methane (CH_4). These emissions are currently small, especially compared to manmade emissions, but could increase due to increased permafrost thaw in the future, causing accelerating feedback in the climate system (Markon et al. 2012, p. 69).

3.2.4.3 Potential Climate Change Impacts in the Project Study Area

The project study area is located within the ACP and dominated by features and processes driven by permafrost. This area has the potential to change greatly with the anticipated degradation and thaw of permafrost. As near-surface permafrost melts and thaws, it creates an irregular landscape referred to as patterned ground resulting from the action of thermokarst. Results of modeling permafrost in the planning area forecast that the mean annual thickness of the active layer of permafrost within the ACP will increase from 0.380 meters (15 inches) thick in the 1980s to 0.453 meters (18 inches) thick in the 2040s (BLM 2012, § 3.2.4.4, p. 154). Recent modeling predicted a broad range of future permafrost states, due to differences in future greenhouse gas emission and climate scenarios; however, permafrost extent is predicted to decrease significantly by 2100 (Slater and Lawrence 2013).

Climate change is predicted to cause alterations to the environment and habitats of the project study area that could adversely affect paleontological resources, although the degree to which this might happen remains unclear. Past episodes of climate fluctuation in Arctic Alaska have caused changes in vegetation coverage and type as well as the physical structure of the landscape itself. The deepening of the active layer and the thawing of near-surface permanently

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[3] One petagram = one trillion kg

frozen ground may cause mass down-slope movement resulting in the erosion of hillsides, bluff faces, river banks and terraces, which, if they recur due to future climate change, could result in the partial or total destruction of paleontological sites located on those land forms. In addition, even when erosion does not occur, the deepening of the active layer and/or thawing of permanently frozen ground could result in decreased preservation of subsurface organic paleontological materials, particularly Pleistocene fossils. In less dynamic circumstances erosion has exposed most of the known paleontological deposits in the NPR-A and this type of natural impact is viewed as positive rather than negative, as it reveals the presence of sites usually with few negative results. The potential climate change impacts are not expected to be universal across the ACP as there are a myriad of factors involved that control the degree to which climate change can affect a specific location, region, habitat or ecosystem. Some locales may not be affected at all (BLM 2012, § 3.2.7.2., p. 183).

There are predictions that climate change will continue to warm and dry the NPR-A region more than historically recorded ranges. Warmer temperatures are not likely to accelerate the soil forming processes significantly enough to measure the change during the period of construction and operations addressed in this SEIS. Soil formation is a very slow process. The climate will remain relatively cool with long periods of freezing and low solar angles. As soils dry, there is also a reduction in the chemical reactions that aid in soil formation. Climate change may affect the depth of permafrost in the soil profiles, as described above (BLM 2012, § 3.2.8.4, p. 189).

Structurally, the increase in the depth of the active layer is expected to have a negative effect on the ability of the soils to carry loads. Any traffic over the surface during non-frozen periods would be expected to create more damage than under the present conditions. This could result in deep ruts and severe channeling of water into the vehicle tracks. Such concentration of water would be likely to accelerate erosion and create new drainage channels that drain water from the surrounding areas. It also would be likely to accelerate the subsidence of the permafrost in the track areas. Similar subsidence has been observed in tracks from early exploration of the region in the 1960s in many other areas of the tundra (BLM 2012, § 3.2.8.4, p. 190). Due to the exacerbation of climate change, subsidence may occur over a broader area than solely in those areas which are directly impacted by vehicle traffic (Shiklomanov et al. 2013). Traffic is restricted on unfrozen ground in the NPR-A.

As the active layer deepens, there are more opportunities for plants to send roots deeper into the profile. This may allow plant communities to begin migrating further north within their ranges. In some instances, the lowering of the water table may result in a gradual shift in plant communities to species that are better suited to a drier site and away from those species that are tolerant of high water content in the soil profile. These processes are not expected to occur rapidly and may take a hundred years or more to shift the ecological composition appreciably. These changes in vegetation will promote soil formation through greater root development and contribution of additional organic matter to the soil profile (BLM 2012, § 3.2.8.4, p. 190).

Warming of the climate will have major impacts on the ecosystems of the North Slope and the project study area. The climate change scenario for the rest of this century suggests that climate will get warmer, with greater precipitation, but that longer, warmer summers will increase evapotranspiration so that there will actually be less moisture available to plants (Grimm et al. 2013). Increases in winter precipitation may have little impact on available soil moisture during the growing season, as most snowmelt runs off the land immediately during the spring thaw. In summer, some precipitation will be lost through evaporation and some through transpiration by plants. In longer, warmer summers, both of these amounts would increase. However, due to the increase in summer precipitation, available soil moisture is predicted to be fairly stable throughout the century (BLM 2012, § 3.3.1.4, p. 217).

The overall result of climate change on vegetation appears to be that growing season will be longer, and soils will be warmer and actually drier. These differences have the potential to drive significant changes in plant communities of the NPR-A, leading to significant acreages of *boreal cordillera*, with vegetative cover ranging from open to closed forest canopies; *western tundra*, which is similar but with a moist, sub-polar climate, patches of stunted trees, and a greater presence of tall shrub communities; and *boreal transition* with boreal forests in valleys and lowlands, and scattered pockets of permafrost. These changes have already been observed to some extent on the North Slope (BLM 2012, § 3.3.1.4, p. 217).

Modeled future climate trends show increasing mean air temperatures during the winter and summer (Clement et al. 2013), which could drive a multitude of projected physical environmental changes that could have an effect on Arctic aquatic habitats and, subsequently, Arctic fish species. Implicit to warming air temperatures is a warming of water temperatures. Warmer water temperatures alone can increase susceptibility to diseases and parasites, increase the effects of contaminants, and decrease biologically available DO. Conversely, it can increase biological productivity and fish growth, although for each fish species an upper limit would be reached that leads to negative effects (e.g., stress and mortality) due to excessive energetic demands. However, the precise effect that warmer water temperatures could have on Arctic fish is complicated beyond these simplified examples since many of these species utilize multiple habitats throughout the year (BLM 2012, § 3.3.4.5, p. 241).

Bird habitats worldwide are threatened by climate change, though species for which breeding is restricted to the Arctic regions may be the most vulnerable to climate change. Many bird species present in the NPR-A have circumpolar distributions with breeding ranges that vary from high latitude tundra only, to widely distributed across Alaska, to those with associated sub-Arctic and temperate breeding areas for which the NPR-A is the northern extension of their breeding range. The abundance and distribution of surface water is of crucial importance to Arctic birds as the aquatic and semi-aquatic habitats of the planning area support very large numbers of birds. Increased summer temperatures could lead to the conversion of aquatic habitats into dryer habitat types resulting in a loss of not only habitat quantity but also habitat quality in terms of potential decrease in food resources (invertebrate and plant). This loss of quantity and quality would likely lead to changes in bird distributions which might in turn lead to increased competition for limited resources and associated decreases in productivity (BLM 2012, § 3.3.5.9, p. 279).

Impacts to the bird community may occur if warmer spring temperatures advance snowmelt, which is closely associated with insect emergence, and result in changes in the timing and patterns of insect emergence and peak abundance to which the birds may not be able to compensate.

A number of hydrologic shifts related to climate change will affect water resources, including seasonal flow patterns, ice-cover thickness and duration, and the frequency and severity of extreme flood events. The geomorphic features (e.g., sinuosity of drainages, bars, beaches, bends, ox bows, cut banks, pools, riffles) are determined by the slopes, discharge volumes, frequency, intensity, timing, obstructions, sediment loading, etc., all of which will continue to change over a period of changing climate. The effects of these climatic and hydrologic changes will result in river systems that increasingly move or migrate over the landscape compared to a period of relatively stable climate, thus, causing potential disruptions to infrastructure (such as roads and bridges), changes in fish and wildlife habitat, and possible hazards to shoreline communities, fish camps, and recreational users (BLM 2012, § 3.2.10.5, p. 201).

In the NPR-A, 44 percent of the precipitation falls during winter months as accumulated snowpack and contributes to water storage across the landscape. Some of this winter storage is lost due to sublimation, but the majority remains until the spring snowmelt converts it to runoff that serves to recharge rivers, lakes, and soils. Warmer temperatures will advance the spring warming period, which means that snowmelt will occur during a period of lower solar radiation, which could lead to a more protracted melt and less intense runoff. Given a scenario of increased temperature and snowfall, effects on the timing of spring melt may be offsetting to some extent — increasing air temperatures facilitate earlier snowmelt, while increasing snow depth retards it (BLM 2012, § 3.2.10.5, p. 203).

The effects of early and less intense spring melt will be most dramatic for catchments within the ACP, where snowmelt forms the major flow event of the year. Reductions in the spring peak will be accentuated where the loss of permafrost through associated warming increases the capacity to store runoff. Increasing soil storage capacity and more rapid moisture export through evapotranspiration may also lead to decreased hydrologic response to summer storms. Reduced surface storage (e.g., lower lake levels) and drier soils will require greater rainfall recharge before significant surface runoff to streams can occur. If the surface and near-surface water storage deficit is high due to dry conditions in the previous summer, then a larger volume of snowmelt the following spring will go directly to recharge surface water bodies and soils and reduce the severity of spring flooding. Overall, the magnitude and frequency of high flows will decline while low flows will increase, thereby flattening the annual hydrograph (BLM 2012, § 3.2.10.5, p. 203).

By the 2090s, based on the projected dates of thaw and freeze, breakup is expected to occur about seven days earlier in the ACP than at present. Presently, freezeup is fairly uniform across the NPR-A. Freezeup is expected to arrive two to four weeks later by the 2090s on the ACP. The latest freezeup dates would occur along the coastline (BLM 2012, § 3.2.10.5, p. 202).

The impacts of climate change may affect the numerous freshwater lakes of the ACP and the project study area. While some investigations of abundance or net surface area change in lakes have found lake expansion and growth, others have found lake shrinkage or disappearance. Lake expansion can result from thermokarst landscape development (BLM 2012, § 3.2.4.4, p. 154).

Suspended sediment and nutrient loading of lakes and rivers will increase as thermokarsting, land subsidence, slumping, and landslides increase with permafrost degradation. With expected warming, degrading ice wedges may progressively integrate into drainage channels with a lower base elevation resulting in increased frequency of lake-tapping (sudden drainage) events. Drainage rates of lakes on the entire North Slope, in cold continuous permafrost, were found to be 1 to 2 lakes per year, but will likely increase in frequency (BLM 2012, § 3.2.10.5, p. 217).

Climate change will not affect the existence or location of the mineral material deposits within the project study area. The Naval Petroleum Reserves Production Act withdrew the NPR-A from hardrock and coal mining, extending withdrawals that President Harding put in place when he established the Reserve in 1923; thus, this discussion is limited to the mining of gravel. Techniques for accessing and extracting those resources would have to take into consideration gravel mine development in a changing climate. Gravel mining in the project study area involves the use of ice roads, snow trails, and ice pads for transportation of equipment to and from the material source, usually during the exploration and mine development phase. As the climate changes, the methods of mining and exploration might change as well. A warmer climate could lengthen the mining season while a cooler climate could shorten the mining season, or force a change in the mining methods to allow mining during the winters. A longer or warmer summer season may increase the volume of materials needed to maintain infrastructure. Depending on the type of material and the mining method used to extract that material, a changing climate could make the excavation easier, due to the melting of the permafrost, or more difficult when attempting to develop deposits in areas with melted permafrost, which may necessitate removing water, or the need to excavate in swampy conditions (BLM 2012, § 3.2.9.3, p. 192).

Some have predicted that climate warming will lead to more wildfires in the Arctic tundra. The largest wildfire (256,000 acres) in history on the North Slope occurred during the summer of 2007 in an area about 25 miles east of the NPR-A (BLM 2012, § 3.3.3.2, p. 223).

3.3 Biological Resources

The following description of the biological environment in the project study area is structured and organized to match the 2004 ASDP EIS. The biological environment remains essentially as described in the 2004 ASDP EIS, with subsequent listing and candidacy of several species under the ESA that may be found in or near the project study area, as described in Section 3.3.5.

3.3.1 Vegetation and Wetlands

Vegetation and wetlands are described for the entire NPR-A in BLM (2012, § 3.3.2.1); for the Northeast NPR-A, (including the project study area) in BLM (2008, §§ 3.3.2-3.3.3); and for much of the project study area in BLM (2004, § 3.3.1). The location of the project study area, NPR-A, is shown in Map 3.1-1.

A summary of the prior assessments is presented along with new information relevant to this topic and focuses on the conditions within the project study area and at the proposed project facilities. A project study area is incorporated that defines a geographic extent of all the action alternatives and allows for a defined area for detailed evaluation. The project study area includes all proposed facilities and the land within 2.5 miles from the perimeter of the facilities. The project study area is used in the analysis of potential impacts to vegetation and wetlands by the project alternatives. A summary of the vegetation types occurring within the bounds of the project study area is provided in Table 3.3-1.

Table 3.3-1. Vegetation Summary for the Project Study Area

Vegetation Type[1]	Wetland Type (Cowardin Code)	Veg Type in Mapped Project Study Area[2] (acres)	Veg Type as % of Mapped Area[2]	Project Study Area (%)
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1
Closed Low Willow	PSS1B	2,425.3	2.2	2.1
Coastal Complex	*No Data Available*	20.7	--	--
Deep Polygon Complex	PUBH, PEM2H, PEM1F, PEM1/SS1B	312.7	0.3	0.3
Dryas Dwarf Shrub Tundra	Upland, PSS3B	101.7	0.1	0.1
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.9
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	18.3	--	--
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8
Open Low Willow	PSS1B	3,573.6	3.2	3.1
Open Tall Willow	PSS1B	66.7	0.1	0.1
Partially Vegetated	PUSR	1,230.7	1.1	1.1
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3
Salt-killed Wet Meadow	*No Data Available*	12.1	--	--
Tussock Tundra	PEM/SS1B	18,766.13	17.0	16.1
Water	PUBH, R2UBH	23,757.06	21.5	20.4
Wet Sedge Meadow Tundra	PEM1E, PEM1F, PEM1F	29,251.5	26.4	25.1
Young Basin Wetland Complex	PUBH, PEM2H, PEM1H, PEM1/SS1B,PEM1B	253.4	0.2	0.2
Barren[3]	Us (upland)	4,756.1	4.3	4.1
Dune Complex[3]	Upland, PEM1B, PEM1/SS1B, PSS1B	41.4	--	--
Total Mapped in Project Study Area		**110,605.3**	**100**	**95.0**

[1] Source: Jorgenson et al. 2004

[2] Percent of vegetation type acreage within the mapped vegetation portion of the project study area. Note that the study area is 116,447.7 acres and that 5,842.4 (5 percent) of the project study area extends outside of the vegetation map coverage.

[3] Wetland status interpreted as upland based on aerial imagery.

Key points about vegetation and wetlands in the project study area include:

- The vegetation classification of the project study area is dominated by wet sedge meadow tundra (26 percent), ponds and lakes (20 percent), and tussock tundra (18 percent), all of which are potential jurisdictional wetlands that are regulated under the CWA;
- The sedge species that dominate the vegetated landscape are tolerant of cold soil and high-moisture conditions. The vegetation canopy is low and individual species are mostly less than 1 foot tall;
- Permafrost maintains the freeze/thaw cycles of the upper, active layer of soil that influences the type of vegetation that can survive the Arctic climate of the study area;

- No federally listed threatened or endangered plants are known to occur in the project study area, the Northeast NPR-A, or elsewhere on the ACP. There are nine species of plants known to occur within the NPR-A that meet the criteria for BLM sensitive species (see later this section). One of these, Alaskan bluegrass (*Poa hartzii ssp. Alaskana*) was found within the project study area, but more than 2 miles from any proposed project alternative facilities (BLM 2004, p. 203);
- The vegetation cover classes most commonly found in the project study area are wetlands, water bodies, and uplands. Wetlands occupies the most land area (more than 75 percent), followed by water bodies (20 percent), and uplands (less than 5 percent); and
- Important hydrologic, water quality, ecologic, and sociologic functions are performed by wetlands and waters.

The vegetation classification used in this analysis is the same used in BLM (2004, § 3.3.1). Descriptions of the classifications of habitat, vegetation, and geomorphology are provided in Jorgenson et al. (2003b) and Johnson et al. (2013).

Information on vegetation and wetlands for the entire NPR-A is provided in BLM (2008, § 3.3.2) and BLM (2012, § 3.3.1). A vegetation classification map of the project study area is presented in Map 3.3-2. Twenty-three vegetation map unit types corresponding to National Wetlands Inventory (NWI) wetland classes occur within the project study area, as listed in Table 3.3-1.

Waters and potential wetlands occupy approximately 97 percent of the project study area; water bodies account for 20 percent of this total (Table 3.3-1). Areas not classified as water bodies or wetlands include gravel fill in the Nuiqsut area and sand dunes; these are considered uplands and occupy less than five percent of the project study area. When a cover type could be wetland or upland, it is assumed to be wetland for this EIS analysis, so the listed acreages of wetlands in the study area may overestimate the total value. The map unit types, NWI classifications, and descriptions are further described in Davis (2013).

Water bodies include areas of open water as lakes, ponds, streams, and rivers, as well as adjacent barren areas consisting of river gravels and beaches. For information about water bodies in the study area, see Section 3.2.2, *Water Resources*.

The dominant wetland cover classes in the study area include wet sedge tundra (26 percent), moist tussock tundra (18 percent), and sedge-shrub tundra (17 percent). Wet tundra is dominated by wet/moist sedges and dwarf shrubs, and occupies wet environments such as drained lake basins and poorly drained river terraces. Sedges (e.g., *Carex spp*.) dominate this tundra type. Small intermixed patches of aquatic sedges and grasses may occur in flooded areas. Large complexes of wet and moist tundra occur, with interspersed areas of open water. Wet tundra is generally characterized in the NWI classification system as saturated or inundated emergent and scrub-shrub wetland (e.g., PEM/SS1B, PEM1E, PEM1F), with a water regime ranging from saturated to permanently flooded. Moist tundra is characterized in the NWI classification system as saturated wetland, dominated by scrub-shrub and emergent vegetation (e.g., PSS1/EM1B).

Areas of mixed moist and wet tundra occur in the drier parts of drained lake basins and on poorly drained river terraces. Patterned ground is widespread and moist sedges and dwarf shrubs dominate areas with better drainage. Wet sedges dominate lower areas and aquatic sedges and grasses may occur in flooded areas. Mixed high and low centered polygons with extensive thermokarst troughs are interspersed with lakes and ponds. High centered polygons may be dominated by dry, dwarf shrubs and fruticose lichens. Moist/wet tundra complexes are generally characterized in the NWI classification system as saturated or inundated emergent and scrub-shrub wetland, with water regimes ranging from seasonally saturated to permanently flooded. Less than one percent of the study area is upland (non-wetland), consisting of sand dunes (Table 3.3-1).

Wetland and waters are known to provide important hydrologic, water quality, ecologic, and sociologic functions (Corps 2009). A corresponding aquatic site assessment (ASA) is being developed by ABR and CPAI in coordination with the Corps, USFWS, and EPA. The ASA will be available for use as supporting documentation in 404 permitting for the GMT1 project. The functions are being assessed through a combination of interpreting imagery, reviewing existing maps, and examining local topography. The functions being evaluated are summarized below.

Hydrologic functions in the ASA include the ability of a wetland to interact with surface water and/or groundwater. Two general processes are being evaluated:

- Flood flow regulation – detention of surface water flow and consequent moderation of downstream flooding.
- Erosion control and shoreline stabilization – degree to which the wetland can reduce erosion.

Water quality functions include the ability of a wetland to detain sediments, toxicants, and nutrients, and to export organic matter. Two general processes are being evaluated:

- Sediment, nitrogen and toxicant removal – retention of suspended sediment and associated toxicants, and the detention and transformation of nitrogen and phosphorus, from surface water entering the wetland.
- Organic matter production and export – production of organic matter (primarily through plant growth) and contribution of organic matter to the food web.

Ecological functions assess the relative ability of a wetland to support fish and wildlife populations and provide species and habitat diversity. Four characteristics of each wetland functional type will be assessed:

- General habitat suitability – direct support of mammals and birds.
- Fish habitat – direct support of fish.
- Subsistence/Recreational/Educational/Scientific use – direct support of hunting and gathering activities, travel, and/or education including scientific research.
- Uniqueness and special status –supports federally listed species, high quality habitat, presence of rare features, and/or supports functions not commonly provided within the watershed.

Surveys for rare plant species, which include BLM sensitive species, were performed in 2001 and 2002 within selected areas of the project study area including: (1) the proposed road alignment from the Nigliq Channel to the Tiŋmiaqsiġvik (Ublutuoch) River; (2) areas around the Spark and CD6 proposed drill site locations, and the formerly proposed Clover site (the ASRC Mine site is the current proposed gravel source); and (3) sections of Fish Creek, Judy Creek, Tiŋmiaqsiġvik (Ublutuoch) River, and adjacent coastal plain (Jorgenson et al. 2004). The proposed locations of some facilities have been revised since the surveys were performed.

There are no plants federally listed under the ESA known or suspected to occur within the NPR-A planning area, which includes the project study area (BLM 2012, p. 316). BLM Sensitive Species are a subset of the BLM Special Status Species category and are designated by the BLM State Director for Alaska. There are nine species of plants known to occur within the NPR-A meeting the criteria for BLM Sensitive Species (BLM 2012, p. 317) as listed below:

- alpine whitlow-grass (*Draba micropetala*);
- Adam's whitlow-grass (*Draba pauciflora*);
- Arctic poppy (*Papaver gorodkovii*);
- oriental junegrass (*Koeleria asiatica*);
- Alaskan bluegrass (*Poa hartzii ssp. alaskana*);
- Drummond's bluebell (*Mertensia drummondii*);
- sabine grass (*Pleuropogon sabinei*);
- circumpolar cinquefoil (*Potentilla stipularis*); and
- grassleaf sorrel (*Rumex graminifolius*).

Five of these species have documented occurrences in the greater Colville River basin region which includes the project study area. Alaskan bluegrass (*Poa hartzii ssp. Alaskana*) is a barren ground habitat species reported growing in sand dunes and sparsely-vegetated river bars in the northern part of Fish Creek, at the confluence with the Tiŋmiaqsiġvik (Ublutuoch) River, at the mouth of Fish Creek (ANHP 2013; Jorgenson et al. 2004, p. 29).

There are two locations of Alaskan bluegrass reported in the vicinity of the project study: one location is the confluence of the Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek, approximately 2.5 miles north of the proposed GMT1 pipeline route. The second location is about 4.5 miles north of the proposed GMT1 site. The dune complex habitat where the Alaskan bluegrass was found is uncommon within the project study area. Alaskan bluegrass is assigned a global conservation rank of G3 (vulnerable; at moderate risk of extinction because of restricted range, relatively few occurrences, small populations, recent and widespread declines, or other factors) to G4 (apparently secure but uncommon; some cause for long-term concern because of declines or other factors); and a state rank of S1 (critically imperiled within the state; at very high risk of extirpation because of very few occurrences, declining populations, or extremely limited range and/or habitat) to S2 (Imperiled within the state; at high risk of extirpation because of few occurrences, declining populations, limited range, and/or habitat).

Oriental junegrass (*Koeleria asiatica*) is widely distributed in the Northeast NPR-A and typically occurs on partially vegetated, active sand dunes adjacent to regularly flooded riverbars (Jorgenson, et al. 2004). *Koeleria asiatica* is ranked globally G4 (apparently secure but uncommon) and state ranking of S3 (rare within the state). The nearest location to the project study area where oriental junegrass was found by Jorgenson et al. (2004) is about 14 miles west of the proposed GMT1 pad site.

Other BLM Sensitive Species found in the region include: Drummond's bluebell (*Mertensia drummondii*), whitlow-grass (*Draba pauciflora*) and circumpolar cinquefoil (*Potentilla stipularis*) reported from the upper Colville River basin more than 60 miles south of the project study area (ANHP 2013).

In addition to the nine species described above, an additional 12 species designated as sensitive by BLM Alaska have been documented on the North Slope (BLM 2012, p. 318). These have not been reported to occur in the NPR-A, but their presence there is possible given their occurrence elsewhere on the North Slope:

- Muir's fleabane (*Erigeron muirii*);
- Bostock's miner's-lettuce (*Montia bostockii*);
- Barneby's locoweed (*Oxytropis arctica* var. *barnebyana*);
- walpole poppy (*Papaver walpolei*);
- hairy lousewort (*Pedicularis hirsuta*);
- Wright’s alkaligrass (*Puccinellia wrightii*);
- glacier buttercup (*Ranunculus camissonis*);
- Turner's butter-cup (*Ranunculus turneri*);
- Cape Krause sorrel (*Rumex krausei*);
- Johnson's false candytuft (*Smelowskia johnsonii*);
- pygmy aster (*Symphyotrichum pygmaeus*);
- Siberian false-oats (*Trisetum sibiricum ssp. litorale*).

None of these were reported at sites surveyed by Jorgenson et al. (2004) within the Northeast NPR-A; subsequently, their distribution within project study area is unknown.

Non-native, invasive plant species occurrence in the NPR-A is discussed in BLM (2012, § 3.3.1.3). In summary, there is evidence that non-native, invasive plant species have the potential to spread into the region. The common dandelion (*Taraxacum officinale*) has been found north of the Brooks Range and there has been anecdotal observation of dandelion in the NPR-A (BLM 2012, § 3.3.1.3, p. 216). The mechanisms for spreading of non-native, invasive plants include equipment and vehicles used for construction and aircraft. Despite the documented economic consequences of non-native, invasive species, few quantitative data exist that have measured the ecological impacts of invasive plants, making the prediction of environmental impact of these species difficult (Barney et al. 2013).

Aquatic, non-native, invasive species are of particular concern throughout Alaska because of the potential for floatplanes to carry these into new areas (ADF&G 2013b). Infestations of waterweed (*Elodea* spp.) in Fairbanks and Anchorage have raised concerns that this aquatic invasive plant is capable of persisting in southern and interior Alaska lakes. Waterweed can easily cling to rudders and floats, as well as boat propellers and can be deposited in water bodies. Waterweed can easily spread when fragments of the plant are introduced to new locations. Like many invasive species, this plant is adapted to disturbance, can grow rapidly, and can survive when lakes and rivers ice up. Infestations have practical as well as ecological implications, as boats and floatplanes may become entangled and damaged in thick growths of these weeds. No reports of waterweed infestations in the Arctic or the NPR-A were identified.

3.3.2 Fish

Fish resources in the project study area are discussed further in BLM (2004, § 3.3.2) and BLM (2012, § 3.3.4). Additional descriptions of the physical and chemical characteristics of rivers and lakes are in Sections 3.2.2, *Water Resources*, and 3.3.1, *Vegetation and Wetlands*. Information on subsistence fisheries in the project study area is described in Section 3.4.5, *Subsistence*. The potential impacts of climate change on fish and fish habitat on the North Slope is discussed in Section 3.2.4.

3.3.2.1 Fish Habitat

The following section on fish habitat is summarized from the BLM (2012, § 3.3.4, p. 223-229). The majority of aquatic habitat in the NPR-A exhibits minimal or no impacts as a result of anthropogenic activities. Many of the more important attributes influencing fish habitat, such as stream banks and channels, lakeshores, substrates, water quality and quantity, floodplains, and riparian areas are largely unaltered from their natural condition.

Annual flow regimes in streams and rivers influence the amount of lake habitat that is accessible to fish. The degree to which a lake is connected or in close proximity to channel habitat determines the extent to which it is available for fish use. Lake connections vary greatly and can change throughout the open-water season, with some only occurring during high flows in the spring. Other lakes consistently remain accessible by fish. High flows during spring breakup also flood some lakes with no discernible connecting channel, with lakes in close proximity to streams and rivers flooding most frequently. These lakes show a gradation of fish use depending on how frequently a lake is inundated by spring flooding.

The three- to four-month Arctic summer is a critical time for fish to find quality feeding habitat, as food is plentiful only during this period. Many of the main river channels are much less productive than small tributaries or connected lakes that are usually warmer. As a result, these peripheral habitats may be more highly utilized for feeding. Particularly early in the summer, shallow lakes that thaw early and are accessible to fish likely provide valuable feeding habitat. Later in the summer, high temperatures may lead some fish to seek out cooler feeding areas in channel habitats or deeper lakes.

Spawning habitat requirements vary for different Arctic fish species and can occur in a wide range of flowing or still waters. Some species can spawn successfully in areas of silt or sand substrate, while many others require gravel of a particular size class and relatively clear water. Except for burbot, which spawn under ice in late winter, Arctic freshwater fish spawn between late May and October. Although general spawning timing is known, species-specific information on spawning locations in the GMT1 area are lacking.

Overwintering habitat is a major factor constraining fish populations in the Arctic. During the eight- to nine-month winter period, ice formation reduces stream habitat by up to 95 percent, portions of the low salinity near-shore coastal habitat freeze, and unfrozen coastal waters are supercooled (i.e., <0° C). Lakes and rivers typically freeze to about 5-6 feet in depth and water depths of approximately 7 feet or more are often necessary to support overwintering freshwater fish. Potential and known overwintering habitats within the project study area are shown in Map 3.3-1.

Migration corridors are an additional habitat requirement for many Arctic fish since feeding, spawning, and overwintering habitat for an individual fish are not always proximate to each other, necessitating seasonal or annual movements. Annual water body connectivity and flow regimes play a major role in determining how much potential habitat is actually accessible. Many fish migrate locally or even extensively between major drainages in order to reach suitable habitat at various life history stages.

The GMT1 Project is located within the NPR-A Fish Habitat Coastal Plain Unit (CPU) of the NPR-A (BLM 2012, Fish Habitat Units Map). The CPU is characterized by extremely low gradient terrain that strongly influences aquatic habitat features and morphology. Rivers and streams are generally slow-moving with many unstable banks, and substrates are dominated by sand and silt with relatively few isolated areas of gravel. A majority of the annual flow occurs during spring breakup when large expanses of land tend to be inundated by water. Flow is reduced significantly by mid to late summer and can even become discontinuous, depending on precipitation. Deep river pools, deep lakes, and deltas provide a majority of overwintering habitat. Outside of the major river corridors, the predominant aquatic habitat type in the CPU consists of complicated networks of lakes and small streams. Most small streams in the project study area are described as "beaded" because deep pools that occur along thermally degraded ice-wedges are connected by narrow channels, resembling beads on a string. These beaded stream/lake complexes represent important, extensive fish habitat in the CPU.

3.3.2.2 Fish Species

Eighteen freshwater, anadromous, and nearshore marine fish species have been documented in the GMT1 Project area and surrounding waters (Table 3.3-2). Freshwater fish species largely remain within river, stream, and lake systems year-round while anadromous species breed in fresh water but spend at least part of the life cycle in the ocean. Known anadromous waters in the project study area are shown in Map 3.3-3. Descriptions of life history traits and general distribution in the NPR-A are included in BLM (2004, § 3.3.2) and BLM (2012, § 3.3.4).

Studies of fish species distribution were conducted by industry and the State in the project study area and contiguous waters prior to BLM (2004) (MJM Research 1998; 2000a,b,c; 2001a,b; 2002a,b,c,d; 2003a,b,c,d,e; 2004; Morris 2003) and have continued to provide additional information since that time (MJM Research 2005a,b; 2007a,b,c; 2008a,b; 2009; 2013). Ongoing research within the project study area being conducted by the BLM in cooperation with the University of Alaska Fairbanks has also provided further data on fish use (Heim 2014; McFarland 2013). Arctic grayling, broad whitefish, ninespine stickleback, and Arctic cisco are the most prevalent fish in the project study area. Alaska blackfish, burbot, least cisco, humpback whitefish, round whitefish, and slimy sculpin are also relatively common, but to a lesser extent. The remaining fish species are only occasionally encountered in the greater surrounding area. Fish distribution in the project study area is shown in Map 3.3-4.

The Tiŋmiaqsiġvik (Ublutuoch) River and Igalliqpik (Fish Creek) channels are used by most fish species found in the area (Table 3.3-2). Although the full extent of fish use in these higher-order streams is not known, these are known to function as migratory corridors that allow fish to access a variety of tributary habitats. Fish use of smaller, tributary stream-lake complexes in the project study area is largely dependent on degree of connectivity. The well-connected stream and lake habitats (e.g., Crea Creek and lake MC7916 in lower Blackfish Creek) have the greatest fish use and are especially utilized by Arctic grayling and broad whitefish. On the contrary, many of the shallow, less-connected systems are either fishless or often contain only ninespine stickleback.

Table 3.3-2. Fish Species Found in the Lower Fish Creek Watershed and Vicinity

Common Name	Scientific Name	Iñupiaq Name
Freshwater Species		
Alaska blackfish	*Dallia pectoralis*	Iłuuqiniq
Arctic grayling	*Thymallus arcticus*	Sulukpaugaq
Burbot	*Lota lota*	Tittaaliq
Ninespine stickleback	*Pungitius pungitius*	Kakalisaauraq
Northern pike	*Esox lucius*	Siulik
Round whitefish	*Prosopium cylindraceum*	Savigunnaq
Slimy sculpin	*Cottus cognatus*	Kanayuq
Anadromous Species		
Arctic cisco	*Coregonus autumnalis*	Qaataq
Bering cisco	*Coregonus laurettae*	Tiipuq
Broad whitefish	*Coregonus nasus*	Aanaaqłiq
Chinook salmon	*Oncorhynchus tschawytscha*	Iqalugruaq
Chum salmon	*Oncorhynchus keta*	Iqalugruaq
Dolly Varden	*Salvelinus malma*	Iqalukpik
Humpback whitefish	*Coregonus pidschian*	Piquktuuq
Least cisco	*Coregonus sardinella*	Iqalusaaq
Pink salmon	*Oncorhynchus gorbuscha*	Amaqtuuq
Rainbow smelt	*Osmerus mordax*	Iłhauġniq
Coastal Marine Species		
Fourhorn sculpin	*Myoxocephalus quadricornus*	Kanayuq

Fish research projects conducted in Crea Creek (Heim 2014; McFarland 2013) have provided additional information about the ecological importance of beaded stream/lake complexes and site-specific habitat use in the GMT1 area. Arctic grayling begin to enter Crea Creek during spring runoff in early June and fish of various size classes utilize the system throughout the summer, with most departing prior to freezeup in late September. In addition to many fish that remain in the channel to feed, the shallow, warm habitat in Lake CC3 is also heavily utilized. Lake L9819 is used to a much lesser extent by Arctic grayling, as the outlet connection begins to recede early in the summer, and Lake L9820 is largely inaccessible since it freezes to the bottom each winter and becomes disconnected rapidly after spring breakup. Diet analyses demonstrate the importance of invertebrate and ninespine stickleback productivity as food sources for Arctic grayling. Other similar clearwater tributaries (e.g., Bill’s Creek) also likely provide critical summer feeding habitat for many fish species.

A radio telemetry project conducted by the State examining Arctic grayling, broad whitefish, and burbot movements in the Fish Creek drainage documented extensive movements by all species (Morris 2003). This included use of both channel and lake habitat in the project study area. Most notably, individuals of all species utilized the lower Tiŋmiaqsiġvik (Ublutuoch) River for overwintering, in a section beginning a short distance upstream of the proposed bridge site down to the confluence with Fish Creek. It is likely other fish species also use this portion of the Tiŋmiaqsiġvik (Ublutuoch) River in the winter, as bathymetric mapping identified numerous deep areas with maximum depths greater than 8 feet (MJM Research 2005a).

3.3.2.3 Essential Fish Habitat

The 1996 Sustainable Fisheries Act enacted additional management measures to protect commercially harvested fish species from overfishing. Along with reauthorizing the Magnuson-

Stevens Fishery Conservation and Management Act Reauthorization (16 USC 1801-1882), one of those added measures is to describe, identify, and minimize adverse impacts to EFH. Arctic freshwater EFH only includes habitat utilized by Pacific salmon. The EFH Assessment for the project study area is in Appendix D.

3.3.3 Birds

About 90 species of birds are expected to occur annually in the NPR-A and adjacent Beaufort and Chukchi sea habitats (BLM 2012, § 3.3.5, p. 242). Approximately 80 of these species are likely to occur in the Alpine Satellite Development Plan (ASDP) area (see BLM 2004, Figure 1.1.1-1, Plan Area Vicinity and Location Map) or in nearshore waters of Harrison Bay. Data to support an exhaustive list of avian species occurrence specifically within the project study area are not available at this time, but information regarding avian species occurrence in the larger ASDP is available. Data to support density, occurrence, and trend estimates of commonly found species in the GMT1 development area are available and summarized within this document (as well as Threatened and Endangered species discussed in Section 3.3.5). Common, scientific, and Iñupiaq names and status of avian species in the ASDP area are presented in Table 3.3-4. The status category includes species (or populations) listed as Birds of Conservation Concern (BCC) by the USFWS (2008), those listed as Threatened or Endangered, and those identified as Sensitive by the BLM (2010). Species listed as BCC are migratory nongame birds that are likely to become candidates for listing under the Endangered Species Act (ESA) in the absence of additional conservation efforts. Species listed as Endangered under the ESA are those in danger of extinction throughout all or a portion of their range, and those listed as Threatened are those likely to become endangered in the foreseeable future. BLM Sensitive Species include those known or predicted to undergo a decline that could threaten the viability of the species under all or a portion of its range, and those that rely on unique or specialized habitats that are threatened with alterations that could jeopardize the viability of the species. Life history and general biology of avian species in the ASDP area and within the NPR-A is provided in BLM (2004, § 3.3.3) and in BLM (2012, § 3.3.5), which are incorporated by reference.

The majority of avian studies available for this region cover a large geographical area. For the purposes of this SEIS, a project study area (see Section 3.1.1 of this SEIS) is used to delineate an area for analysis of the affected environment and potential impacts from the proposed GMT1 development. Avian surveys in the ASDP area have been conducted by the Applicant (CPAI) and its predecessors since 1992 and in sections of the Colville River delta since 1989. Appendix J provides a summary of all available data for the Applicant's contracted avian surveys. The Applicant's contractor for avian studies, ABR Inc. (ABR), conducts studies that survey both the Colville Delta, termed ABR Colville Delta Study Area (CDSA) in this document, and the northeastern NPR-A, termed ABR NPR-A Study Area (NASA) in this document. Table 3.3-3 lists the avian study areas, further divided by study subareas, and provides a reference to the location of the project study area. Map 3.3-5 shows the location of the project study area and the CDSA and NASA subareas.

Federal and state agencies have been conducting avian studies for similar time periods in response to resource development activities. USFWS's Migratory Bird Management (MBM) has a long-term dataset consisting of estimated onshore densities and these data have been analyzed for the species occurring in the project study area. The USFWS's MBM has also estimated annual avian population growth rates using their long-term aerial survey index data and these rates are presented for the relevant species that occur in the project study area.

Table 3.3-3. CDSA and NASA Subareas in Relation to the GMT1 Project Study Area

ABR Colville Delta Study Area (CDSA)[a]	
CD North Subarea	A portion of this subarea crosses the project study area but contains no project infrastructure.
Northeast Delta Subarea	Not contained within project study area
CD South Subarea	Includes GMT1 pipelines from CD1-CD4N portion of the existing pipe from CD4N to CD5
ABR NPR-A STUDY AREA (NASA)[a]	
Fish and Judy Creek Corridor Subarea	Overlaps with 2011-2012 Development Subarea
Fish Creek Delta Subarea	The southeast corner of this subarea crosses the project study area but contains no project infrastructure.
Alpine West Subarea	Includes a portion of road and pipeline from CD4 to CD5
2011-2012 Development Subarea[b]	Includes proposed road and pipeline from CD5 to GMT1 pad and the GMT1 proposed pad

Source: Johnson et al. 2013

[a] See Map 3.3-5 for subareas in relation to the GMT1 project study area.

[b] The 2011-2012 Development Subarea is a portion of a larger development subarea that was studied in previous years.

Beginning in 1992, the Applicant engaged in consultation with resource agencies and local communities to select a focal group of wildlife species to study using annual aerial surveys in the CDSA and NASA. Surveys have and continue to collect data on distribution, abundance, and habitat use of these focal wildlife species. Wildlife species were selected using the following criteria: 1) threatened or sensitive status, 2) indications of declining populations, 3) restricted breeding range, 4) importance to subsistence hunting, or 5) concern of regulatory agencies for development impacts. The focal group of wildlife included both birds and mammals. The avian focal species included the following: spectacled eider, king eider, tundra swan, yellow-billed loon, brant, snow goose, greater white-fronted goose, and Canada goose. Data were also collected on the glaucous gull and Sabine's gull due to their predatory associations with eggs of ground nesting birds (Johnson et al. 2009). Three additional species that share similar conservation concerns as the focal avian species and may occur in the project study area, red knot, short-eared owl, and golden eagle, are described in BLM (2004, § 3.3.5, pp. 242-280) and BLM (2012, § 3.3.8.2, pp. 318-337). Passerines, raptors, ptarmigan, geese, swans, eiders, loons, and shorebirds are species groups discussed in this SEIS that have been noted regularly (ptarmigan, shorebirds, geese, swans, eiders, and passerines) or on an infrequent basis (raptors) during CPAI avian surveys in the ASDP area (Johnson et al. 2013).

Habitat maps were used in conjunction with wildlife survey data to describe habitat selection and preference by birds and mammals on the North Slope (Johnson et al. 2013). This approach, known as the ecological land survey approach, is described in BLM (2004, § 3.3.1.2, pp. 202-204). Map 3.3-6 depicts habitat classes delineated within the project study area. A description of habitat classification units is provided in Jorgenson et al. (2003b) and Johnson et al. (2013).

Generally, on the ACP of Alaska's North Slope, the following habitat characteristics are attractive to shorebirds, geese, ducks, and loons: availability of large deep lakes with ice floes, shoreline with low relief, peat or mud substrate for resting, graminoid meadows with moss, low predator and human population or disturbance, and proximity to coastal staging areas (BLM 2004, § 3.3.3.1, p. 239). The most common habitat types in the project study area include, in decreasing order: patterned wet meadow, ponds, water bodies, moist tussock tundra, and moist sedge-shrub meadow (Map 3.3-6 and Table 3.3-1 with cross reference in Jorgenson et al. [2003b] and Johnson et al. [2013]).

Proposed infrastructure development may have both direct and indirect impacts on birds (Chapter 4). Direct impacts include long-term bird habitat loss during construction of roads and pads because tundra covered by gravel would be lost to use by birds. Indirect impacts include migration of dust from gravel infrastructure and subsequent deposition on adjacent tundra. Dust deposition can alter bird habitat by causing early snowmelt, early green-up of tundra vegetation, increased thermokarsting, increased soil pH, and reduced photosynthetic capabilities of plants (Chapter 4). The areal extent of direct impacts on bird habitat was evaluated by estimating the footprint of gravel infrastructure development for each Alternative. Indirect impacts to bird habitat based on altered vegetation were estimated by applying a 300-foot zone from the edge of gravel infrastructure (Chapter 4). The areal extent of direct and indirect impacts on bird habitat is called the impact zone and is discussed below for the affected environment of focal birds.

The following sections describe the focal avian species occurring in the project study area. Steller's eider, spectacled eider, and yellow-billed loon are addressed in Section 3.3.5, *Threatened and Endangered Species*.

Table 3.3-4. Common, Scientific and Iñupiaq Names and Status of Avian Species Found in the ASDP Area

Common Name	Scientific Name[a]	Iñupiaq Name[b]	Status[c]
Waterfowl (Tinmiagruich) and Waterbirds			
greater white-fronted goose	*Anser albifrons*	niglik	-
snow goose	*Chen caerulescens*	kanuq	-
Canada goose	*Branta canadensis*	iqsragutilik	-
brant	*Branta bernicla*	niglingaq	-
tundra swan	*Cygnus columbianus*	kugruk	-
gadwall	*Anas strepera*	-	-
American wigeon	*Anas americana*		-
mallard	*Anas platyrhynchos*	kurugaktak	-
northern shoveler	*Anas clypeata*	alluutaq	-
northern pintail	*Anas acuta*	kurugak	-
green-winged teal	*Anas crecca*	qaiffiq	-
canvasback	*Aythya valisineria*		-
greater scaup	*Aythya marila*	qaqluktuuq	-
lesser scaup	*Aythya affinis*	kaklutuk	-
Steller's eider	*Polysticta stelleri*	igniqauqtu	T
spectacled eider	*Somateria fischeri*	kavaasuk	T
king eider	*Somateria spectabilis*	qinalik	-
common eider	*Somateria mollissima*	amauligruaq	-
surf scoter	*Melanitta perspicillata*	aviluktuq	-
white-winged scoter	*Melanitta fusca*	killalik	-
black scoter	*Melanitta nigra*	tuungaagrupiaq	-
long-tailed duck	*Clangula hyemalis*	ahaaliq	-
red-breasted merganser	*Mergus serrator*	aqpaqsruayuuq	-
Loons (Malgitch) and Grebes			
red-throated loon	*Gavia stellata*	qaqsraupiagruk	BCC
pacific loon	*Gavia pacifica*	qaqsrauq	-
yellow-billed loon	*Gavia adamsii*	tuullik	BCC, SS
red-necked grebe	*Podiceps grisegena*	aqpaqsruayuuq	-
horned grebe	*Podiceps auritus*	subliq	-

Table 3.3-4. Common, Scientific and Iñupiaq Names and Status of Avian Species Found in the ASDP Area (Continued)

Common Name	Scientific Name[a]	Iñupiaq Name[b]	Status[c]
Ptarmigan			
willow ptarmigan	*Lagopus lagopus*	nasaullik	-
rock ptarmigan	*Lagopus mutus*	niksaaktun	-
Cranes			
sandhill crane	*Grus canadensis*	tatirgak	-
Raptors and Owls			
bald eagle	*Haliaeetus leucocephalus*	tinmiaqpak	-
northern harrier	*Circus cyaneus*	papiktuuq	-
rough-legged hawk	*Buteo lagopus*	qixbiq	-
golden eagle	*Aquila chrysaetos*	tingmiak	SS
merlin	*Falco columbarius*	tinmiabruum kirbavia	-
gyrfalcon	*Falco rusticolus*	aatqarruaq	-
peregrine falcon	*Falco peregrinus*	kirgavik	BCC
snowy owl	*Bubo scandiacus*	ukpik	-
short-eared owl	*Asio flammeus*	nipailuktaq	SS
Shorebirds			
black-bellied plover	*Pluvialis squatarola*	tullikpak	-
American golden plover	*Pluvialis dominica*	tullik	-
semipalmated plover	*Charadrius semipalmatus*	kurraquraq	-
whimbrel	*Numenius phaeopus*	sigguktuvak	BCC
bar-tailed godwit	*Limosa lapponica*	turraaturaq	BCC
red knot	*Calidris canutus*	-	BCC, SS
ruddy turnstone	*Arenaria interpres*	tullignaq	-
black turnstone	*Arenaria melanocephala*	-	-
sanderling	*Calidris alba*	kimitquilaq	-
semipalmated sandpiper	*Calidris pusilla*	livalivakpauruk	-
western sandpiper	*Calidris mauri*	-	-
least sandpiper	*Calidris minutilla*	livalivaurak	-
white-rumped sandpiper	*Calidris fuscicollis*	-	-
Baird's sandpiper	*Calidris bairdii*	puviaqtuuyaaq	-
pectoral sandpiper	*Calidris melanotos*	puviaqtuuq	-
dunlin	*Calidris alpina*	kayuttavak	BCC
stilt sandpiper	*Calidris himantopus*	-	-
buff-breasted sandpiper	*Tryngites subruficollis*	puviaqtuuq	BCC
long-billed dowitcher	*Limnodromus scolopaceus*	kilyaktalik	-
Wilson’s snipe	*Gallinago delicata*	-	-
red-necked phalarope	*Phalaropus lobatus*	qayyiuun	-
red phalarope	*Phalaropus fulicarius*	auksruaq	-
Seabirds			
pomarine jaeger	*Stercorarius pomarinus*	isunngluk	-
parasitic jaeger	*Stercorarius parasiticus*	migiaqsaayuk	-
long-tailed jaeger	*Stercorarius longicaudus*	isunnaq	-
herring gull	*Larus argentatus*	nauyavvaaq	-
Thayer's gull	*Larus thayeri*	-	-
glaucous-winged gull	*Larus glaucescens*	-	-
glaucous gull	*Larus hyperboreus*	nauyak	-
Sabine's gull	*Xema sabini*	iqirgagiaq	-
black-legged kittiwake	*Rissa tridactyla*	-	-

Table 3.3-4. Common, Scientific and Iñupiaq Names and Status of Avian Species Found in the ASDP Area (Continued)

Common Name	Scientific Name[a]	Iñupiaq Name[b]	Status[c]
Arctic tern	*Sterna paradisaea*	mitqutailaq	BCC
black guillemot	*Cepphus grylle*	-	-
Passerines			
common raven	*Corvus corax*	tulugaq	-
Arctic warbler	*Phylloscopus borealis*	sonakpalutuniq	-
bluethroat	*Luscinia svecica*	-	-
yellow wagtail	*Motacilla flava*	iksriktaayuuq	-
American tree sparrow	*Spizella arborea*	misapsaq	-
Savannah sparrow	*Passerculus sandwichensis*	okpisioyuk	-
Lapland longspur	*Calcarius lapponicus*	qupaluk, putukiiluk	-
snow bunting	*Plectrophenax nivalis*	amautlgaq	-
common redpoll	*Carduelis flammea*	saksakiq	-
hoary redpoll	*Carduelis hornemanni*	saksakiq	-
BCC = USFWS BIRDS OF CONSERVATION CONCERN SS = BLM SENSITIVE SPECIES		T = USFWS THREATENED	

[a] Scientific names from List of the 2,031 Bird Species (with Scientific and English Names) Known from the A.O.U. Checklist Area (http://www.aou.org/checklist/north/print.php). The list incorporates changes made in the 42nd, 43rd, and 44th supplements to the check-list, as published in The AUK 117:847-858 (2000); 119:897-906 (2002); 120:923-932 (2003). Subspecies designations are presented where relevant.

[b] Iñupiaq names as presented in PAI (2002), Appendix B, Table B-3 and in Birds of Central Beringia, a taxonomic List in English, Russian, Iñupiaq, Siberian Yupik, and Latin (http:/www.nps.gov/akso/beringia/).

[c] USFWS 2008, USFWS 2014, BLM 2010.

(--) = no corresponding Iñupiaq word found.

3.3.3.1 Gulls

The summary presented below provides information from data collected on glaucous and Sabine’s gulls throughout the ACP, as well as limited site-specific data regarding glaucous gulls and Sabine’s gulls in the project study area. This summary is supplemental to information provided in BLM (2012, § 3.3.5.1) and BLM (2004, § 3.3.3.7), which are incorporated by reference.

Due to the potential for an increase in gull populations, resulting from their attraction to industrial development, and their known ability to predate ground nesting birds and nests, CPAI and its predecessors have been collecting data on glaucous and Sabine’s gulls in the CDSA since 1995, and the NASA since 1999 (Appendix J). In some years, observations of gulls were collected opportunistically as part of studies that focused on other bird species. The project study area lies within CDSA and NASA avian survey areas (see Map 3.3-5).

Over the entire ACP, the average annual population growth rates (total bird index) from 1992 to 2012 for the glaucous and Sabine’s gulls were 1.020 and 1.044, respectively, indicating a positive population growth trend for these species across the ACP (Stehn et al. 2013).

Estimated onshore density indices of glaucous gulls across the ACP are presented in BLM (2012, Volume 7, Figure 3.3.5-1). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0.052 to 4.033 birds per km^2 encompassing all but the lowest range present on the ACP (Table 3.3-5). The highest density contour is only found in only one percent of the project study area while the second and third highest density contours are present in 90 percent of the project study area (Table 3.3-5). Outside of the project study area the nearest high-density concentration (1.992-4.033 birds per km^2) of glaucous gulls is located near the Beaufort Sea coast (Colville River delta), approximately 13 miles to the northeast of the GMT1 pad location.

Table 3.3-5. Estimated Density Contours of Glaucous Gulls on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.051	342	<1%
0.052 – 0.419	9,656	8%
0.420 – 0.980	56,017	48%
0.980 – 1.991	49,467	42%
1.992 – 4.033	966	1%

Source: USFWS 2010a, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Estimated onshore density indices of Sabine's gulls across the ACP are presented in BLM (2012, Volume 7, Figure 3.3.5-2). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0 – 0.030 to 0.310 - 0.664 birds per km^2, encompassing the lowest three contours present on the ACP (Table 3.3-6). Only seven percent project study area is contained within the highest of these three contours. The nearest high-density concentration (1.311 – 2.926 birds per km^2) of Sabine's gulls outside of the project study area, approximately 5.3 miles west of the GMT1 pad location.

Table 3.3-6. Estimated Density Contours of Sabine's Gull on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.030	30,834	26%
0.031 – 0.309	77,188	66%
0.310 – 0.664	8,425	7%
0.665 – 1.310	--	--
1.311 – 2.926	--	--

Source: USFWS 2010a, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Although glaucous and Sabine's gulls were observed as part of aerial loon nesting surveys on selected lakes within the CDSA and the NASA, the survey area did not include lakes located within the project study area. A total of 73 glaucous gull nests were observed in the CDSA in 2012, with the highest number reported (37 nests) in the CD South Subarea (see Map 3.3-7). The largest single colony of glaucous gulls observed within the CDSA in 2012 was in the CD South Subarea and supported 17 nests; a range of six to 19 nests have been historically observed over the last 11 years for this particular colony. No Sabine's gull nests were observed in the CDSA in 2012, although between the years 2003 - 2010, a range of one to 16 nests had been observed.

The number of glaucous gull nests in the CDSA increased significantly between 2002 and 2012 (Johnson et al. 2013). In the NASA, survey areas varied between years, thus the trend in glaucous gull nesting is less clear. Sabine's gull nest counts have varied annually for the CDSA and NASA, but solitary Sabine's gull nests are difficult to detect and the observed variability may be due to differences in detection rates and may not reflect changes in the size of nesting populations.

Lakes surveyed for gulls in the NASA were located in the Alpine West Subarea and the 2012 survey portion of the Fish and Judy Creek Subarea. The area around the proposed GMT1 pad was not included in these searches. Of a total 25 glaucous gull nests recorded in the NASA, 17 were found in the Alpine West Subarea (see Map 3.3-7). Five Sabine's gull nests were observed in the NASA, all of which were in the Fish Creek Delta Subarea (outside of the project study area) (Johnson et al. 2013).

Habitats used by glaucous gulls in the CDSA included brackish water, deep open water with islands or polygonized margins, deep open water without islands, deep polygon complex, grass marsh, nonpatterned wet meadow, pattered wet meadow, shallow open water with islands or polygonized margins, and tapped lakes with high-water connections (Johnson et al. 2013). With the exception of brackish water, deep polygon complex, and tapped lakes with high-water connections, the above habitats occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4). In the NASA, the majority of the glaucous gull nests (20 nests, or 80 percent) occurred on islands in shallow open water with islands or polygonized margins, with the remaining nests on islands or complex shorelines of three other aquatic habitats; only one nest was observed in a terrestrial habitat (Johnson et al. 2013). Sabine's gulls were also observed utilizing shallow open water with islands or polygonized margins, as well as patterned wet meadow and sedge marsh (Johnson et al. 2013). All three of these habitat types occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

3.3.3.2 Passerines

A discussion of passerine species distribution, nesting habitats, foraging, and surveys on the ACP, as well as in the project study area, is included in BLM (2004, § 3.3.3.8 pp. 257-258 and 2012, § 3.3.5.7, pp. 276-277). Information in these documents is summarized below. Most passerines found in the NPR-A generally arrive on the North Slope from late May to early June and remain until mid- to late August (Johnson and Herter 1989). Passerines breeding in the project study area are generally tundra or shrub-nesting species. Savannah sparrow, common redpoll, snow bunting, Lapland longspur, common raven, and yellow wagtail are expected to occur in the project study area (BLM 2012, § 3.3.5.8, p. 276). Nesting and foraging habitats used by passerines that are likely to occur in the project study area are summarized in BLM (2004, Table 3.3.3-8, p. 257 and § 4F.3.3 p. 1134-1153). This section will address the Lapland longspur in detail due to their presence accounting for the vast majority of nesting birds in the NPR-A and Colville River delta surveys since the 1970s (BLM 1978; Derksen et al. 1981; Burgess et al. 2003; Liebezeit and Zack 2006, 2007, 2008). Ravens will be addressed due to their known association with industrial development and their potential for predating nest contents and nesting birds.

Lapland longspurs are the most common species nesting across the NPR-A (BLM 2012, § 3.3.5.8, p. 276). Lapland longspurs were present in all of the 24 breeding-bird plots (31.3 nests per km^2) in the NASA reported by Johnson et al. (2005). Over a three-year period, Lapland longspurs were found to be the highest density nesting passerine species (40.0 to 42.5 nests per km^2) in an area near Teshekpuk Lake (BLM 2012, § 3.3.5.8, p. 276). In-ground-nest searches near the Alpine development and the NPR-A satellite developments, over three- to four-year nest survey periods, Lapland longspurs accounted for greater than 80 percent of all bird nests documented each year (BLM 2004, § 3.3.3.8, p. 258).

Other passerine bird nests observed included those of Savannah sparrows (infrequent; 2 of 24 plots; 0.8 nests per km^2), eastern yellow wagtail (one nest found in 2004; Johnson et al. 2005), American tree sparrows, and common redpolls nesting along the channels of the Colville River.

Common raven, though not abundant, is the only resident passerine in the NPR-A, and is commonly found only where nesting opportunities are available, such as along the Colville River bluffs, the foothills and mountains of the Brooks Range, and often, where man-made structures provide nesting platforms (BLM 2012, § 3.3.5.8, p. 277). Larned et al. (2011) reported that although there are concerns that raven populations are expanding on the North Slope (in response to an increase in artificial structures used for nesting structures and the potential for a year-round food source in the form of garbage), their aerial survey results do not indicate a positive growth rate nor a geographic shift. However, they note that the probability of their survey to detect ravens is low in human settlements and oil field infrastructure, an area where a high occurrence of ravens would be expected as human settlements and areas of oil field infrastructure are avoided during aerial surveys due to safety concerns.

During a workshop designed to determine human influences on predators of nesting birds on the North Slope of Alaska held by the USFWS in 2003, participants agreed that ravens have increased in number on the ACP in response to human activity. However, consensus was not achieved on how much and where the increase in the raven population has taken place (USFWS 2003). Human activities may benefit ravens by increasing the over-winter survival of adults and/or young due to an increased food supply. Indirect evidence from Audubon Society Christmas Bird Counts at Prudhoe Bay supports this hypothetical benefit. In 26 years of collecting Christmas Bird Counts, the raven has been the only species recorded. This evidence suggests that ravens are surviving the winter by eating anthropogenic foods at Prudhoe Bay; hence, enhancing their likelihood of winter survival on the North Slope (Day 1998). However the data from the Christmas Bird Counts at Prudhoe Bay do not indicate an increase in the population of ravens in that area (Audubon 2014). There are reports of ravens nesting in the Alpine oilfield (BLM 2012, § 3.3.5.8, p. 278) and ravens were reported to use buildings as roosting sites at CD1, with nests confirmed in 2000 and 2001 (Johnson et al. 2003a). Common ravens are successful egg predators of passerines, shorebirds, loons, and waterfowl on the ACP (BLM 2012, §3.3.5.8, p.277), and thus, could have an impact to existing local ground nesting bird populations.

3.3.3.3 Ptarmigan

Two species of ptarmigan, willow, and rock ptarmigan, occur in the NPR-A (BLM 2012, § 3.3.5.8, p. 276). Ptarmigan are ground-nesting birds in the grouse family that remain in the NPR-A year-round and are utilized for subsistence harvest. Rock ptarmigan may conduct local migrations during the fall to obtain willow forage (Johnson and Herter 1989), and nest in dry rocky habitats and in hummocky areas of wet sedge meadows (Holder and Montgomerie1993). Willow ptarmigan have been found nesting in both dense vegetation and on open tundra (Hannon et al. 1998, Johnson and Herter 1989). Specifically, ground-based nest searches in 2002 found willow ptarmigan nests in three habitat types at a study site approximately 1 mile northwest of the project study area (patterned wet meadow, moist sedge-shrub meadow, and moist tussock tundra; Burgess et al. 2003). Over 44 percent (12 of 21 nests) of the nests occurred in moist tussock tundra (Burgess et al. 2003).

Although no research studies targeting these species were identified, both species of ptarmigan have been recorded during various large waterbird nest searches conducted in areas representative of the project study area. In 2002, ptarmigan nested at a study location titled

Lookout (approximately 1 mile northwest of GMT1 proposed pad location) in higher densities than any other ground-search area in the NPR-A at 1.15 nests per km^2 (Burgess et al. 2003). Similar high nesting densities (compared to the rest of NPR-A for the survey period) were found in the CD South Subarea at a three year average of 1.62 nests per km^2 (Burgess et al. 2003). More recently, ptarmigan were reported within the project study area during eider surveys, but no individuals or nesting sites were found within 400 meters of the proposed GMT1 pad location (Seiser and Johnson 2011).

3.3.3.4 Waterfowl

Waterfowl are among the most populous avian groups in the ACP and the project study area. Waterfowl are present on the ACP from early spring until late fall when they leave the area to travel to their wintering grounds. The following section summarizes information for select species of waterfowl (tundra swan, brant, snow goose, king eider, greater white-fronted goose, and Canada goose) and is supplemental to information provided in BLM (2012, § 3.3.5 and 2004, § 3.3.3), incorporated by reference here.

Tundra Swan

The summary presented below provides information from data collected on tundra swans throughout the ACP and limited site-specific data in the project study area. This summary is supplemental to information provided in the BLM (2012, § 3.3.5.5) and the BLM (2004, § 3.3.3.2), incorporated by reference here.

CPAI and its predecessors have been conducting aerial surveys of nesting and brood-rearing tundra swans in the NASA beginning in 1999 and continuing in 2011-2012, and in the CDSA since 1992 (Appendix J). The survey areas and percentage of area surveyed differed among years. Six of the avian survey areas lay partially within the project study area (see Map 3.3-5).

Tundra swans are common along the Arctic coast of Alaska, and are present in the project study area. The average annual population growth rate (total bird index) for tundra swans from 1986 to 2012 was 1.046, indicating a positive population growth trend for this species across the ACP (Stehn et al. 2013). The overall trend in counts of pairs, nests, and broods in the CDSA has been one of slow increase. Due to variation of study areas between years, an overall trend for pairs, nests, and broods is not available for the data collected on tundra swans in the NASA (Johnson et al. 2013).

Estimated onshore density indices of tundra swans across the ACP are presented in BLM (2012, Figure 3.3.5-7). Those density classes that occurred within the project study area were determined by GIS analysis. The entire range of density index contours found within the ACP are also found within the project study area and range from 0 - 0.050 to 0.706 - 1.777 birds per km^2 (Table 3.3-7). Table 3.3-7 shows that 66 percent of the project study area contains high to moderately high densities (0.217 – 1.777 birds per km^2) of tundra swans and that only five percent of the project study area is contained within the lowest of the density contours. Outside of the project study area the nearest high-density (0.706 – 1.777 birds per km^2) concentration of tundra swans is located near the Beaufort Sea coast, approximately 5.3 miles north of the GMT1 pad location.

Table 3.3-7. Estimated Density Contours of Tundra Swans on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.050	6,177	5%
0.051 – 0.216	32,536	28%
0.217 – 0.417	33,873	29%
0.418 – 0.705	23,811	20%
0.706 – 1.777	20,051	17%

Source: USFWS 2010a, Migratory Bird Management

Within the CDSA, the 19-year average density of tundra swan nests was reported at 0.06 nests per km^2 (total of 34 nests) while surveys conducted in 2012 show a total of 40 nests and a density of 0.07 nests per km^2. The majority of the nests found in 2012 occurred north and east of the project study area, with 14 nests occurring in the CD South Subarea (see Map 3.3-7). In 2012, productivity in the entire CDSA was below average, with 58 percent nesting success, a total of 23 broods at 0.04 broods per km^2, brood size of 2.2 young, and overall production of 51 young; these numbers compare to a 19 year average of 73 percent nesting success, 25 broods, 2.5 young per brood, and 62 total young, respectively. Productivity data at the subarea level was not available for the CDSA (Johnson et al. 2013).

Within the NASA, 19 tundra swan nests (0.06 nests per km^2) were observed in 2012 surveys, with four nests in the Alpine West Subarea and nine nests in the Development Subarea (see Map 3.3-7). A total of 12 broods were recorded in the NASA (0.04 broods per km^2) with an average brood size of two. Three of the broods occurred in the Alpine West Subarea and five occurred in the Development Subarea (Johnson et al. 2013).

The habitats preferred by nesting tundra swans was evaluated using 19 years of aerial survey data in the CDSA and 11 years of aerial survey data in the NASA. Nesting tundra swans in the CDSA utilized 19 of 24 available habitats, preferring eight (Johnson et al. 2013). Of these eight preferred habitats, seven (deep open water with islands and polygonized margins, sedge marsh, patterned wet meadow, salt marsh, deep polygon complex, grass marsh, and moist sedge-shrub meadow) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). Tundra swans in the CDSA utilized 20 of 24 available habitats for brood-rearing, preferring nine (Johnson et al. 2013). All of these nine preferred brood-rearing habitats occur in the project study area (deep open water with islands or polygonized margins, deep open water without islands, grass marsh, shallow open water without islands, brackish water, tapped lake with high-water connection, tapped lake with low water connection, salt marsh, and salt killed tundra). Of these nine, five habitats (salt marsh, deep open water with islands or polygonized margins, grass marsh, shallow open water without islands, and deep open water without islands) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

Nesting tundra swans in the NASA utilized 21 of 26 available habitats, preferring four, all of which occur in the project study area (grass marsh, salt marsh, shallow open water with islands or polygonized margins, and young basin wetland complex; see Map 3.3-6). Of these four preferred nesting habitats, only young basin wetland complex does not occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). Tundra swans in the NASA utilized 22 of 26 available habitats for brood-rearing, preferring five. Four of these preferred habitats (river or stream, grass marsh, deep open water without islands, deep open water with islands or polygonized margins) occur within the impact zone of the proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6) (Johnson et al. 2013).

Brant and Snow Goose

The summary presented below provides information from data collected on brant and snow geese throughout the ACP, and site-specific information collected in the project study area. This is supplemental to information provided in BLM (2012, § 3.3.5.5 and 2004, § 3.3.3.2), incorporated by reference here.

Aerial surveys for nesting or brood-rearing brant and snow geese have been performed in the CDSA and NASA since at least 1999 (Appendix J). Also, ground-based searches for large waterbirds (e.g., ducks, geese, swans, loons, gulls, and others) conducted from 2002 to 2004 documented nesting, brood-rearing, and fall staging of various bird species along a previously proposed road corridor between CD2, CD5, and the GMT1 pad area (Johnson et al. 2005). These surveys were conducted one kilometer around proposed pad footprints for CD5 and CD6 (now known as GMT1), as well as 200 meters from the previously proposed road centerline between CD2, CD5, and the GMT1 pad area. Since those surveys were conducted, the road corridor has been moved southward (approximately 1 mile) on the western end in coordination with the proposed GMT1 pad location moving southward in current plans, but is still representative of the affected environment. In 2009, ground-based nest searches (focused on eiders with opportunistic large waterbird documentation) were conducted in a 400-meter buffer around the proposed GMT1 and CD5 pads as well as a 200-meter buffer surrounding the proposed road route between CD4 and GMT1 (Seiser and Johnson 2011). Proposed pad and road locations studied in 2009 are representative of current planned infrastructure.

Brant

The average annual population growth rate (total bird index) from 1986 to 2012 for brant was 1.095, indicating a positive population growth trend for this species across the ACP (Stehn et al. 2013). Estimated onshore density indices of brant across the ACP are presented in BLM (2012, Volume 7, Figure 3.3.5-8). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0 to 2.291 birds per km^2, encompassing all but the highest density contour present on the ACP (Table 3.3-8). The second highest density contour (0.989 – 2.291 birds per km$^{2)}$ is only found on 3 percent of the project study area and the highest density contour (2.292 – 5.448 birds per km^2) is not present in the project study area (Table 3.3-8). Outside of the project study area the nearest high-density concentration (2.292 – 5.448 birds per km^2) of brant is found northwest of the project study area along the Beaufort Sea coast, approximately 8.4 miles from the proposed GMT1 pad. Estimated density index contours within the project study area range from 0 - 0.029 to 0.988 - 2.291 birds per km^2 (BLM 2012, Volume 7, Figure 3.3.5-8), and are represented in Table 3.3-8.

Table 3.3-8. Estimated Density Contours of Brant on the ACP (2007 - 2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.029	75,566	65%
0.030 – 0.366	23,775	20%
0.368 – 0.988	13,927	12%
0.989 – 2.291	3,180	3%
2.292 – 5.448	0	0%

Source: USFWS, 2010a, Migratory Bird Management

In 2012, 1,145 brant (adults and goslings) were observed during aerial surveys of the CDSA, and 1,684 were observed in the NASA (Johnson et al. 2013). In 2012 both the CDSA and NASA, counts of total numbers of brant were near long-term averages, but numbers of goslings were below average. All brood-rearing groups in both the CDSA and NASA were observed in four types of salt-affected habitats: Open Nearshore Water, Brackish Water, Tidal Flat Barrens, and Salt Marsh (Johnson et al. 2013). Of these habitats, only salt marsh is present within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

In 2004, ground-based large waterbird nest searches documented a total of eight brant nests (1.9 nests per km^2) at the CD5 proposed drill site. No nests were observed at the CD6 survey location (now referred to as GMT1). Within the proposed road corridor study plots, 13 brant nests (1.3 nests per km^2) were observed. Nesting success for all NASA study plots was moderate to high, with 76 percent of brant nests successful (Johnson et al. 2005). Nesting brant utilized shallow open water with islands or polygonized margins, and young basin wetland complex within the search areas of the NASA (Johnson et al. 2005). One of these two habitat types utilized for nesting brant (shallow open water with islands or polygonized margins) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). In 2009, two brant nests were recorded along road corridor searches (Seiser and Johnson 2011).

Snow Goose

The average annual population growth rate for snow geese from 1986 to 2012 was 1.249 (total bird index; Stehn et al. 2013), indicating a positive population growth trend for this species across the ACP. Snow geese represented the most rapid growth rate among all species surveyed on the ACP. The last ten-year estimated population growth rate (from 2003 to 2012) for snow geese is 1.237 (total bird index; Stehn et al. 2013). If this rate continues, the population of 6,171 total birds (in 2008) could potentially number 50,000 individuals by 2018 (Stehn et al. 2013).

A total of 4,035 snow geese (adults and goslings) were observed in the CDSA during aerial surveys of brood-rearing groups in 2012. Aerial brood-rearing and fall staging surveys in the NASA observed 289 snow geese with all birds located in the Fish Creek Delta Subarea which is within the GMT1 project study area, but outside of the zone of impacts associated with action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). For both the CDSA and NASA, snow goose counts in 2012 were higher than other previous counts (Johnson et al. 2013).

During ground nest searches at CD3 (outside of the project area), three successful snow goose nests (0.2 nests per km^2) were found around the proposed pad location in 2004; although, no brood-rearing snow geese were observed near CD3 in that year (Johnson et al. 2005).

Aerial brood-rearing surveys conducted in 2012 were used to determine brood-rearing habitat selection for snow goose. In both the NASA and CDSA, the majority of snow goose utilized salt-affected habitats (Johnson et al. 2013). In the NASA, 63 percent of observed brood-rearing snow goose were found in the following salt-affected habitats: salt-killed tundra, brackish water, salt marsh, tapped lake with low-water connection, tidal flat barrens, and open nearshore water (Johnson et al. 2013). Brood-rearing groups were also observed in barrens, river or stream, and deep polygon complex (Johnson et al. 2013). Of these nine regularly utilized habitats for brood-rearing, three (salt marsh, barrens, and river or stream) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

King Eider

The summary presented below provides information from data collected on king eiders throughout the ACP and limited site-specific data in the project study area. This summary is supplemental to information provided in BLM (2012, § 3.3.5.5) and BLM (2004, § 3.3.3.2), incorporated by reference here.

CPAI and its predecessors have been conducting aerial and/or ground-based surveys of pre-nesting, nesting, and/or brooding eiders in the CDSA since 1992 and in the NASA since 1999. The survey areas and survey coverage sometimes differed among years (Appendix J).

King eiders breed along the Arctic coast of Alaska and are present in the project study area. The average annual population growth rate (total bird index) from 1986 to 2012 was 1.031, indicating a positive population growth trend for this species across the ACP (Stehn et al. 2013). Within the CDSA and the NASA, Johnson et al. (2013) estimated population growth rates of 1.003 (1992 - 2012) and 1.091 (2000 - 2012) respectively.

Estimated onshore density indices of king eiders across the ACP are presented in BLM (2012, Figure 3.3.5-19). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area ranged from 0-0.032 to 0.729-1.310 birds per km^2 encompassing four of the five density contours found within the ACP (BLM 2012, Figure 3.3.5-19), and are represented in Table 3.3-9. The project study area did not contain any area in which the highest density contour (1.311 – 2.367 birds per km^2) was found (Table 3.3-9). The nearest highest-density concentration of king eiders is located outside of the project study area along the Beaufort Sea coast, approximately 9.6 miles north of the proposed GMT1 pad location.

Table 3.3-9. Estimated Density Contours of King Eiders on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.032	16,266	14%
0.033 – 0.337	42,705	37%
0.338 – 0.728	41,171	35%
0.729 – 1.310	16,305	14%
1.311 – 2.367	--	--

Source: USFWS, 2010a, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Within the CDSA, the average indicated density for pre-nesting king eiders over a 19-year period (1993-1998 and 2000-2012) was reported at 0.08 birds per km^2. In 2012, the majority of the 25 total king eiders observed in the CDSA occurred outside of the project study area in the CD North Subarea (Johnson et al. 2013).

Within the NASA in 2012, pre-nesting king eider density was 13 times greater than the density on the CDSA (Johnson et al. 2013). When the long-term (1999 – 2012) average density of king eiders is compared between NASA and CDSA, the NASA averages 4.8 times greater density than the CDSA (Johnson et al. 2013). Aerial pre-nesting surveys conducted in 2012 detected 27 birds in the Development Subarea (0.44 birds per km^2), and 13 birds in the Alpine West Subarea (0.33 birds per km^2) (Johnson et al. 2013).

In 2009, ground-based nest searches were conducted in a 400 meter buffer around the proposed GMT1 and CD5 pads, as well as a 200 meter buffer surrounding the proposed road route between CD4 and GMT1. During these searches, five king eider nests were found (1.38 nests per km^2) (Seiser and Johnson 2011).

The habitats preferred by pre-nesting king eiders was evaluated using 19 years of aerial survey data in the CDSA, and 11 years of aerial survey data in the NASA. Pre-nesting king eiders in the CDSA utilized 19 of 24 available (preferring six) (Johnson et al. 2013). Of these six preferred habitats, three (salt marsh, river or stream, and grass marsh) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). In the NASA, king eiders utilized 21 of the 26 available habitats and were found to prefer ten (Johnson et al. 2013). Of these ten preferred habitats, eight (salt marsh, deep open water without islands, deep open water with islands or polygonized margins, shallow open water without islands, shallow open water with islands or polygonized margins, river or stream, sedge marsh, and old basin wetland complex) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

Greater White-Fronted Goose and Canada Goose

The greater white-fronted goose and Canada goose are common species along the Arctic coast of Alaska and are present in the project study area. The summary presented below provides information from data collected on these geese throughout the ACP and limited site-specific data in the project study area. As of 2004, the Canada goose was split into two species: Canada goose and cackling goose (*Branta hutchinsii*) (Banks et al. 2004). The cackling goose is the common Canada goose species present in the project study area (Stehn et al. 2013). For the purpose of this section, “Canada goose” refers to both Canada goose and cackling goose. This summary is supplemental to information provided in the BLM (2012, § 3.3.5.5) and BLM (2004 § 3.3.3.2), incorporated by reference here.

CPAI and its predecessors have been conducting aerial and/or ground-based surveys of geese in the CDSA since 1992, and in the NASA since 1999 (Appendix J). In some years, observations of geese were collected opportunistically in studies that targeted other large waterbirds (e.g., brant, eider), and in some years surveys were also performed for brooding geese (Appendix J). The greater white-fronted goose was included in the ASDP wildlife study surveys because of their importance as a subsistence species (Johnson et al. 2005). The survey areas and survey coverage sometimes differed among years. The project study area lies within these survey areas (Johnson et al. 2005).

Average annual greater white-fronted goose population growth rates of the greater white-fronted goose and Canada goose on the ACP from 2003 to 2012 were reported at 1.137 and 1.045 (total bird index) respectively, indicating a positive trend in population growth for both species (Stehn et al. 2013).

Estimated density indices of greater white-fronted goose across the ACP are presented in BLM (2012, Figure 3.3.5-13). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0.119 – 2.303 to 8.782 – 15.846 birds per km^2 encompassing four of the five density contours found within the ACP (Table 3.3-10). The project study area did not contain any area in which the lowest density contour (0 – 0.118 birds per km^2) was found (Table 3.3-10). Moderate to high densities (2.304 – 15.846 birds per km^2) of greater white-fronted goose encompass approximately 92 percent of the project study area; similar to densities that are exhibited across the entire ACP.

Table 3.3-10. Estimated Density Contours of Greater White-Fronted Goose on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.118	--	--
0.119 – 2.303	10,366	9%
2.304 – 5.001	44,872	39%
5.002 – 8.781	27,744	24%
8.782 – 15.846	33,466	29%

Source: USFWS 2010a, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

The habitat selection of nesting greater white-fronted goose was evaluated using one year of ground-based survey data in the NASA, and five years of ground-based survey data in ABR's CD3 search area, representative of the CDSA. Nesting greater white-fronted geese in the NASA commonly utilized 4 of 16 available, preferring two (Johnson et al. 2005). Of the two preferred habitats, both (patterned wet meadow and old basin wetland complex) occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). In the CD3 search area (representative of CDSA), greater white-fronted geese utilized 4 of the 18 available habitats and were found to prefer two (Johnson et al. 2005). Of these two preferred habitats, one (patterned wet meadow) occurs within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

Estimated density indices of Canada goose across the ACP are presented in BLM (2012, Volume 7, Figure 3.3.5-16). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0 to 1.293 birds per km^2, encompassing the lower three density contours present on the ACP (Table 3.3-11). The project study area did not contain any area in which the two highest density contours (1.294 – 2.972 and 2.973 – 8.104 birds per km^2) were found (Table 3.3-10). Ares on the ACP where these two highest density contours are found are concentrated along the Beaufort Sea coast , north of Teshekpuk Lake as shown in BLM (2012, Volume 7, Figure 3.3.5-16).

Table 3.3-11. Estimated Density Contours of Canada Goose on the ACP (2007-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.029	25,077	22%
0.030 – 0.460	57,796	50%
0.460 – 1.293	33,574	29%
1.294 – 2.972	--	--
2.973 – 8.104	--	--

Source: USFWS 2010a, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

The most recently-collected site-specific density data available for greater white-fronted goose and Canada goose is presented in Johnson et al. (2005). Ground-based nest searches were conducted in a one kilometer radius around the proposed CD3, CD4, CD5, CD6, and CD7 pad locations. For the purpose of this summary, only results from CD5 and CD6 nest surveys will be discussed, as they are both within the project study area for GMT1 (CD6 was surveyed at its former location, but it remains representative for the project study area). Within the CD5 nest search area, 33 greater white-fronted goose nests were reported at a density of 8.0 nests per km^2 and twenty Canada goose nests were reported at a density of 5.0 nests per km^2 (Johnson et al.

2005). Within the CD6 nest search area, three greater white-fronted goose nests were reported with a density of 0.7 nests per km^2 and no Canada goose nests were reported (Johnson et al. 2005).

Brood-rearing adults and young were also surveyed for at CD5 and CD6, with no individuals of either species detected (Johnson et al. 2005).

The habitat selection of nesting Canada goose was evaluated during 2004 ground-based surveys in the NASA, and in ABR's 2004 CD3 search area, representative of the CDSA. Nesting Canada goose in the NASA were primarily located in aquatic or wetland basins, showing preference for shallow open water with islands or polygonized margins and old basin wetland complex (Johnson et al. 2005). Of the two preferred habitats, both occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). In the CD3 search area (representative of CDSA), Canada goose utilized 4 of the 16 available habitats, all located on small islands, hummocks, and polygon rims within 10 feet of water (Johnson et al. 2005). Of these four utilized habitats (deep open water with islands or polygonized margins, shallow open water with islands or polygonized margins, nonpatterned wet meadow and patterned wet meadow), all occur within the impact zone of proposed infrastructure for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

3.3.3.5 Shorebirds

The summary presented below provides information from data collected on shorebirds throughout the ACP and limited site-specific data regarding nesting densities, nesting success, population growth rates, and habitat selection for shorebirds that occur in the project study area. This information is supplemental to BLM (2012, § 3.3.5.6) and BLM (2004, § 3.3.3.6), incorporated by reference here.

The average annual population growth rate for all shorebird species (shorebirds were not identified to the species level) was 1.103 (total bird index) from 2003 to 2012 (Stehn et al. 2013), indicating a positive population growth trend for shorebirds in general within the ACP.

A number of species of shorebirds were observed during ground-based nest searches conducted within breeding bird study plots and large waterbird survey corridors along a previously proposed road corridor between CD2 and the GMT1 pad area, a portion of which is within the project study area (Burgess et al. 2003, Johnson et al. 2004, Johnson et al. 2005). During the period 2001-2004, pectoral sandpiper (24 nests, 10 nests per km^2) and semipalmated sandpiper (19 nests, 7.9 nests per km^2) were among the most common breeding shorebird species detected during the surveys (Burgess et al. 2003, Johnson et al. 2004, Johnson et al. 2005). Between 2002 and 2004, the five most abundant shorebird species within these same study plots were the pectoral sandpiper, semipalmated sandpiper, long-billed dowitcher, red-necked phalarope, and red phalarope. American golden plover, stilt sandpiper, dunlin, and bar-tailed godwit were also observed (Johnson et al. 2005). Overall shorebird nest density for all study plots in 2004 was 38.3 nests per km^2, with nesting success estimated at 63 percent (64 percent and 60 percent in 2002 and 2003 respectively) (Burgess et al. 2003, Johnson et al. 2004, Johnson et al. 2005).

Four shorebird species nesting in the project study are listed by USFWS as BCC: whimbrel, bar-tailed godwit, dunlin, and buff-breasted sandpiper. Ground-based nest searches conducted in a portion of the project study area between 2001 and 2004 recorded dunlin nests each breeding season at densities ranging from 1.3 to 2.5 nests per km^2 (Burgess et al. 2003, Johnson et al. 2004, Johnson et al. 2005). Bar-tailed godwit nests were recorded in 2001 to 2003 at densities ranging from 0.4 to 1.7 nests per km^2 (Burgess et al. 2003, Johnson et al. 2004). A bar-tailed godwit nest was also observed in 2009 along a study corridor between CD4 and the NASA boundary (Seiser and Johnson 2011). Buff-breasted sandpiper nests were recorded only in 2002 at a density of 2.5 nests per km^2 (Burgess et al. 2003). Whimbrel nests were not observed during nest surveys, but individuals are reported to have been observed as part of various bird surveys in the NPR-A (Johnson et al. 2005).

Habitat selection for shorebirds varies depending on species and life stage. In general, habitats used by shorebirds for breeding, nesting, and brood-rearing differ from those used for pre-migratory staging (Connors and Connors 1982). Many shorebirds nest and rear broods in tundra habitats, then migrate to coastal littoral zone habitats for pre-migratory staging (Connors and Connors 1982). Using results of bird surveys and habitat information, Saalfeld et al. (2013) developed habitat suitability models for several shorebirds that breed on the ACP. In general, the suitability of breeding habitat for most shorebirds increased at lower elevations, suggesting that many shorebirds may favor wet or moist lowland habitats. Results of these habitat suitability models were generally consistent with observations of the regional spatial distributions of breeding shorebird populations (Johnson et al. 2007). For example, most breeding shorebirds on the ACP are observed more frequently near the coast than in the foothills of the Brooks Range (Johnson et al. 2007), and the low elevation wetland habitats are generally preferred by several shorebirds are often located near the coast (Saalfeld et al. 2013).

After breeding, but prior to their southern migration, many shorebirds stage on coastal littoral habitats where they forage and develop fat stores (Connors and Connors 1982). Species such as black-bellied plovers, red phalaropes, rednecked phalaropes, ruddy turnstones, and sanderlings tend to prefer gravel beach habitats, while dunlin and semipalmated sandpipers tend to prefer mudflats (Taylor et al. 2010). Other shorebird species tend to stage on salt marshes or the edges of ponds. Habitat preferences are likely influenced by prey availability, feeding mechanics, and foraging strategies (Connors et al. 1981).

3.3.3.6 Raptors

Raptors are birds of prey that include falcons, hawks, eagles, and owls. Raptors that occur on the ACP, and therefore may be present occasionally or found breeding within the project study area, are discussed in BLM (2012, § 3.3.5.7, pp. 270-275) and BLM (2004, § 3.3.3.5 pp. 252-253), incorporated by reference here.

The gyrfalcon and occasionally the snowy owl are the only raptors known to overwinter in the NPR-A; all other species migrate south to overwinter (Johnson and Herter 1989). Arctic peregrine falcon, gyrfalcon, golden eagle, and rough-legged hawks utilize nesting habitat along the cliffs of the Colville River and other rivers in the Arctic foothills region of the NPR-A where suitable habitat is present (Ritchie et al. 2003). Although, the bluffs along the lower reaches of the Colville River and adjacent wetlands are important raptor nesting habitat, they are well outside of the project study area. The closest documented peregrine falcon nesting activity in 29 years of ground-based surveys is 8.5 miles from the GMT1 project study area boundary and 11 miles from the proposed GMT1 pad (BLM 2012, § 3.3.5.7, p. 270). However, not all suitable nesting habitat for peregrine falcons is covered by the ground or aerial surveys (Ritchie et al. 2003) so there is a possibility that peregrine falcons may nest on the lower reaches of Fish Creek, as has been reported by several residents of Nuiqsut. Although they are sometimes seen in the project study area, the closest documented golden eagle nesting activity in 29 years of ground-based surveys is 175 miles from the GMT1 project study area boundary and 177.5 miles from the proposed GMT1 pad (BLM 2012, § 3.3.5.7, p. 270).

The snowy owl, short-eared owl (a BLM sensitive species), and northern harrier, all ground-nesting species, are widely dispersed and nest irregularly throughout the NPR-A (BLM 2012, § 3.3.5.7, p. 270).

Observations of ground-nesting raptors have been reported during ground-nest searches for large waterbirds. One short-eared owl nest was located in the Alpine search area in 1996, which was the only raptor nest found in six years of nest searches in that area (1996-2001; Johnson et al. 2003b).

3.3.3.7 Other BLM Sensitive Species

The red knot is a medium-sized shorebird that is listed as a BLM Sensitive Species. Their breeding range in Alaska is only generally known. Within the NPR-A the red knot is a rare migrant on both the Chukchi Sea and Bering Sea coasts, but has been recorded breeding in small numbers near Barrow (BLM 2012, § 3.3.8.2, p. 331). Nesting surveys in shorebird ground plots in both the Colville River delta and NPR-A found no evidence of this species in the area (BLM 2004, § 3.3.3.6, p. 256).

The golden eagle occurs in NPR-A as a migratory species and is listed as a BLM Sensitive Species. The northern distribution limit of the breeding range for the golden eagle is the northern foothills of the Brooks Range. However, predominantly subadult golden eagles have been reported in the ACP during spring and summer seasons. There is no area-wide systematic survey of golden eagles that can be linked to the ASDP area and they are considered rare within the ASDP area (BLM 2012, § 3.3.8.2, pp. 334-335). The BLM (2012) and BLM (2004) do not provide population densities or occurrences of golden eagles relevant to the project study area.

3.3.4 Mammals

This section presents information about terrestrial mammals that occur in the project study area. More than ten species of terrestrial mammals are reported to occur in the area, as listed in Table 3.3-12.

The project study area is entirely onshore, with all facilities and pipelines on or located more than 4 miles from the Beaufort Sea Coast line in Harrison Bay (see Map 2.5-1). Essentially all mammals with the potential of impact are terrestrial, with the exception of the polar bear, a marine mammal (discussed in Section 3.3.5). In the unlikely event of a very large oil spill reaching coastal open water, some individual marine mammals could be present in the affected area. A brief discussion of marine mammals is provided in Section 3.3.4.2.

3.3.4.1 Terrestrial Mammals

Terrestrial mammals and their habitats are discussed in BLM (2004, § 3.3.4.1, pp. 259-271; BLM 2008, § 3.3.7.1, and BLM 2012, § 3.3.6, pp. 280-306), incorporated by reference here. A summary of supplemental information for the proposed GMT1 development follows.

Table 3.3-12. Abundant, Common, and Uncommon Mammal Species Known or Suspected to Occur in the Region of the Colville River Delta, Alaska

Common Name	Scientific name	Iñupiaq Name	Abundance
Large Mammals			
caribou	*Rangifer tarandus*	Tuttu	Abundant
grizzly (brown) bear	*Ursus arctos*	Akjaq	Common
moose	*Alces alces*	Tiniikaq/tuttubak/titiniika	Uncommon
muskox	*Ovibos moschatus*	Umifmak/imummak	Common
Arctic fox	*Alopex lagopus*	Tibiganniaq	Common
red fox	*Vulpes vulpes*	Kavviaq/kayuqtuq	Uncommon
wolf	*Canis lupus*	Amabuq	Uncommon
wolverine	*Gulo gulo*	Qavvik/qapvik	Uncommon
Small Mammals			
Arctic ground squirrel	*Spermophilus parryii*	Siksrik	Abundant
barren-ground shrew	*Sorex ugyunak*	Ugrugnaq	Common
brown lemming	*Lemmus trimucronatus*	Aviffaq	Uncommon
collared lemming	*Dicrostonyx groenlandicus*	Qixafmiutauraq	Common
ermine (short-tailed weasel)	*Mustela ermine*	Itibiaq/tibiaq	Common
least weasel	*Mustela nivalis*	Naulayuq	Uncommon
singing vole	*Microtus miurus*	--	Common
tundra shrew	*Sorex tundrensis*	Ugrfnaq	Uncommon
tundra vole	*Microtus oeconomus*	Avieeaq	Uncommon

Source: This table was modified from Table 3.3.4-1 of BLM (2004) and Table 3-19 of BLM (2012).

(--) = no corresponding Iñupiaq word found.

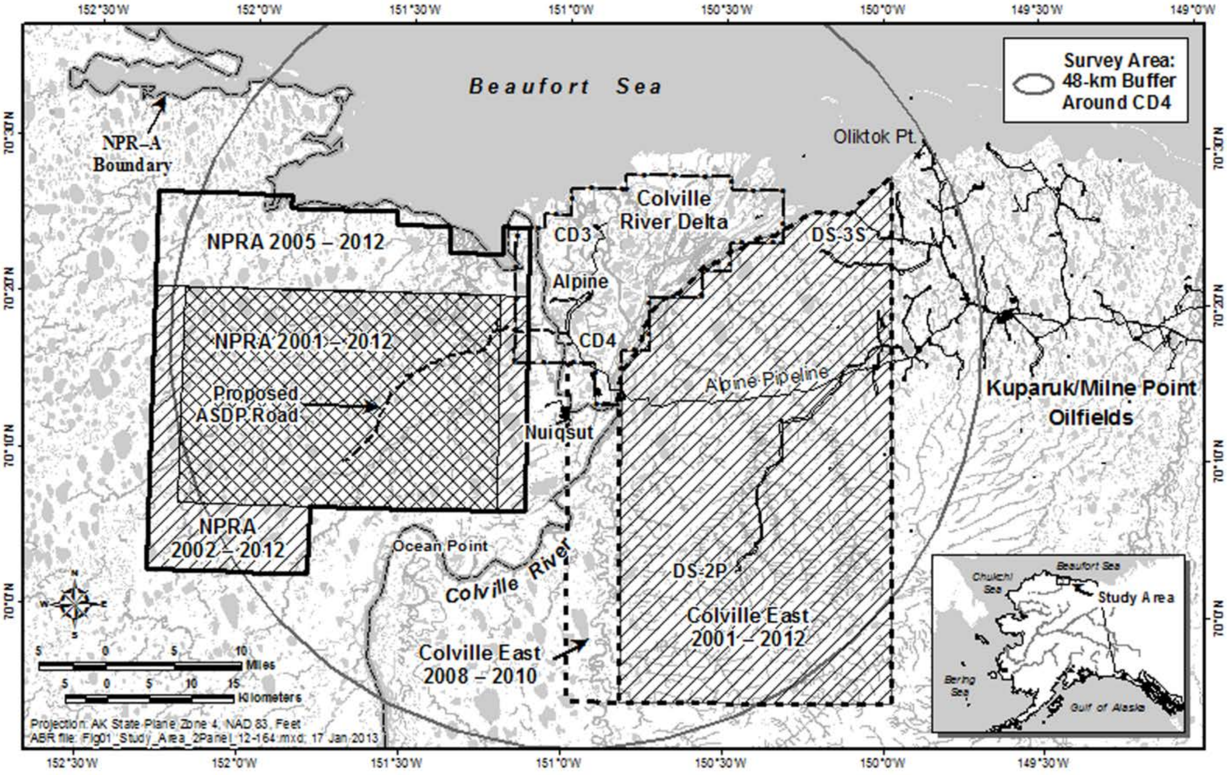
None of the terrestrial mammals reported to occur within the proposed GMT1 development are currently listed under the ESA, or occur on the federal or State of Alaska Endangered Species Act lists. The BLM has identified the Alaska hare (*Lepus othus*) and the Alaska tiny shrew (*Sorex yukonicus*) as sensitive mammal species in Alaska that may occur in the NPR-A. There have been no reports of the Alaska hare on the North Slope since 1951 and no report of the Alaska tiny shrew in the NPR-A (BLM 2012 § 3.3.8.3, pp. 337 and 338). Neither species are known to occur in or near the project area.

Caribou

Caribou biology, population status, seasonal ranges and distribution, migration patterns, calving, and harvest in the NPR-A are described in BLM (2012, § 3.3.6.1, pp. 280-292). The 2013 IAP ROD made unavailable for leasing large tracts of land important for the Teshekpuk Herd (TH) and the Western Arctic Herd (WAH), both of which have great importance for subsistence use. Localized information on the ASDP is included in BLM (2004, § 3.3.4.1, pp. 260-266). These documents are incorporated by reference. Additionally, caribou research is reported for the project study area by CPAI and ADF&G. A discussion of the information in these documents and references are summarized below.

In its approval for construction of CD4 (the first ASDP development), the NSB included the permit stipulation that a ten-year study of impacts on caribou distribution and movements be conducted within a 30-mile radius of CD4 and is referred to as the ASDP caribou monitoring study area (Figure 3.3-8). Details of the stipulation were later adjusted to account for additional development in the ASDP area and, at the request of Nuiqsut residents, wording regarding the 30-mile radius was dropped (Lawhead et al. 2013). Since 2004, CPAI has continued a caribou monitoring study associated with development of the Alpine satellites, including GMT1. As part of this ongoing monitoring program, caribou calving and post-calving distribution between the Colville and Kuparuk Rivers has been surveyed annually between 1993 and 1995-2013.

The ASDP caribou monitoring study combines results from aerial surveys of caribou locations, radio, and satellite telemetry of caribou locations. As of 2013, the study is in its ninth consecutive year (with results presented for eight years). The study area encompasses the CD3, CD5, GMT1 and GMT2 development areas, as well as the original Alpine Project infrastructure. Data collected under the CD4 permit stipulation builds on previously collected research on caribou that began in the early 1980s (Lawhead et al. 2013). Within the 30-mile radius three aerial survey areas were established: NPR-A, Colville River delta, and Colville East (Figure 3.3-1). The southeastern portion of the NPR-A survey area contains most of the proposed elements of the ASDP, including the proposed pipeline and road corridor to GMT1 (Lawhead et al. 2013). This portion of the survey area was selected for detailed analysis of potential impacts to caribou from the proposed GMT1 development.



Source: Lawhead, et al. 2013, Figure 1

Note: Proposed ASDP road shown in the ASDP study area is the road to GMT2 (formerly CD7), as planned in 2004. It extends approximately 6 miles beyond the currently proposed GMT1 pad.

Figure 3.3-1. Location of the ASDP Caribou Monitoring Study Area (2001-2012)

Caribou is an important species in the project study area and across the North Slope because it is harvested for subsistence by all North Slope communities. Four caribou herds populate Alaska's North Slope: TH, Central Arctic Herd (CAH), WAH, and Porcupine Caribou Herd (PCH). The TH and the CAH are the primary herds in the project study area. Information on these herds is discussed in BLM (2012, § 3.3.6.1, pp. 282-287 relevant to the TH; and pp. 291-

292 relevant to the CAH; BLM 2004, § 3.3.4.1, pp. 260-266). Historical and current data indicate that the TH generally ranges to the west of the Colville River delta and the CAH ranges to the east of the project study area (Lawhead et al. 2013). The ASDP area is used as both winter and summer range by the TH and as summer range for the CAH. Seasonal ranges of the TH and the CAH were depicted by BLM (2004, Figure 3.3.4.1-1) and were updated in BLM (2012, Maps 3.3.6-2 and 3.3.6.3). The ASDP area and proposed GMT1 road are located at the interface between the annual ranges of the TH and the CAH (Lawhead et al. 2013). The ASDP area and proposed GMT1 road are in the peripheral range, if not further, for the PCH and WAH and these herds are therefore not discussed further in this document (BLM and MMS 2003; Lawhead et al. 2013) (Maps 3.3-12 and 3.3-13).

Arctic caribou distribution and movements are influenced heavily by annual events: calving, mosquito harassment, oestrid fly harassment, and migration to and from wintering grounds. Caribou distribution, habitat preferences, and movement rates differ for each event. Examples include preference for newly emerged high-quality vegetation in calving areas, movements to coastal areas during mosquito harassment, and use of riverine habitats and barren unvegetated areas in response to oestrid-fly harassment.

Habitat Use

Caribou utilize various habitat types throughout their range dependent upon their annual life cycle (Table 3.3-13). During winter and early spring, the caribou diet is dominated by lichens, which are present throughout their winter range. In spring and early summer, caribou begin to migrate north as vascular plants become available. The timing is dependent upon annual snowmelt and temperatures. Spring migration to traditional calving grounds provides highly nutritional forage to lactating females (during calving and nursing periods). The availability of high quality and high quantity desired forage species (apparently influenced by temperature and snow cover) probably affects specific calving locations and calving success (BLM 2012, § 3.3.6.1, p. 283). Caribou groups in the NPR-A survey area generally showed selection for areas with high vegetative biomass, although there was seasonal and annual variation (Lawhead et al. 2013). During insect relief season from late June to early August, caribou display a preference for streamside sand bars, sand dunes, and coastal plains in response to mosquito and oestrid fly harassment.

Patterns of selection varied through summer, but caribou consistently avoided patches of flooded vegetation and selected areas with a high density of sedge-grass meadow. When insect harassment was low, caribou primarily selected the areas around Teshekpuk Lake but when it was high, caribou used areas where insect abundance was lower such as coastal margins and gravel bars (Wilson et al. 2012). For the years 2002-2012 combined, caribou in the NPR-A survey area used flooded tundra significantly less than expected (based on availability) during calving, postcalving, and fall, whereas riverine habitats were used more than expected (based on availability) from postcalving through late summer, possibly for forage availability and oestrid-fly relief (Lawhead et al. 2013).

Table 3.3-13. Caribou Forage Habitats within the GMT1 Project Study Area

Caribou Life Cycle Stage	Habitat Type
Summer Forage/Calving Habitat	Moist Tussock Tundra
	Moist Sedge-Shrub Meadow
Caribou Insect Relief Habitat	Riverine
	Barrens
Caribou Winter Forage Habitat	Lichen-Bearing Habitats

Source: BLM 2012 and Lawhead et al. 2013

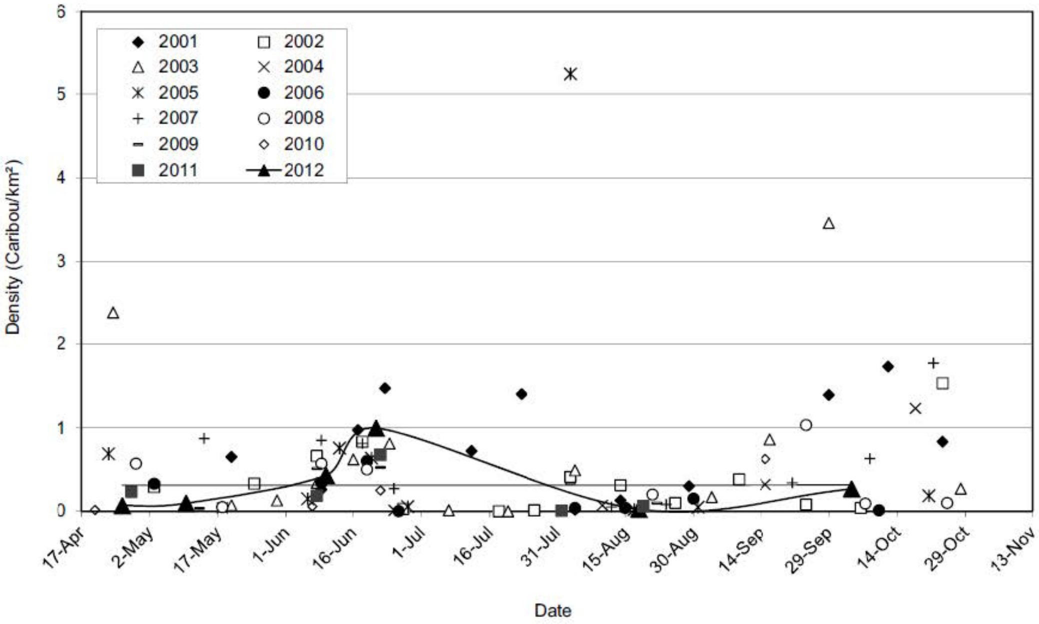
Caribou Densities and Distribution

Caribou densities in the NPR-A survey area in the years 2001 through 2012 were low in the spring, moderately high during calving, high in late June, and low in August (Figure 3.3-2). In October, densities were moderate. However, the TH size appears to be in decline due to a combination of low and declining calf production, poor calf survival (<30 percent) and high adult mortality rates (Parrett et al. 2014). The underlying mechanisms are not totally clear but are likely related to poor summer and winter nutrition and difficult winters, high levels of predation of calves in winter, and nutritionally mediated risk of predation (Parrett et al. 2014). Research conducted by CPAI during 2001 through 2011 indicate that the project study area, which is used mainly by TH caribou, is not a high density calving area, in contrast to the Colville East survey area, which is used mainly by CAH caribou (Lawhead et al. 2013). The project study area is on the eastern edge of the TH range, and a west-to-east gradient of decreasing density throughout the year. Caribou density is lowest in the southeastern section of the NPR-A Survey Area (compared to other survey areas within the 30-mile radius), where the project study area is located (Lawhead et al. 2013).

The TH typically calves in the northeastern portion of the NPR-A near Teshekpuk Lake. Predicted use by parturient females during calving was almost entirely restricted to the area surrounding Teshekpuk Lake, where there is a concentration of sedge-grass meadow habitat (Wilson et al. 2012). In the 2001-2012 study period, the estimated density of caribou in the NPR-A survey area ranged from a high of 0.99 caribou per km^2 on 21 June to a low of 0.02 caribou per km^2 on 18 August (Lawhead et al. 2013). The density of caribou during calving (0.43 caribou per km^2 on 10-11 June) was in the middle of the range of densities observed during 2001-2011 (0.06 – 0.87 caribou per km^2 for 6-9 June) (Lawhead et al. 2013). Although some calving occurs in the western half of the ASDP area, where the project study area is located, it is not a concentrated calving area for the TH (Lawhead et al. 2013) (Map 3.3-13).

The project study area is utilized by the TH in winter, but there is variation in the amount of utilization from year to year (BLM 1998a; Lawhead et al. 2013). During most years, TH winter on the ACP, including the project study area, and high densities have been recorded occasionally in the NPR-A survey area during late winter (2.4 caribou per km^2 in April 2003) (Lawhead et al. 2013).

Survey results from 2003 to 2012 have reported several herds exhibiting shifts from typical seasonal use areas, such as the TH which has shown increased movements to the east (2003-2004) and southeast (2004-2005) during winter (Lawhead et al. 2013). Since 2012, the TH herd has consistently utilized a larger area of land (further west) for calving grounds than previously observed (Lawhead et al. 2013).



Source: Lawhead et al. 2013, Figure 6

Figure 3.3-2. Caribou Density Observed on 100 Surveys of the NPR-A Survey Area

Caribou use of and distribution throughout the project study area have been studied by CPAI and ADF&G through aerial surveys, GPS tracking, and satellite tracking since the 1980s. Map 3.3-8 presents the distribution and size of caribou groups within the project study area during the monitoring period of April-October 2012. Presence and movement of satellite and GPS collared caribou are presented in Maps 3.3-8 and 3.3-9. In recent years, large portions of the TH have calved further west between Atqasuk and the Ikpikpuk River (Lawhead et al. 2013; Parrett 2011). Selection of calving grounds appears to be correlated with annual snowmelt and availability of vegetation (BLM 2012, §3.3.6.1, p. 283). TH caribou use the project study area throughout the year, although usually at low densities. From the onset of the caribou monitoring study in NPR-A in 2001, the highest densities of caribou in the NPR-A survey area typically have occurred during the mosquito and oestrid fly harassment periods in mid to late summer, and from mid-September through late October during fall migrations (Lawhead et al. 2013). Riverine habitat along Fish Creek and Judy Creek, include sand dunes, barrens, and sparsely vegetated areas, provide habitat for relief from oestrid-fly harassment (Lawhead et al. 2013).

While the TH utilizes much of the area around Teshekpuk Lake in the summer during calving, the herd will also utilize habitats in the ASDP area, such as the Colville River delta, sand dunes, and ridges (BLM 2004, § 3.3.4.1, p. 261; BLM 1998a; Wilson et al. 2012).

The majority of the CAH remains to the east of the Colville River (BLM 2004, §3.3.4.1, pp. 262). Aerial surveys conducted in July 2001 documented approximately 6,000 CAH caribou moving west across the Colville River delta into the NPR-A in the summer, however this was reported as a rare event and CAH movements into the NPR-A are uncommon (Lawhead et al. 2013). The ASDP area contains areas of high-density utilization by the CAH (east of the Colville River delta) and low-density calving areas for the TH. In recent years, however, range use by both herds has changed somewhat. CAH caribou have shown a tendency to move farther east into the Arctic National Wildlife Refuge and even crossing the Canadian border during the insect harassment season than in former years (Lawhead et al. 2013).

In documenting the 2001-2012 surveys, Lawhead et al. (2013) reported:

> *"There was little evidence for selection or avoidance of specific distance zones within 6 km of the proposed ASDP road alignment. Fewer groups than expected (assuming a uniform distribution for statistical testing) occurred around the corridor during the oestrid-fly season, probably due to increased use of riparian habitats along Fish and Judy Creeks by fly-harassed caribou. Although radio-collared TH caribou have crossed the proposed ASDP road alignment in the NPR-A occasionally (primarily during fall migration), the data collected thus far indicate that the proposed road and pipeline corridor is in an area of low-density use by caribou."*

In general, within the NPR-A study area, more caribou are likely to occur in the western portion than the southeastern section where ASDP infrastructure exists and more is proposed. ABR states that:

> *"Whatever the reason(s), it is important to recognize that this pattern of distribution exists before construction of the proposed ASDP pipeline/road corridor."* (Lawhead et al. 2013)

Muskoxen

The history, sightings in the project study area, and habitat preferences of muskoxen are included in BLM (2012, § 3.3.6.2, pp. 293-294) and BLM (2004, § 3.3.4-1, pp. 266-267), incorporated by reference here. Muskoxen historically occurred throughout northern Alaska, but no longer occupy what is now the NPR-A. Their population was re-established by translocation to Barter Island and the Kavik River in 1969 and 1970. As their numbers on the ACP increased, their range continued a westward expansion to the Colville River and an eastward expansion to Babbage River. Small numbers of muskoxen have occasionally been observed west of the Colville River; however, they are not considered to be abundant in the project study area. Muskoxen have been noted in the Colville River delta area since 1993. In 2012, one group was reported moving west into the NPR-A. In previous years (2005, 2006, and 2007) a group of muskoxen was observed near the Kalikpik River and west of the Fish Creek delta (Lawhead et al. 2013). While their population numbers are reported as stable or in slight decline (Arthur and Del Vecchio 2013), the population could expand into the project study area.

Moose

A discussion of moose occurrence on the ACP, as well as in the project study area, is included in BLM (2004, § 3.3.4.1, p. 267) and BLM (2012, § 3.3.6.3, pp. 295-296). A summary of this information and limited site-specific information follows.

Moose occur at low densities on the ACP, which is at the northern limit of their range in Alaska (BLM 2004, § 3.3.4.1, p. 267). Moose are widely distributed during the summer, ranging from the northern foothills of the Brooks Range to the Arctic Coast. As snow accumulates during fall, moose move to riparian corridors of large river systems, where they concentrate in winter. The largest winter concentrations of moose occur in the inland portions of the Colville River drainage (BLM 2004, § 3.3.4.1, p. 267).

As noted in BLM (2004, § 3.3.4.1, p. 267), in eight years of observations by the Helmericks family (at Colville Village 1992-1998 and 2001), only five moose were seen. To the southwest, moose have been noted sporadically in the general project study area near Fish Creek (Lawhead et al. 2009).

Grizzly Bear

There are relatively low densities of grizzly bears (0.5 to 2.0 bears per 1,000 km^2) on the ACP, as compared to densities of grizzly bears in the mountains and foothills of the Brooks Range. A discussion on the factors that influence grizzly bear presence throughout the NPR-A is discussed in BLM (2012, § 3.3.6.5; and 2004, § 3.3.4.1).

Studies carried out between 1999 and 2004 found 25 marked grizzly bears and their dens in the Colville River delta, the Fish Creek and Judy Creek delta, and other riparian areas in and near the project study area (BLM 2004, § 3.3.4.1, Figures 3.3.4.1-10 and 3.3.4.1-11). Although incidental observations of grizzly bears and their dens during surveys for caribou and fox dens showed more bears east of the Colville River than west, in general, the project study area and adjacent areas of the NPR-A are considered to be better grizzly bear habitat, with proportionally more well-drained potential denning habitat and ground squirrel habitat than areas of the coastal plain east of the Colville River (BLM 2004; Shideler 2004, personal communication).

Fox

Arctic fox is the most common furbearer in the Colville River delta and adjacent coastal plain. A discussion on their population status, diet, habitat and denning is presented in BLM (2004, § 3.3.4.1) and BLM (2012, § 3.3.6.6). Populations of fox fluctuate with the availability of prey species (e.g., lemmings and voles). They prefer well-drained soils (e.g., riparian or upland shrub habitat), including banks of lakes, streams, drained lake basins, and pingos. During fox den surveys conducted in 2001-2004 (BLM 2004, Figure 3.3.4.1-12; Johnson et al. 2005), Arctic fox were routinely reported to be observed in the project study area. Red fox are also found in the project study area, but according to local knowledge, the number of red fox has increased recently, corresponding with the warmer winters (BLM 2012, § 3.3.6.6). Red fox utilize denning habitat similar to the Arctic fox. The red fox is aggressive towards Arctic foxes, and will displace them from feeding areas and den sites (Johnson et al. 2005).

Wolf

Wolves may occur in the project study area, but are uncommon (Lawhead et al. 2013; Johnson et al. 2005; BLM 2012, § 3.3.6.6). Wolf distribution and abundance data for the project study area is not available. The discussion below is provided to summarize general information about wolves in the area.

In general, wolves are more abundant in the Brooks Range than on the ACP. This could be because of better prey availability and denning habitat in the Brooks Range, and rabies outbreaks and hunting pressure on the coastal plain (BLM 2004, § 3.3.4.1, p. 268). In 1993, the population estimate for all of Game Management Unit 26A, which is all of the North Slope west of the Itkillik River watershed, was 240 to 390 wolves in 32 to 53 packs (BLM 2012, § 3.3.6, p. 300). The highest wolf densities in the NPR-A are reported along the Colville River. Surveys near Umiat showed that the density of wolves increased from 2.6 wolves per 1,000 km^2 in 1987 to 4.1 wolves per 1,000 km^2 in 1994 (Bente 1998 in BLM 2004, § 3.3.4.1, p. 268).

Wolverine

Wolverines may occur in the project study area, but are uncommon (Lawhead et al. 2013, Johnson et al. 2005, BLM 2012, § 3.3.6.6). BLM (2004, § 3.3.4.1, p. 269) provides a discussion of the rare accounts of wolverines in the ASDP area.

Wolverines occur throughout the ACP but are more common in the mountains and foothills of the Brooks Range (Bee and Hall 1956; BLM 1998a). In 1984, Magoun estimated a fall population size of 821 wolverines for game management unit 26A (includes the NPR-A), based on a density 1 wolverine per 54 square miles (BLM 2004, § 3.3.4.1, p. 269). Wolverines require large territories and utilize a broad range of habitats, frequently occurring in tussock meadow, riparian willow, and alpine tundra habitats (BLM 1998b).

Small Mammals

Small terrestrial mammals such as those listed in Table 3.3-12 are important prey for predatory birds and mammals in the region. Arctic ground squirrels hibernate during winter, while lemmings, voles, and shrews are active throughout the year. Many small mammal species have cyclical population fluctuations. Arctic ground squirrels, lemmings, voles, and shrews are ground-dwelling and utilize a variety of habitat types for burrowing and dens (BLM 2004, § 3.3.4.1) and BLM (2012, § 3.3.6).

Distribution and abundance data for small mammals in the project study area are not available, but all species mentioned listed in Table 3.3-12 are likely to be present.

3.3.4.2 Marine Mammals

Marine mammals are described in BLM (2012, § 3.3.7) and BLM (2004, § 3.3.4.2), incorporated by reference here. Marine mammals with a status listed under the ESA, are discussed in Section 3.3.5. Marine mammals (common name, scientific name, and Iñupiaq name) addressed in this section are listed in Table 3.3-14. Bearded seals are not expected to occur in the project area, but because of the recent (2014) federal court decision to vacate the listing as threatened it is included in the discussion below (U.S. District Court for the District of Alaska 2014).

Table 3.3-14. Marine Mammals that are Reported to Occur along the Coast of Harrison Bay, in the Colville River delta, or in the Beaufort Sea Offshore North of the Project Study Area (not threatened, endangered, or candidate species)

Common Name	Scientific Name	Iñupiaq Name [a]
spotted seal	*Phoca largha pallas*	qasigiaq
beluga whale	*Delphinapterus leucas*	sisuaq
gray whale	*Eschrichtius robustus*	abvibluaq
ribbon seal	*Phoca fasciata or Histriophoca fasciata* [b]	qaigullik
minke whale	*Balaenoptera acutorostrata*	--
narwhal	*Monodon monoceros*	--
harbor porpoise	*Phocoena phocoena*	--
killer whale	*Orcinus orca*	aabluq
bearded seal	*Erignathus barbatus*	ugruk

[a] Source of Iñupiaq: http://www.alaskool.org/language/dictionaries/Inupiaq/dictionary.htm (Webster and Zibell 1970)

[b] Phoca fasciata are also referred to as Histriophoca fasciata due to a taxonomic debate about how closely ribbon seals are related to harbor, spotted, and ringed seals. (ADF&G [2008] website at http://www.adfg.alaska.gov/static/education/wns/ribbon_seal.pdf, accessed September 2014)

(--) = no corresponding Iñupiaq word found

Polar Bear

Polar bears occur in the NPR-A in terrestrial and marine habitats, but they are considered marine mammals (regulated under the Marine Mammal Protection Act) and have been listed as a threatened species under the ESA (USFWS 2009a). Polar bears are described in Section 3.3.5.

Spotted Seal

The spotted seal, may be seasonally present along the coast of Harrison Bay and in the Colville River delta (BLM 2012, § 3.3.7.1). Spotted seals are generally distributed along the continental shelf, where their seasonal habitats include pack ice and land-based haul outs. When sea ice melts during the summer and suitable ice floes are not available, spotted seals may be found closer to shore, using isolated land-based haul outs such as mud, sand bars, gravel beaches, or barrier islands close to shore (BLM 2012, § 3.3.7.1; Boveng et al. 2009). There is documentation of spotted seals regularly occurring (during summer and fall) in the Colville River, as far upstream as Ocean Point (BLM 2004, Figure 3.3.4.2-1).

Historically, as many as 400 spotted seal individuals were estimated to utilize the Colville River, but this number fell to 150-200 in the 1970s (post establishment of Nuiqsut), and more recently in 1996 and 1998, Johnson and PAI observed up to 24 individuals on haulouts in the main channel of the Colville River (BLM 2004, § 3.3.4.2). A reliable stock assessment for spotted seal in Alaska is not available, but the most recent estimates (1993, 2009, and 2010) ranges in size from 59,214 to 100,000 individuals (BLM 2012, § 3.3.7.1, pp. 308).

Beluga Whale

The Beaufort Sea stock of beluga whale may be seasonally present along the coast of Harrison Bay in rare occasions. Available evidence suggests that beluga whales show a preference for deeper waters (600 feet to 6,500 feet depth) during spring and fall migrations to and from summer grounds in the north and eastern Beaufort Sea (BLM 2008, § 3.3.7.2, pp. 3-77). However, belugas do occasionally occur in coastal shallow water (brackish and marine) for periods of molting, thermal benefits for calves, or in pursuit of prey items (BLM 2012, §3.3.7.3, p. 313). Northeast of the project study area, off the coast of and within the Colville River delta, reports of beluga whales have been made by the Helmericks family, a survey conducted by Seaman et al. (1981), and several hunters from the NVN (BLM 2008, § 3.3.7.2, pp. 3-78).

These rare instances of belugas involve only a small proportion of the remaining population which migrates far off-shore along the shelf break in the Beaufort Sea (BLM 2004, § 3.3.4.2, p. 276). The last population estimate of the Beaufort Sea beluga stock (39,358 individuals) is considered an artificially low estimate by the National Marine Fisheries Service (BLM 2012, §3.3.7.3, p. 313). A reliable and widely-accepted stock assessment is not available at this time.

Beringia DPS Bearded Seal

Although bearded seals may be present throughout the year in the Beaufort Sea, the population in Alaskan waters is largely migratory, with most individuals overwintering in the Bering Sea (Allen and Angliss 2013). Their most important habitat during winter and spring is active ice or offshore leads. Farther north, they are restricted to areas in the pack ice where conditions create persistent openings such as leads, polynyas (areas of open water in the pack ice), and flaw zones. These conditions become progressively more limited north of the Bering Strait, especially in the Beaufort Sea (Burns 1967; Burns and Frost 1979; Kelly 1988), hence fewer bearded seals will overwinter in the Chukchi and Beaufort Seas where conditions are less favorable. As the ice recedes in the spring, bearded seals migrate through the Bering Strait (mid-April to June) and summer either along the margin of the multi-year ice in the Chukchi Sea or in nearshore areas of the central and western Beaufort Sea (Kelly 1988).

Bearded seals are not expected to occur within the project study area.

Other Marine Mammals

Other marine mammals that occasionally occur in the Beaufort Sea include ribbon seal, gray whale, minke whale, narwhal, harbor porpoise, and killer whale. The coastline of Harrison Bay, north of the project study area, is either too shallow or well outside the range limits of these mammals. They are not expected to occur.

3.3.5 Threatened and Endangered Species

Five species listed as endangered or threatened under the Endangered Species Act (ESA) are reported to occur or have the potential to occur in the project study area or in marine waters of Harrison Bay north of the project study area (listed in Table 3.3-15): spectacled eider; Steller's eider; polar bear; bowhead whale; and ringed seal. In addition, the yellow-billed loon was an ESA candidate species, with a range that included the project study area when this SEIS process was begun; however, on October 1, 2014, the USFWS made the decision that listing the yellow-billed loon under the ESA was not warranted (Federal Register, Vol. 79, No 190, p. 59195). The loon no longer has status under the ESA, but the species is still recognized as a special status species by the BLM and as a species of conservation concern by the USFWS and will be discussed in this section. Threatened and Endangered species are discussed in BLM (2004, §§ 3.3.3.3, 3.3.4.2, and 3.3.5) and BLM (2012, §§ 3.3.7 and 3.3.8), incorporated by reference here.

The listing of the bearded seal as threatened (December 2012) was vacated in federal court on July 25, 2014 (U.S. District Court for the District of Alaska 2014). The decision cited the NMFS failed to demonstrate that any near-term threats to the Beringia population exist. The bearded seal is discussed in Section 3.3.4.2, *Marine Mammals*.

The Pacific walrus (scientific name: *Odobenus rosmarus divergens;* Iñupiaq name: `aiviq`) is the only subspecies of walrus occurring in Alaskan waters and is an ESA candidate species that is considered extralimital in the Southern Beaufort Sea (*Marine Mammals; Incidental Take During Specified Activities: Final Rule*, 76 FR 47010-47054, August 3, 2011, p. 47040). Accordingly, due to the extremely low potential for pacific walrus to be near the project study area, they are not considered further in this analysis.

Bowhead whale and ringed seal may be found near shore in Harrison Bay. All project facilities and the project study area are entirely inland, with no facilities, pipelines, or activities related to the project occurring on or immediately adjacent to the marine coastal zone.

In the 2011 Programmatic BO for Polar Bears, Polar Bear Habitat, and Conference Opinion for the Pacific Walrus on Beaufort Sea Incidental Take Regulations, the USFWS notes that the probability of a large spill to marine waters is considered to be *"very unlikely to occur and cannot be said to be reasonably expected to occur"* (USFWS 2011a, p. 31). The action area covered by the proposed regulations includes the GMT1 Project (USFWS 2011a, pp. 14-15, 17).

The 2012 NMFS ESA Section 7 informal consultation for the Point Thomson Project states:

> *"historically, spills from offshore or coastal oil and gas facilities or barges in the Chukchi and Beaufort seas have involved only small amounts (less than 100 gal [2.4 bbl.]) of oil. The probability of a large or very large spill is very low (approaching zero); therefore we conclude that the effects from a large to very large oil spill associated with the proposed drilling and production operations are discountable and thus not likely to adversely affect bowhead whales, bearded seals, ringed seals, their prey, and/or their habitats…"* (NMFS 2012, p. 20)

As a result, the risk of impact to bowhead whales and ringed seals is very small, but due to their protected status, these species are included in this SEIS.

The six sensitive or ESA-listed species described in this section are listed in Table 3.3-15. The following sections describe the general ecology, including occurrence or likelihood of occurrence in the proposed project study area of those species. Additional information is provided in BLM (2004, §§ 3.3.3.3, 3.3.4.2, and 3.3.5; BLM 2012, §§ 3.3.7 and 3.3.8), incorporated by reference here.

Table 3.3-15. Threatened, Endangered, or Candidate Species Documented or Potentially Occurring in or Near the Project Study Area

Common Name	Scientific Name	Iñupiaq Name	Likely to Occur in Project Study Area	Conservation Status	Potential for Impacts [b]
spectacled eider	*Somateria fischeri*	qavaasuk	Yes	Threatened	H, P
Steller's eider	*Polysticta stelleri*	igniqauqtuq	No	Threatened	U
yellow-billed loon	*Gavia adamsii*	tuutlik	Yes	Finding that the listing of the yellow-billed loon under the ESA is not warranted.	H, P
polar bear [a]	*Ursus maritimus*	nanuq	Yes	Threatened	H, P
bowhead whale	*Balaena mysticetus*	abviq	No	Endangered	U
ringed seal (Arctic subspecies)	*Phoca hispida hispida*	qaibulik	No	Threatened	U

[a] ESA status refers only to the Beaufort Sea populations of the species.

[b] H = potential impacts on habitat; P = physical or noise disturbance/deterrent effect; U = unlikely to cause an effect

[c] On October 1, 2014 the USFWS announced a finding that the listing of the yellow-billed loon was not warranted under the ESA. The yellow-billed loon has no status under the ESA although it remains a USFWS Bird of Conservation Concern and a BLM Sensitive Species (Table 3.3-4).

3.3.5.1 Spectacled Eider

The spectacled eider was listed as a threatened species under the ESA in May 1993. The listing was prompted by declines in the western Alaska breeding population and indications of a decline on the North Slope of Alaska. There is no critical habitat designated for spectacled eiders on the North Slope; all designated critical habitat is in western Alaska and in nearshore and offshore areas in Norton Sound, Ledyard Bay and the Bering Sea between St. Lawrence and St. Matthew Islands (66 FR 9146 9185). The status of the North Slope spectacled eider population prior to the start of the ACP aerial survey in 1992 is unknown. An estimate of 3,000 pairs (6,000 birds) was made for the pre-1993 ACP population based on data from limited migration and ground studies (Dau and Kistchinski 1977). Since 1992, aerial surveys for many waterbirds, including spectacled eider, have been conducted across the ACP each year. Aerial surveys have been conducted within the ABR's avian study series in the CDSA for 19 years (1993-1998, 2000-2012) and in the northeastern NASA for 13 years (1999-2006 and 2008-2012.

The following summary provides data collected throughout the ACP, and limited site-specific data available for on-shore densities, population growth rates, and site-specific habitat selection, and nesting locations, for spectacled eiders in the project study area. This discussion is supplemental to information provided in BLM (2012, § 3.3.5.5) and BLM (2004, § 3.3.3.2), which are incorporated by reference.

The estimated population (total index) for spectacled eider on the ACP for the period 1992 through 2012 is 7,158 birds with a slightly negative average annual population growth rates in both the long-term (0.990 for 1986 to 2012) and short-term (0.976 for 2003 to 2012) (Stehn et al. 2013). The confidence interval around both of these growth rates includes positive values and as such, they do not indicate a significant decline. Spatial distribution of eiders during the 2007 – 2010 survey period was similar to the previous four-year period and to the distribution when all data are combined (1993 to 2010); showing the highest concentrations of birds occurring within approximately 40 miles of the coast between Barrow and Wainwright, and north and northeast of Teshekpuk Lake (BLM 2012, Map 3.3.8-1).

Estimated density indices of spectacled eider across the ACP are presented in BLM (2012, Volume 7, Figure 3.3.8-1). Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0 – 0.034 to 0.147 – 0.225 birds per km^2, encompassing the lower three density contours present on the ACP (Table 3.3-16). The project study area contained a very small area in which the contour interval of 0.226 – 0.409 birds per km^2 were present (less than 1 percent of the project study area) and did not contain any area in which the highest density contour (0.410 – 1.409 birds per km^2) were found (Table 3.3-16). Most of the project study area (67 percent) is contained within the lowest density band; and none of the project study area lies within the highest density contour, suggesting that spectacled eiders are not found in high densities within the project study area.

Table 3.3-16. Estimated Density Contours for Spectacled Eiders on the ACP (1993-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.034	77,787	67%
0.035 – 0.146	24,227	21%
0.147 – 0.225	13,978	12%
0.226 – 0.409	456	--
0.410 – 1.409	--	--

Source: USFWS 2010b, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

The overall population growth trends for spectacled eiders found within the CDSA and the NASA are slightly positive at 1.003 and 1.020 respectively (Johnson et al. 2013). Within the CDSA, the estimated density for pre-nesting spectacled eiders over a 19-year study period (1993-1998, 2000-2012) is 0.10 birds per km^2 (Johnson et al. 2013). Surveys conducted in 2012 indicate a total of five birds in the CD South Subarea, corresponding to 0.01 birds per km^2 Johnson et al. 2012). Surveys conducted in 2012 indicate a density of spectacled eiders in the CD North Subarea (49 birds, 0.24 birds per km^2) was twice that in the entire CDSA (59 birds.

0.12 birds per km^2), including 5 birds found outside the project study area (Johnson et al. 2012). The density of spectacled eiders in the NASA has been consistently low (0.03 birds per km^2), averaging only 38 percent of the density found in the CDSA. During 2012 pre-nesting surveys, spectacled eiders were found only in the Fish Creek Delta Subarea of the NASA (which is outside of the project study area) and traditionally the greatest numbers of pre-nesting spectacled eiders have been concentrated in the CD North Subarea, also outside of the project study area (Johnson et al. 2013).

Habitat preference for pre-nesting spectacled eiders was evaluated using 19 years (1993-1998 and 2000-2012) of aerial survey data in the CDSA, and 11 years (2001-2006 and 2008-2012) of aerial survey data in the NASA. Pre-nesting spectacled eiders in the CDSA utilized 17 of 24 available habitats, preferring seven (Johnson et al. 2013). Of the seven preferred habitats, (brackish water, salt marsh, salt killed tundra, deep open water with islands or polygonized margins, shallow open water with islands or polygonized margins, grass marsh, and deep polygon complex), all are present in the project study area. Of these habitats, four (salt marsh, deep open water with islands or polygonized margins, shallow open water with islands or polygonized margins, and grass marsh) occur within the impact zone of proposed infrastructure for action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). In the NASA, spectacled eiders utilized 12 of the 26 available habitats, preferring four (Johnson et al. 2013). All of the four preferred habitats (brackish water, shallow open water with islands or polygonized margins, grass marsh and shallow open water without islands) occur within the project study area. Of these habitats, three (grass marsh, shallow open water with islands or polygonized margins and shallow open water without islands) occur within the impact zone of proposed infrastructure for action alternatives (discussed in Chapter 4). Due to the low numbers of spectacled eiders found in the NASA there is low power in the selection analysis thus it is expected that additional habitats will become preferred as more detections of spectacled eiders are added to the selection analysis.

In 2009, pre-nesting aerial surveys and ground-based nest searches for eiders were performed around three of the proposed Alpine satellite drill sites: CD5, GMT1 (formerly CD6), and Fiord West (Seiser and Johnson 2011). Aerial surveys were conducted as part of a broader study of bird species within the CDSA and the NASA (Johnson et al. 2010), but the ground-based work was designed specifically to support the permitting process for these three proposed Alpine satellite drill sites. Nest search areas included proposed pads, proposed road routes, and their alternatives for each of the selected search locations. The majority of the area where the ground-based work took place in 2009 lies within the project study area, except the roads and facilities north of where the road to Fiord West forks (see Figure 1 of Seiser and Johnson 2011).

The 2009 pre-nesting aerial survey detected one pair of spectacled eiders within the GMT1 project study area, occupying patterned wet meadow habitat along the road alignment between CD5 and CD4 on the west side of the Colville River.

During the 2009 nest survey, no spectacled eider nests were found within the bounds of the project study area, a single nest was found in nonpatterned wet meadow habitat in the Fiord West survey area that lies outside of the project study area (Seiser and Johnson 2011). Six spectacled eider nests have been found on nest searches in the NASA in previous years (Seiser and Johnson 2011).

3.3.5.2 Steller's Eider

The Alaska breeding population of Steller’s eider was listed as threatened under the ESA in June 1997. There is no critical habitat designated on the North Slope for Steller’s eiders; designated critical habitat is located in western Alaska and along the Alaska Peninsula.

The size of the Steller’s eider Alaska breeding population is highly variable and is densest near Barrow, extending in very small numbers, southwest to Point Lay and east to Nuiqsut (BLM 2012, Vol. 7, Figure 3.3.8-2). Historically, Steller’s eider have utilized both the ACP and the western coast of Alaska as breeding grounds. The Barrow vicinity supports the largest known concentration of nesting Steller’s eiders in Alaska (BLM 2012, Vol. 1, § 3.3.8.2, p. 322). There are only two records of Steller’s eider breeding east of Barrow in the last three decades (on the Colville River delta in 1987 and in Prudhoe Bay in 1994; USFWS 1997).

The average annual population growth rate (total bird index) from 1989 to 2012 for Steller’s eider was 0.946, indicating negative population growth for this species across the ACP (Stehn et al. 2013). Due to the very small numbers of birds detected on these aerial surveys Stehn et al. (2013) importantly notes that although showing a decline, the trend was very imprecisely estimated and that these data do not support a definitive conclusion on population trend. The population size of Steller’s eiders on the ACP is approximately 680 birds (Stehn et al. 2013). Since 1992, aerial and ground-based nest searches have been conducted in multiple locations within and adjacent to the project study area and over almost 2 decades, no nests or indications of breeding by Steller’s eiders have been observed (Johnson et al. 2013). The only sightings of Steller’s eider in or near the project study area have been a few single males (seen in 2001 and 2007) and one pair seen on the ground in the CD North study area in 2001 (Johnson et al. 2013).

3.3.5.3 Yellow-Billed Loon

The yellow-billed loon was designated as a candidate for protection under the ESA in March of 2009. On October 1, 2014, the USFWS made the decision that listing the yellow-billed loon under the ESA was not warranted (Federal Register, Vol. 79, No 190, p. 59195). The yellow-billed loon is still recognized as a special status species by the BLM and as a species of conservation concern by the USFWS.

Yellow-billed loon are discussed in BLM (2012, § 3.3.5.5) and BLM (2004, § 3.3.3.2), which are incorporated by reference here.

Earnst (2004) estimated the worldwide population of yellow-billed loons to be 16,000 individuals, with approximately 3,300 individuals breeding in Alaska’s two known breeding locations; the North Slope and the area surrounding Kotzebue Sound in northwest Alaska. The estimate of the population index for yellow-billed loons on the ACP for the period 1986 – 2012 is 2,122 birds with an increasing annual population growth rate of 1.014 (total bird index; Stehn et al. 2013). The population growth rate indicates a positive trend over both the long-term (0.946 for 1989-2012) and most recent ten-year period (0.958 for 2003-2012) (Stehn et al. 2013). Spatial distribution of loons during the 1993-2010 survey period (Map 4.3-1) was very similar to the previously presented 1992-2005 survey results (BLM 2008 EIS Map 3-10), with the exception of a reduction of relative density of yellow-billed loons in the area between the eastern most point of Teshekpuk Lake and Atigaru Point.

Estimated density indices of yellow-billed loon across the ACP are presented in Map 4.3-2 of this document. Those density classes that occurred within the project study area were determined by GIS analysis. Density index contours within the project study area range from 0 – 0.03 to

0.204 – 0.321 birds per km², encompassing four of the five density contours present on the ACP (Map 4.3-2; Table 3.3-17). The project study area contained a very small area in which the highest density contour interval of 0.322 – 0.516 birds per km² were present (less than 1 percent of the project study area) (Table 3.3-17). Much of the project study area (65 percent) is contained within the lowest two density bands; and less than 1 percent of the project study area lies within the highest density contour.

Table 3.3-17. Estimated Density Contours for Yellow-billed Loons on the ACP (1993-2010)

Density Index Contour (birds per km^2)	Acreage within Project Study Area	Percent of Project Study Area
0.000 – 0.030	40,445	35%
0.031 – 0.102	34,514	30%
0.103 – 0.203	20,530	18%
0.204 – 0.321	20,426	18%
0.322 – 0.516	532	--

Source: USFWS 2010b, Migratory Bird Management

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Due to variation in coverage of subareas on the Colville River delta during the different years that nesting surveys were conducted, counts of nests were not directly comparable so a surrogate comprised of territory occupancy of nests (number of nests found divided by the number of territories surveyed) was calculated in order to compare annual occupation of nests. Within the CDSA, nest territory occupancy by nests was between 41 and 60 percent for the first eight years of the study, while during the last ten years territory occupancy was between 63 and 90 percent, and the average of all years was reported at 63.1 percent of territory occupancy by nests (Johnson et al. 2013). Population trends were estimated using territory occupancy by adults and territory occupancy of nests during the period 2000 – 2012. Based on these analyses, the number of both adults and nests on the Colville River delta appear to have increased since 2000 (Johnson et al. 2013). In the NASA during 2012, territory occupancy by nests was 86 percent, which is the highest occupancy recorded for this study area and much higher than the 11–year average of 64.2 percent (Johnson et al. 2013).

The project study area was included during the first four years of aerial surveys (2001 – 2004), with no yellow-billed loon nests or broods observed within one mile of the proposed roads or facilities for Alternative A (BLM 2004, Figure 3.3.3.3-5; Johnson et al. 2005). After 2004, surveys within the NASA focused on the Fish and Judy creek areas and the Alpine West Subarea (both of which partially include the project study area). The CD South Subarea, which includes a portion of the project study area, has been surveyed annually since 1993 and yellow-billed loon nests and broods have been recorded as present in that area every year (Johnson et al. 2013).

In 2012, 11 nests (0.07 nests per km²) were found in the CD South Subarea within the CDSA, and of the 18 nests (0.07 nests per km²) found in the NASA only one nest (0.01 nests per km²) was found in the Alpine West Subarea while the remainder were found in the Fish Creek delta and Fish and Judy Creek Corridor Subareas. All of these 2012 nest counts and densities are very close to the long-term averages for each subarea (Johnson et al. 2013).

During brood-rearing surveys in 2012, four broods were found in the CD South subarea (out of a total of 17 in the entire CDSA) and one brood was found in the Alpine West Subarea (out of a total of 12 for the entire NASA). Densities of adults and broods in the CD South Subarea (0.16

birds per km^2 and 0.03 broods per km^2) and the Alpine West Subarea (0.03 birds per km^2 and 0.01 broods per km^2) were both very similar to their long-term averages (Johnson et al. 2013).

The habitats preferred by nesting yellow-billed loons was evaluated using 18 years of aerial survey data in the CDSA and five years of aerial survey data in the NASA. Habitat preference of nesting and brood-rearing yellow-billed loons was calculated on the scale of the entire CDSA and NASA and not by subarea so it may not be a perfect representation of the habitat preference of yellow-billed loons in the CD South and Alpine West subareas. Nesting yellow-billed loons in the CDSA utilized 11 of 24 available habitats, preferring six (Johnson et al. 2013). Five of these six preferred habitats occur within the impact zone of proposed infrastructure (deep open water without islands, deep open water with islands or polygons, sedge marsh, grass marsh, and patterned wet meadow) for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6). Yellow-billed loons in the CDSA utilized 4 of the 24 available habitats for brood-rearing, preferring three (Johnson et al. 2013). Of these three preferred brood-rearing habitats, two occur within the impact zone of proposed infrastructure (deep open water without islands, and deep open water with islands or polygonized margins) for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

Habitat selection within the NASA was determined collectively for the three subareas surveyed for loons during 2008 – 2012 (Alpine West, Fish Creek delta, and Fish and Judy Creek Corridor). Nesting yellow-billed loons utilized 12 of 26 available habitats, preferring four (Johnson et al. 2013). Of these four preferred nesting habitats, two occur within the impact zone of proposed infrastructure (deep open water with islands or polygonized margins and sedge marsh. Yellow-billed loons in the NASA utilized 3 of the 26 available habitats for brood-rearing, preferring two (Johnson et al. 2013). Of these two preferred brood-rearing habitats, one occurs within the impact zone of proposed infrastructure (deep open water with islands or polygonized margins) for the action alternatives (discussed in Chapter 4 and Chapter 7, Map 3.3-6).

Apparent nesting success of yellow-billed loons was also calculated on the scale of the entire CDSA and NASA and not by subarea, and so may not fully represent the true nest success of loons in the CD South and Alpine West Subareas. Apparent nesting success within the CDSA for an eight-year period (2005-2012) was 58.7 percent with an average of 31.3 nests, an average of 0.86 chick per nest at hatch, and 0.55 chicks per nest in mid-September (Johnson et al. 2013). For the NASA, apparent nesting success calculated over a five-year period (2008-2012; not all subareas were surveyed in all years) was 46.3 percent, with an average of 0.73 chick per nest at hatch, and 0.55 chicks per nest in mid-September (Johnson et al. 2013).

Cameras placed at yellow-billed loon nests have documented egg predation by a variety of predators including glaucous gull, parasitic jaeger, red fox, golden eagle, and grizzly bear within the CDSA. Within the NASA, only avian predators have been documented. After camera monitoring was begun in 2008 in CDSA, 42 percent of monitored nests have been predated and 47 percent of identified predators were glaucous gulls and parasitic jaegers. Within the NASA where camera monitoring began in 2010, 52 percent of the monitored nests have been predated, exclusively by avian predators. The results of this study also highlight the importance of minimizing human disturbance to nests due to the majority of predation occurring at unattended nests (Johnson et al. 2013).

3.3.5.4 Polar Bear

The polar bear was listed as threatened under the ESA in May 2008 in response to sea-ice habitat loss associated with climate change (USFWS 2009a). Dependent on sea ice for survival, climate change-induced reduction in sea ice is the bear's largest overall threat (Corps 2012). In addition to climate change, anthropogenic threats include the accumulation of persistent organic pollutants, impacts from tourism and human-bear conflict, and increased development across potential terrestrial habitats (Corps 2012).

Two distinct stocks of polar bears occur in Alaska, the Chukchi/Bering Seas Stock and the Southern Beaufort Sea Stock. While occurrences of animals from the Southern Beaufort Sea Stock are more likely, animals from the Chukchi/Bering Seas Stock also occur in the region. The Chukchi/Bering Seas Stock was estimated at 2000 animals in 2002 and 2006 (Lunn et al. 2002, IUCN 2006). A population of 1,800 animals is the current population estimate for the Southern Beaufort Sea stock (Allen and Angliss 2011). A combination of declining survival, recruitment, and body size (Regehr et al. 2006, Regehr et al. 2010, Rode et al. 2010), and low population growth rates during years of reduced sea ice (2004 and 2005), combined with an overall declining population growth rate of 0.3 percent per year from 2001 to 2005 (Hunter et al. 2007) suggest that the Southern Beaufort Sea stock is in decline (Corps 2012).

Polar bears occur in maritime and coastal zones throughout the year, with specific life cycle events dictating location and timing. Reliant on sea ice for the majority of their hunting habitat, polar bear populations are sensitive to sea ice loss in optimal habitat locations (Durner et al. 2009). Polar bears utilize sea ice for hunting, feeding, breeding, maternity denning, resting, and long-distance movement (Corps 2012). Additionally, polar bears use terrestrial habitats for maternity denning, scavenging, resting, and travel between marine habitats (Regehr et al. 2010). During late autumn to early spring, polar bear range is extensive and includes pack ice, landfast ice, and land (BLM 2004; BLM 2012). Denning and birthing periods occur from late October through early April. Suitable terrestrial denning habitat is defined as having topographic features with ≥8° slope and ≥ 1.3 meters in height (Durner et al. 2013). The majority of maternal dens located between the Kavik River and Barrow were found to occur within 5 miles of the coast (Amstrup and Gardner 1994). A study by Schliebe et al. (2008) found Barter Island to have the highest on-shore concentration of polar bears, followed by Barrow and Cross Island, all located outside of NPR-A and the project study area. On-shore polar bear densities are greatly influenced by the presence of whale carcasses, as they provide an increasingly important protein source as sea ice extent diminishes (Bentzen et al. 2007).

Potential polar bear denning habitat, sightings, and den locations in relation to the proposed project study area are shown in Map 3.3-14. No polar bear den locations have been observed near the proposed project study area (Stirling et al. 2011). The nearest den locations reported are more than 3 miles (3.7 miles and 3.9 miles) from infrastructure associated with the proposed GMT1 development, which are outside the project study area (Durner et al. 2013). While females may change den locations, it is important to note that the proposed location of the GMT1 pad and most of the road and pipelines are outside the area previously considered critical habitat for denning; and all proposed GMT1 facilities are outside of the area previously considered for feeding.

3.3.5.5 Bowhead Whale

The bowhead whale has both ecological and cultural importance in the Alaskan Arctic. The bowhead whale was listed as endangered under the ESA in 1973, but no critical habitat has been designated. In 2011, the population was estimated to be 16,892 animals (Givens et al. 2013). The Western Arctic stock of bowhead whale increased at an annual rate of 3.2 percent from 1984 to 2003 (NMFS 2013, p. 22).

Bowhead whales are not expected to occur within the project study area.

3.3.5.6 Arctic Subspecies of Ringed Seal

Ringed seals have a circumpolar distribution (King 1983) and are year-round residents in the Beaufort, Bering, and Chukchi Seas (King 1983; Allen and Angliss 2011). These are the most common seal in the Beaufort Sea (Frost et al. 1988a; Kelly et al. 2010). At this time there is no reliable population estimate available for the entire Alaskan stock (Allen and Angliss 2013). Historic ringed seal population estimates in the Bering-Chukchi-Beaufort area ranged from 1 to 1.5 million (Frost 1985) to 3.3 to 3.6 million (Frost et al. 1988b). Frost and Lowry (1999) estimated 80,000 ringed seals in the Beaufort Sea during summer and 40,000 during winter, indicating that half of the population moves into the Chukchi and Bering Seas in winter.

The Arctic subspecies of ringed seal was designated as threatened under the ESA in 2012. Climate change induced modification of ice habitat is the main conservation concern. Ocean acidification induced habitat modifications, which have the potential to alter prey populations and availability, are a secondary concern (NOAA 2012). The density of ringed seals during winter and spring in nearshore Harrison Bay likely depends on a variety of factors, including food availability, water depth, ice stability, and ice topography. Ringed seals prefer nearshore stable landfast ice, where they maintain breathing holes throughout the winter in areas where the water depth is generally more than 10 feet (3 meters) deep (Moulton et al. 2002).

Ringed seals are unlikely to occur in the project study area.

3.4 Social Systems

Social systems associated within the project study area were described in BLM (2004, § 3.4) and updated in BLM (2012, § 3.4). This section tiers to and incorporates by reference relevant information, while placing emphasis on the proposed GMT1 Project location and potential socioeconomic impacts on a narrower scale.

Overview of Nuiqsut

Nuiqsut is an Iñupiaq community located on the Nigliq Channel of the Colville River, approximately 35 miles upstream from the Beaufort Sea, in an area that provides abundant opportunities for harvests of fish, land mammals, birds, and other resources. Nuiqsut is located approximately 13 miles southeast of the proposed GMT1 pad. The Nuiqsut area was formerly a place where Iñupiat and Athabascans gathered to trade and fish and was also important for maintaining connections between the Nunamiut of the inland areas and the coastal Iñupiat (formerly referred to as Taremiut) (Brown 1979). After the passage of the ANCSA in 1970, a group of 27 Iñupiaq families from Barrow resettled at Nuiqsut to live in a more traditional manner, and many of those who moved there had a family connection to the area (IAI 1990a). Since its resettlement 41 years ago, Nuiqsut has grown to a population of 402 residents living in 114 households in 2010 (U.S. Census Bureau 2011).

3.4.1 Cultural Resources

This section describes cultural resources of the ACP with a focus on cultural resources near the proposed GMT1 Project area. As defined in BLM (2004b, Glossary p. 2), cultural resources include:

> *"a definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups. (Cf. 'traditional cultural property'; see 'definite location'.) Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit described in this Manual series. They may be but are not necessarily eligible for the National Register."*

Based on the above definition, this analysis focuses on traditional cultural sites, trails, travel/trade routes, and other cultural features near the GMT1 Project. Because the ASDP and NPR-A IAP EISs (BLM 2004; BLM 2012) have already evaluated the proposed GMT1 Project (formerly referred to as CD6), this section is tiered off of those documents and focuses on information that is new, updated, or not included in the previous EISs. Information for this section relies on the ADNR Office of History and Archaeology (OHA) Alaska Heritage Resources Survey (AHRS) database (ADNR OHA 2013), the NSB Traditional Land Use Inventory (TLUI) (NSB, Iñupiat History, Language, and Culture Division [IHLC] 2013), and relevant cultural resources literature (e.g., oral histories, gray literature, academic journals).

3.4.1.1 Study Area

The study area for cultural resources includes all areas where the project may directly or indirectly impact cultural resources. The direct impact analysis area (e.g., ground-disturbing activities) is limited to the footprint of GMT1 Project components. The indirect impacts analysis area (e.g., increased access, erosion) consists of the project study area (i.e., 2.5-mile buffer surrounding the proposed GMT1 Project footprint). The visual and noise impacts analysis area is a 5-mile buffer encompassing the proposed GMT1 Project footprint. The buffer for visual and noise impacts are based on BLM (2012, §§ 3.4.7 and 4.3.19) and (BLM 2004, § 3.2.3.3 and 4A.2.3.3) (Map 3.3-11). BLM (2012, p. 3-161) visual analysis identifies 5 miles as the distance in which management activities might be viewed in detail, and BLM (2004, pp. 505-506) noise analysis states that minor noise impacts would occur to Nuiqsut residents at a distance of 5 miles from project construction and drilling. Activities that can be heard or viewed in detail (i.e., those less than 5 miles) may affect the setting, feeling, and/or association of cultural resources within the surrounding environment.

History

The rich cultural history of northern Alaska is described in detail in BLM (2012, § 3.4.2). The BLM (2008) also provides a summary of the Northeast NPR-A cultural resources, which is incorporated by reference and summarized below as it relates to the proposed GMT1 Project.

Ancestral History

The cultural history of the NPR-A mirrors that of the rest of Arctic Alaska. The earliest evidence for human occupation of the North Slope dates to the late Pleistocene and early Holocene around 14,000 years ago and belongs to the Paleoindian or Paleo-Arctic traditions[4] (Table 3.4-1). These populations were among the earliest migrants into North America: archaeological data suggest that these early humans traveled across a land bridge that once existed between Siberia and Alaska, when world-wide sea levels were as much as 300 feet lower than today. Over thousands of years, different cultures came to occupy Arctic Alaska and various parts of the NPR-A region, subsisting on resources available to them, and developing various tools for survival. As the Holocene era progressed, cultural changes that occurred in the region included the initial appearance of the Northern Archaic tradition at around 7,500 years ago. Archaeological evidence for the Northern Archaic tradition exists throughout the Arctic Foothills, Arctic Mountains, and ACP. The Arctic Small Tool tradition (ASTt) developed on the central Seward Peninsula and spread eastward across the Alaskan Arctic and beyond. ASTt includes the cultures of Denbigh Flint Complex, Choris, Norton, and Ipiutak (Kunz et al. 2003). Approximately 1,600 years ago, evidence of whaling using boats appeared with the Birnirk culture. The Thule culture emerged about 1,000 years ago and is evident in archaeological sites across the North Slope region, as well as most Arctic areas. The Thule people are the direct ancestors of the North Slope Iñupiat who continue to live throughout the region.

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[4] Tradition is defined as “a (primarily) temporal continuity represented by persistent configurations in single technologies or other systems of related forms” (Willey and Phillips 1958: 37).

Table 3.4-1. Ancestral Cultures of the NPR-A

Cultural Tradition/Age	Environment/Subsistence	Artifacts/Tools
Paleoindian Mesa and Sluiceway Complexes, Raven Bluff Assemblage 13,700–11,800 years ago	Land bridge connects Siberia and Alaska; drier and cooler than now; grassland, steppe prairie—mammoth, bison, muskox, caribou, moose, lion, short-faced bear	Bifacial, edge-ground fluted and unfluted lanceolate projectile points; bifacial knives; multi-spurred gravers; microblades w/Raven Bluff
American Paleoarctic 10,300–7,500 years ago	Climate becomes warmer and wetter; tundra replaces grass; land bridge subsides; mammoth and bison gone	Microblade technology; burins; bifacial projectile points and knives
Northern Archaic 7,500–3,000 years ago	Annual temperatures similar or a bit warmer than 20th century average; dependence on big game primarily caribou, no evidence of marine exploitation	Microblade technology; notched and stemmed bifacial projectile points and knives; large scrapers
Denbigh Flint Complex 5,000–2,400 years ago (beginning of Eskimo cultural tradition)	Climate cooled slightly, drier than preceding period; caribou is primary subsistence animal; first evidence of sea mammal hunting; orientation more toward terrestrial than marine resources	Microblade technology; burins; diminutive side and end blades; flake knives; discoids; composite tools; semi-subterranean houses
Choris 3,800–2,200 years ago	Climate same as during the Denbigh Flint Complex period; caribou is primary subsistence animal, but there is increased emphasis on the hunting of sea mammals, primarily seals; most known sites are coastal; orientation slightly more toward terrestrial than marine resources	Burins; large bifacial projectile points; pottery; ground stone; bone, antler and ivory implements; semi-subterranean houses
Norton 2,600–1,800 years ago	Climate same as during the Denbigh Flint Complex period; caribou is primary subsistence animal, although seal hunting is an important aspect of the economy; generally more oriented toward terrestrial than marine resources	Pentagonal projectile points; end and side blades; flake knives; discoids; ground stone; pottery; composite tools; antler, bone and ivory implements; semi-subterranean houses
Ipiutak 1,800–1,200 years ago	Climate slightly warmer and wetter than preceding 3,000 years; marine and terrestrial resources equally exploited; more emphasis on sea mammal hunting than previously	End and side blades; flake knives; discoids; no pottery or ground stone; composite tools; intricate ornamental ivory carvings; burials; semi-subterranean houses
Birnirk 1,600–1,000 years ago	Climate same as during Ipiutak period; coastal resources exploited more than terrestrial; more emphasis on sea mammal hunting than previously; watercraft based open water whaling begins	End and side blades; ground slate tools; ivory and antler harpoon heads; composite tools; pottery; semi-subterranean houses
Thule 1,000–400 years ago	The climate cools about the middle of this period; almost exclusively a marine orientation; whaling technology at its prehistoric peak; caribou remains an important part of subsistence economy	End and side blades; ground slate tools; ivory and antler harpoon heads; composite tools; dragfloat; pottery, semi-subterranean houses
Late Prehistoric Eskimo 700–400 years ago	During most of this period the average annual temperature is cooler than previous 1,000 years; primarily a terrestrial subsistence economy centered around caribou; some exploitation of coastal ecosystem	End and side blades; long-stemmed projectile points; pottery, bone, antler, ivory implements; ground stone, semi-subterranean houses
Nunamiut 400 years ago–Historic	Warming begins about 150 years ago; exploitation of inland ecosystem centered on caribou; dramatic shift in aspects of subsistence economy after Euro-American contact about 125 years ago	Bifacial stone projectile points; bone and antler projectile points; metal projectile points; firearms; sod houses; Euro-American items after 1875

Reproduced from BLM 2012, § 3.4.2, Table 3-24

3.4.1.2 Cultural Resources in the Study Area

This section provides details on the types and numbers of cultural resources in the proposed GMT1 project study area using existing, new, and updated data, as well as previously available information not included in BLM (2004; 2012). In addition to the AHRS and TLUI databases, the cultural resources described in this section include cultural resources documented in other sources, including traditional camps, cabins, trails, travel routes, and subsistence use areas. These cultural resources are included in the Nuiqsut Cultural Landscape that was documented by Brown (1979) and recently updated with new information as part of the research for the *Cultural Resources Survey Report, Foothills West Transportation Access Project* (SRB&A 2013a). Each of the individual cultural resources described in this section are also contributing characteristics to the Nuiqsut Cultural Landscape.

The AHRS and TLUI databases are the primary repositories for cultural resource site information on the North Slope. The OHA maintains the AHRS database, an inventory of reported and paleontological locations within the State of Alaska (ADNR OHA 2013). The AHRS database includes objects, structures, buildings, sites, districts, and travel ways, with the general, but not absolute, provision that they are over 50 years old. The AHRS is primarily a geographic information system (GIS) database. The AHRS provides a broad overview of documented resources. In regards to adequacy, most of the data in the AHRS were compiled before precise mapping methods, involving global positioning system (GPS) locations, were available so locations and extents of cultural resources are often imprecise. Additionally, archaeological reports rarely address cultural resources that are non-artifactual, such as traditional cultural properties and cultural landscapes. Despite the limitations, the AHRS files, including the GIS and map-based data, archived documents, and reports, represent the best available information for archaeological and historic site locations and extents for the project study area.

The IHLC created the TLUI database to document place names, landmarks, traditional land use sites, travel routes, and important locations remembered by the Iñupiat. The inventory is designed to perpetuate this knowledge and protect these sites from disturbance or destruction due to development activities on the North Slope. The IHLC continues to update the TLUI database and documents continued use of Iñupiaq cultural properties, which reflects the continuity of use of historic and prehistoric sites by contemporary people. The TLUI database represents the best effort at integrating history, oral history, and archaeology to understand the late prehistoric and historic period use of lands by the Iñupiat. In total, 13 AHRS and 13 TLUI sites are located within the impact analysis areas. Six of the 13 AHRS sites match the descriptions of corresponding TLUI sites. These sites include several grave sites; multiple historic settlements or camps that include sod houses, caches, ice cellars, and historic artifacts; and a site consisting of caribou bones with evidence of butchering.

In addition to the AHRS and TLUI databases, a number of sources have documented cultural resource sites through various research methods including field surveys, oral histories, and subsistence mapping interviews. Limitations of these data are that they may include duplicate features documented within or by other similar studies. Due to time constraints, differences in data collection methods, and location discrepancies, efforts were not made to reconcile duplicate features within and between data sources, and counts of these features are not included in the environmental consequences analysis. However, these sources provide additional details and context regarding cultural resource sites in the project study area that are not available in the AHRS and TLUI databases, and the cultural landscape as a whole is addressed in the environmental consequences analysis. Place names were not included unless they were associated with a site. The following is a list of these sources and brief description of the types of information they documented:

- ASRC and Arctic Environmental Information and Data Center (AEIDC 1975) – the Native Land Use and Place Name Map of Arctic Alaska provides Iñupiat land use locations, trails, and routes;
- Amsden (1977) – dissertation on inland Iñupiat historic settlement patterns, recorded camps, and other localities;
- SRB&A (2011b) – data collected during interviews with Anaktuvuk Pass residents related to the *Cultural Resources Survey Report, Foothills West Transportation Access Project*. Data include areas of cultural importance, historic camps, and cabins;
- SRB&A (2010a) – data collected during subsistence mapping interviews in Nuiqsut for the 1995-2006 time period. Data include historic camps, cabins, travel routes, and trails;
- Selkregg (1975) – profile of Alaska's Arctic region. Data includes historic trade routes in the region; and
- Aboriginal Trade Routes documented in the *Nuiqsut Paisanich* (Brown 1979).

Table 3.4-2 presents a list and description of the various types of cultural resources documented from the above sources. These sites include historic camping locations, cabins, and travel routes, in addition to, historic sod house remains, grave sites, drying rack locations, and storage cellars.

Table 3.4-2. Additional Cultural Resources Documented within the Project Study Area

Site # (Source)	Time Period	Site Type/ Description	Direct (Project Footprint)	Indirect (2.5 mile buffer)	Visual/ Noise (5 mile buffer)
114 (Amsden 1977)	Historic	Site Name: *Tuigaurak.* Amsden (1977) documented two occupations of this camping location by Anaktuvuk Pass residents prior to 1969. The site is few miles upriver from the Colville Delta.			X
116 (Amsden 1977)	Historic	Site Name: *Neglik.* Amsden (1977) documented nine occupations of this camping location by Anaktuvuk Pass residents prior to 1969.			X
AKP CBN 10-01 (SRB&A 2011b)	Historic	"[I was born] a long time ago. 1934 on Colville River, outside of Nuiqsut. July 4. ...Sod house…1934 until 1939, we come down here [to Anaktuvuk Pass area]. I was this tall. It was a long time ago. "			X
NUI CMP 04-01 (SRB&A 2010a)	Historic and contemporary Iñupiat	*Remnagak*, the place name for the camp location was described as a seasonal fish camp from the old days. Possibly from the 1920s-1950s.			X
NUI TRV 05-29 (SRB&A 2010a)	Historic and contemporary Iñupiat	"In wintertime we've got a trail, the old cat train trail. [The trail goes] between Itkillik [River] and Anaktuvuk [River].... An old trail from back in the 1930s and 1940s."		X	X
Brown 1979	Historic	The aboriginal trade route parallels the Colville River from the confluence of the Colville and Killik rivers to the coast. Along the coast the trail runs from Tangent Point to Nechelik Channel.		X	X
Brown 1979	Historic	This aboriginal trade route follows the easternmost channel of the Colville River from the coast to just south of the confluence with the Nechelik Channel. On the coast the trail extends from the easternmost Channel of the Colville River to Tigvariak Island.		X	X
ASRC and AEIDC 1975	Historic	Drying Rack Places			X

Table 3.4-2. Additional Cultural Resources Documented within the Project Study Area (Continued)

Site # (Source)	Time Period	Site Type/ Description	Direct (Project Footprint)	Indirect (2.5 mile buffer)	Visual/ Noise (5 mile buffer)
ASRC and AEIDC 1975	Historic	Storage Cellars		X	X
ASRC and AEIDC 1975	Historic	Storage Cellars		X	X
ASRC and AEIDC 1975	Historic	Boat Launching or Carrying Places			X
ASRC and AEIDC 1975	Historic	Boat Launching or Carrying Places		X	X
ASRC and AEIDC 1975	Historic	Boat Launching or Carrying Places		X	X
ASRC and AEIDC 1975	Historic	Dump Sites		X	X
ASRC and AEIDC 1975	Historic	Winter and Summer Water		X	X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain			X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain		X	X
ASRC and AEIDC 1975	Historic	Old Graves			X
ASRC and AEIDC 1975	Historic	Drying Rack Places		X	X
ASRC and AEIDC 1975	Historic	Drying Rack Places			X
ASRC and AEIDC 1975	Historic	Drying Rack Places			X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain			X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain		X	X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain		X	X
ASRC and AEIDC 1975	Historic	Ruined Cabins - Driftwood and Sod Still Remain			X
ASRC and AEIDC 1975	Historic	[Winter travel route from Kaktovik to Point Hope accessed by snowmachine or dog team]		X	X
ASRC and AEIDC 1975	Historic	[Winter travel route following the Colville River from the Brooks Range to coastal winter trail from Point Hope to Kaktovik]		X	X
Selkregg 1975	Historic	The trail follows the Colville River from the confluence of the Colville and Killik rivers to the coast where the trail turns east and follows the coast just beyond Oliktok Pt.		X	X

Although the Colville River delta and the proposed GMT1 Project area were no doubt frequented by many, if not all, of these cultures, the archaeological record here consists primarily of sites representing twentieth century Iñupiat use of the land (Table 3.4-15). Five archaeological sites with sod houses were once found along the Nechelik (*Nigliq*) Channel of the Colville River, but two of these have now been lost to riverbank erosion. One of these sites, *Nigliq*, is still seasonally used for subsistence. *Nigliq* is one of the most important archaeological sites along the Beaufort Sea coast because it was the setting of an annual trade fair. Here, inland and coastal Iñupiat societies came together to celebrate, trade, and intermarry amongst themselves and with Athabascans who formally inhabited areas of the ACP and Brooks Range (Burch 1979). Sites along the *Nigliq* channel were winter camps used for hunting and fishing, but also, in the first half of the twentieth century, for reindeer herding and trapping. These sites, together with information on traditional land use gathered by the NSB from Elders in the 1970s, provide a rich account of life in the first half of the twentieth century. In many cases the names of individuals living at these sites from the 1920s to the 1940s are known, providing a connection between families living in present-day Nuiqsut and places that are now the sod house ruins of their ancestors. The *Nigliq* channel continues to be a central hunting and harvesting ground for the Iñupiat living in Nuiqsut. The project study area overlaps the *Nigliq* channel.

While *Nigliq* was an early location associated with Nuiqsut, the first year-round settlement location for the community was *Nuiqsutpiat,* located on *Nuekshat* Island in the main channel of the *Kuukpik*. A second year-round settlement, *Niglinaat,* was established in the 1930s but abandoned in the 1940s, when most of the earlier inhabitants relocated to Barrow, 150 miles away, so their children could attend school. When the present-day Nuiqsut was re-established in 1973, it was located on the Nigliq Channel of the Colville River to allow easy access to the river's main channel for fishing and hunting (although sedimentation has since made navigation to the main channel difficult or impossible). The motivation for this move back to Nuiqsut was to revive traditional Iñupiat values of hunting and fishing, and to experience Iñupiaq social and cultural life (BLM 2004, § 3.4.1).

Overview of Regional History

Initial contact between North Slope Iñupiat and Europeans occurred early in the nineteenth century with the arrival of European explorers. Contact between the Iñupiat and non-Iñupiaq people dramatically increased with commercial whaling beginning in 1848. The era of commercial whaling came to a close by 1910. Reindeer herding and the trapping economy, with the assistance of steel traps, rifles, and trading posts along the coast, led the North Slope Iñupiat to spread out, repopulate the land, and likely lead a more heavily subsistence-based lifestyle throughout the 1920s and 30s (Sonnenfeld 1956). The Spanish influenza decimated the population of many arctic Alaska Native villages in 1918-19. The Depression led to the decline of trapping; the trading posts closed, and the law requiring children to attend school depopulated the land. Most of the Kuukpikmiut moved to Barrow: one family stayed and several families returned seasonally to hunt and fish.

The Naval Petroleum Reserve Number Four (now NPR-A) was established in 1923 with the Colville River as its eastern boundary. Oil exploration, World War II, and the ensuing Cold War brought myriad impacts to Arctic Alaska, including DEW Line radar bases and adding wage labor to the mixed cash and subsistence economy and a generation of men with industrial skills. With the passage of Alaskan statehood in 1959, the new state government began to select 105 million acres, sparking a period of critical events in the Arctic. The State selected some land on the North Slope, eventually began selling oil leases there, and Prudhoe Bay was discovered, on state land, in 1967.

The Iñupiat of the North Slope, who had been harvested oil-soaked sod for centuries and had guided geologists to the oil seeps, saw the land and oil as their own natural resources. With State land selections and lease sales in the Prudhoe Bay area, they feared that most of their homeland would be taken and developed while leaving them out of the profits. The movement for Alaska Native land claims grew significantly when the oil industry and State of Alaska made plans for TAPS. After a DOI-imposed statewide freeze on land selections, the ANCSA was passed in 1971. ANCSA established 12 regional native corporations, and the ASRC was established for the North Slope area. ANCSA divided land ownership: regional corporations retained subsurface rights to oil and minerals, while village corporations retained surface rights and subsistence uses of the land. The Iñupiat of the North Slope incorporated the NSB in 1972 with the same boundaries of ASRC. The establishment of the NSB made it feasible to re-establish outlying villages such as Nuiqsut with schools and public facilities. Table 3.4-3 provides a synopsis of the regional history.

Table 3.4-3. Regional History Synopsis

Time Frame	Historic Theme	Synopsis
1820s-1880s	European/Euro-American Exploration	Begins when Captain F.W. Beechey and Sir John Franklin attempted a rendezvous at Point Barrow Ship crews during this period interact with coastal Iñupiat and document landscape, Iñupiaq culture, and name geographic features Ends with the failed second Franklin Expedition rescue missions
1840s-1900s	Commercial Whaling	Begins when the first commercial whaling vessel passes through the Bering Strait to the Arctic Commercial whalers slaughter Arctic whale and walrus populations, introduce venereal disease and epidemics that decimate Iñupiat population, disrupt indigenous trade networks, establish on-shore whaling stations, and provide an influx of trade goods Ends when commodities traditionally made from whale oil and baleen lose economic viability to similar products made from petroleum products and other materials (e.g., oil, corsets)
1880s-Present	Ethnographic and Anthropological Research	Begins with U.S. Army Signal Corps establishing a camp in Barrow to document Iñupiaq culture and other scientific pursuits as part of the first International Polar Expedition Researchers examine Iñupiaq life and cultural objects, Iñupiaq physical and cultural adaptations for Arctic survival, effects of resource development and cash economy on Iñupiaq culture Continues today as part of Iñupiaq cultural revival, academic research, and state and federal permitting process
1880s-Present	Military	Begins when the U.S. Army Signal Corps sets up a scientific station at Pt. Barrow U.S. Army and Navy personnel explore major North Slope rivers documenting ethnographic, geographic, and travel route information; the military conducts oil and gas exploration of the NPR-A; the Cold War spurs the U.S. military to establish the Distant Early Warning (DEW) line in the 1950s to detect Soviet long-range bombers; end of the Cold War leads to the demobilization and removal of DEW line sites across Alaska Continues today with increased presence of the U.S. Coast Guard patrolling the Beaufort and Chukchi seas

Table 3.4-3. Regional History Synopsis (Continued)

Time Frame	Historic Theme	Synopsis
1890s-Present	Christian Missionaries	Begins with Sheldon Jackson's arrival and becoming head of education Missionaries convert Iñupiat to Christianity, build schools and hospitals, help manage reindeer herds, pressure Iñupiat to abandon traditional cultural practices; missionaries eventually singularize efforts to spreading Christianity Continues today as missionaries seek new converts and multiple denominations continue to establish in North Slope communities
1890s-Present	Reindeer Herding	Begins when Sheldon Jackson introduces reindeer herding to the Arctic to provide a stable food source Incompatibility of reindeer herding with Iñupiat subsistence practices, competition between Iñupiat and non-Natives, problem-plagued governmental regulations, the checker-boarding of land ownership, and lack of communication between government and academic research and herders contribute to steady decline of reindeer herding on the North Slope (Stern et al. 1980) Continues today in some areas of Alaska, but in a greatly reduced form than in the first half of the twentieth century
1890s-1970s	Centralization of Communities	Begins with schools, post offices, trading posts, and reindeer stations altering Iñupiat settlement patterns through centralization into permanent communities Kaktovik permanently settled following establishment of trading post by Tom Gordon in 1923 Anaktuvuk Pass established in 1949 following formation of regular air service, postal office, and a school Ends with Nuiqsut, Point Lay, and Atqasuk reestablished as permanent communities in the 1970s following passage of ANCSA.
1900s-1930s	Trapping and Trading Posts	Begins with decline in whaling and rising importance of furs as an economic driver Former whalers such as Charles Brower and Tom Gordon establish trading posts at Barter Island and Demarcation Point Trading posts, combined with dramatic decreases in the caribou and Iñupiat populations, lure the remaining inland Iñupiat to settle in coastal settlements Ends when the Great Depression lessens the demand for furs
1900s-Present	Geologic Exploration and Oil and Gas Development	Begins with Schrader and Peters (1904) and Leffingwell (1919) geologic surveys of the Brooks Range and Canning and Colville Rivers Early geological exploration leads the way to the creation of the NPR-A; governmental oil and gas exploration NPR-A eventually leads to private industry investigating areas of the ACP, which leads to the discovery of Prudhoe Bay and construction of TAPS and the Dalton Highway Exploration continues today with the GMT1 Project and other projects across the North Slope
1930s-Present	Tourism	Begins with the advent of airplanes and several well-known aviators traveling to Barrow including Charles Lindbergh and Wiley Post in the early 1930s Continues today in Barrow and other North Slope communities as well as remote areas of the North Slope for hiking, sightseeing, boating, polar bear viewing, and other tourist activities

3.4.2 Sociocultural Systems

This section describes the affected environment for sociocultural resources potentially affected by the Project. The proposed GMT1 Project has previously been evaluated and addressed within earlier NEPA documents: (BLM 2004, 2012). Therefore, this section is tiered off of those documents and focuses on information that is new or updated since those previous EISs. This section includes a general overview of sociocultural systems on the North Slope, particularly for Nuiqsut, including history, social organization, economic organization, community institutions, community health and welfare, and population and employment. There are two distinct populations found in the general project area: local permanent residents, a majority of whom are Iñupiaq Eskimos indigenous to the area, and oil and gas industry workers who rotate on a shift schedule and are temporary residents. This discussion focuses on the sociocultural systems of the permanent residents of the North Slope with a particular focus on the Iñupiat and on the community of Nuiqsut. Nuiqsut, located on the western bank of the Nigliq Channel of the Colville River delta, is the closest residential community to the proposed project, approximately 13 miles southeast of the proposed GMT1 pad.

3.4.2.1 Population and Employment

In 2010, the NSB contracted with Circumpolar Research Associates to prepare a NSB 2010 Economic Profile and Census Report. This report updates demographic data for Nuiqsut. The data from this report is considered by the NSB as more reliable than the U.S. Census data and is therefore used in preparation of the SEIS.

Based on the NSB 2010 census data, in 2010, Nuiqsut had a total population of 415 residents with Iñupiaq people making up 87.7 percent of the total. Individuals under the age of 18 made up 30.7 percent of the population while individuals 18 to 64 years of age made up 66.4 percent of the total. The proportion of the labor force to the total population was 55.9 percent. The number of unemployed was approximately 29.3 percent.

The median reported household income (all households) in Nuiqsut in 2010 was $70,000; Iñupiat household incomes were $64,196, while non-Iñupiat household incomes were $85,600.

The Nuiqsut Trapper School is a K-12 school that is part of the NSB School District. For the 2011-2012 school year, the Nuiqsut Trapper School had an enrollment of 104 students with a graduation rate of 44 percent, below the graduation rate of 57 percent for the NSB School District (ADEED 2013). Ilisagvik College in Barrow provides for advanced education in the North Slope.

3.4.2.2 Social Organization

Iñupiaq social organization traditionally revolved around the bilateral family unit and their extended kin, in addition to trading partnerships and friendships (Hall 1984). Following European and American contact, the social and political organization of the Iñupiat changed. These changes were a result of various factors including compulsory education, which led to the centralization of people into permanent villages; introduction of modern technologies, which altered residents' methods for harvesting and processing subsistence foods; the introduction of a cash economy; the introduction of Christianity; and incorporation of the Iñupiat into new systems of laws and governing. Alaska Natives began forming local village councils, which were formally reorganized under the Indian Reorganization Act of 1934. The ANCSA was passed in 1971 and resulted in the formation of regional and village corporations, and the NSB formed in 1972.

Despite the changes in social and political organization over time, the core of Iñupiaq social organization is similar on the North Slope today, in that it encompasses not only households and families, but also wider networks of kinship and friends, and individual family groups which depend on the extended family for support. The sharing and exchange of subsistence resources strengthen these kinship ties. In addition, despite the Christianization of the Iñupiat through missionaries, the Iñupiat maintain certain aspects of traditional Iñupiaq belief systems, which revolve around a system oriented to the environment and its animals and require that hunters follow proper hunting rituals to ensure successful harvests. For these reasons, the relationship of the Iñupiat and their natural environment remains the cornerstone of their cultural identity (BLM 2004).

Sociocultural systems in Nuiqsut can be impacted by nearby oil development in a number of ways, including:

- Employment opportunities
- Increased or variable income
- Tensions related to the permitting process for development
- Devaluation of the Nuiqsut cultural landscape
- Disruptions to subsistence resources and activities

3.4.2.3 Government and Community Institutions

The people of Nuiqsut are the “Kuukpikmuit,” or the “People of the Lower Colville River” (BLM 2004, § 3.4.1.2; BLM 2008). Over 400 people reside in Nuiqsut today, the majority of whom are Iñupiat (see Section 3.4.2.1). The Native Village of Nuiqsut is a federally recognized tribe, and the Kuukpik Corporation is the local ANCSA village corporation. Nuiqsut was incorporated as a second class city in 1975. Several subsistence-related organizations exist in Nuiqsut. The Kuukpik Subsistence Oversight Panel, Inc. (KSOPI) was established in 1996 in response to development of the Alpine oilfield. The purpose of KSOPI is to provide a method of communication between Nuiqsut residents and industry and to relay concerns to industry regarding impacts on subsistence harvesting activities. KSOPI has also been involved in the establishment of resource-specific panels of experts, such as the Nuiqsut Caribou Panel and the *Qaaktaq* (Arctic cisco) Panel. Another subsistence-related organization is the Nuiqsut Whaling Captains Association.

The proposed GMT1 Project is within the NSB. The NSB government offices are located in Barrow, the seat of government. The NSB has permit authority relevant to the proposed project. Other federal and state agencies, including BLM who is the land manager for all non-Native land with the NPR-A, have permit authority related to the project. Nuiqsut residents, along with residents from seven other North Slope communities, are members of the regional federally recognized tribe Iñupiat Community of the Arctic Slope (ICAS) and many are shareholders in the ASRC.

3.4.3 Economy

Oil and gas exploration, development, and production activities on Alaska's North Slope contribute to the economy of the nation, the State, the NSB, and local communities. Oil and gas development in the region supports local and non-local, direct and indirect hires, and induces jobs and generates federal, state, and local government revenues through rentals and royalties from oil and gas leases, income taxes, severance taxes, property taxes, sales taxes, and other payments.

The BLM (2004, § 3.4.2.1) describes the relationship of the oil and gas industry to the North Slope economy, the economy of the State of Alaska, and the nation's economy. BLM (2012, § 3.4.11) provides a more recent and detailed account of the structure of the NSB economy, including the local economies affected by oil and gas development in the NPR-A, as well as the revenues that accrue to the federal, state, and regional, and local governments. Given that the impacts to the nation's economy are diluted by resources and activities elsewhere, the U.S. economy is not addressed in this section.

The information provided in the following subsections is the most current regarding condition of the affected economies at the state, regional, and local level.

3.4.3.1 Economic Organization

The Iñupiat traditionally participated in an economy that relied on subsistence resources and utilized trade to acquire goods not readily available in their immediate area. The economy of the North Slope underwent major changes beginning in the mid-nineteenth century, when commercial whaling introduced a new type of economy to the Iñupiat. The whaling industry was followed by other economic developments, including reindeer herding, fur trapping, military development, and oil and gas exploration, and development.

Today, the Iñupiat of the North Slope continue to rely on subsistence resources while also participating in the cash economy. Like other communities on the North Slope, Nuiqsut has a "mixed, subsistence-market" economy, where families invest money into small-scale, efficient technologies to harvest wild foods (BLM 2008). These investments can include gill nets, motorized skiffs, and snowmachines used to conduct subsistence activities, and are not oriented toward sales or profits, but are focused on meeting the self-limiting needs of families and small communities. The contribution of subsistence harvests toward the mixed subsistence-market economy is substantial, with documented per capita harvests in Nuiqsut ranging from 399 (in 1985) and 742 (in 1993) pounds. Subsistence activities have economic, social, cultural, and nutritional value for Nuiqsut residents.

The primary sources of wage employment in Nuiqsut are the NSB (including the school district), the Kuukpik Corporation, and the City of Nuiqsut (see Section 3.4.2.1). Craft sales are also a small part of Nuiqsut's economy. According to the NSB 2010 census report, 8.4 percent of respondents worked for the oil industry in 2010; the number of residents employed by the oil industry was higher in 2010 than during 2003.

The Kuukpik Corporation, Nuiqsut's village corporation established in 1973, owns the surface rights to land in the vicinity of Nuiqsut, including portions of the Alpine oil field which is located approximately 8 miles from the community. The corporation receives royalties for the use of their land, and its subsidiaries also provide oil support services. The corporation has over 250 enrolled shareholders who receive dividends. Industrial development in the vicinity of Nuiqsut consists of oil production infrastructure. CPAI operates the Alpine production facilities that include: ongoing drilling and production operations, processing facilities, wells and pipelines, camp facilities, gravel roads and airstrip, communications and power generation, as well as sanitation utilities, warehouses and other oil field support facilities.

The NSB owns and operates a 4,300-foot airstrip in Nuiqsut. For about four months per year (commonly January through April), ice roads constructed by CPAI connect Alpine and Nuiqsut to the Kuparuk and Prudhoe Bay road system. This allows residents of Nuiqsut to buy vehicles, boats, snowmachines, and other goods in urban centers and drive them to their community; no other community (aside from Prudhoe Bay) on the North Slope has this ability. Snowmachines are also used for local transportation in the winter, and boats and four-wheelers are a source of transportation during the snow-free months. Permit for construction of the Nuiqsut Spur Road was granted by the Corps to Kuukpik (March 2014), and construction is nearly complete (additional fill to be placed winter 2014-2015). The Nuiqsut Spur Road connects with Alpine facilities with the purpose to enhance training and employment opportunities for residents, as well as to improve access for subsistence activities.

The Kuukpik Alaska Commercial Company (AC) store in Nuiqsut provides commercial goods including groceries, general merchandise, propane, diesel, and gasoline. Except for winter access by ice road, the majority of goods are transported to Nuiqsut by air.

Colville Village is the Helmericks' family homestead on Anachlik Island, on the northeast side of the Colville River delta. Established in the mid-1950s, primarily as a commercial fishing operation, this site consists of several homes, a lodge, an airstrip, aircraft hangers, warehouses, barn, workshops, and other outbuildings. While the family still resides at the homestead, the commercial fishing business is no longer operational.

3.4.3.2 Regional/Local Economy

The proposed GMT1 development is contained within the NSB jurisdiction. The community of Nuiqsut, the closest community to the proposed development and the most likely to experience direct impacts, is the focus of the local economic impacts analysis. Although there are other communities within the NSB that could experience economic impacts as a result of revenues generated from NPR-A activities, the intensity and extent of impacts on these communities have already been discussed or are within the range of impacts analyzed in the 2004 ASDP Final EIS and the 2012 NPR-A Final IAP/EIS.

North Slope ANCSA regional and village corporations are also active in the oil and gas sector. ASRC has several oil services contracts with operators in the North Slope oilfields as well as a royalty interest in the Colville River Unit and Greater Mooses Tooth Unit. In addition to royalties received for land access, Kuukpik Corporation has direct contracts to provide subsistence representatives and ice road monitors to support CPAI and other oil and gas operators in the area and has service companies that also provide contract services for the oil industry. Ukpeagvik Iñupiat Corporation (Barrow), Olgoonik Corporation (Wainwright), Tikagaq Corporation (Point Hope), Cully Corporation (Point Lay), and Kaktovik Iñupiat Corporation (Kaktovik) all have service companies providing contract services to the oil and gas industry on the North Slope.

This subsection incorporates by reference economic information for the NSB and the community of Nuiqsut contained in BLM (2004, § 3.4.2, pp.3-296 – 3-299) and BLM (2012, § 3.4.11, pp. 473 - 486).

Regional Economy: North Slope Borough

Oil and gas exploration and development continues to be the main industry in the NSB and the largest employer of the region's industrial or census area workforce; this includes the non-resident workforce. In 2012, there were 8,459 oil industry jobs on the North Slope; only 69 positions were filled by residents of the North Slope[5] (ADOLWD 2013c). Total employment for all industries in 2012 was 14,247 (ADOLWD 2013b). The unemployment rate in the NSB in 2012 was 5.4 percent (statewide unemployment rate was 6.9 percent). Wages from the oil and gas sector accounted for 73 percent of the total wages earned for all industries in the North Slope in 2012. However, most of the earnings are not spent in the North Slope because they go to workers that reside outside the NSB.

Oil production at Prudhoe Bay, Kuparuk, and Alpine fields, including the satellite fields, account for most of the oil production activities in the region. More recent oil and gas industry activities in (and offshore of) the North Slope include Pioneer Natural Resources' Oooguruk offshore development, ENI's offshore Nikaitchuq development, Shell's offshore exploration drilling efforts in 2012, and ExxonMobil's Point Thomson development project (ADOLWD 2013c). These industry projects have and will continue to contribute to the North Slope economy through taxes, oil field services contracts, and other indirect and induced effects of industry spending in the region. The indirect impacts from government and industry spending have expanded the private support sector in the region.

Oil and gas property taxes are still the primary source of revenue for the NSB government. According to the State Assessor's Office, in 2012, the NSB received about $322 million in oil and gas property taxes, accounting for 98 percent of the total property tax collected by the NSB that year. This amount accounts for approximately 90 percent of the total general fund revenues (ADCCED 2013c). With significant oil and gas property tax revenues, the NSB has been able to finance construction projects through its Capital Improvement Program. The NSB government also provides a wide range of public services to all of its communities; the NSB's actual operating budget in FY12 amounted to about $365.9 million.

The local government sector (primarily the NSB government) is the largest employer of North Slope residents. In 2012, the local government sector employed 1,944 residents, accounting for 57 percent of the resident workers in the region. The next largest employment sector is trade, transportation, and utilities, accounting for about 9 percent of the resident working population (Table 3.4-4).

The ANCSA regional and the village corporations in the North Slope are also important economic players in the region, employing local residents, participating in the oil and gas service industry, and creating additional wealth in the region.

A portion of the ANCSA corporations' profits goes to shareholders in the form of dividends. ASRC is the regional ANCSA corporation that is owned by, and represents the business interests of, the North Slope Iñupiat. For nearly two decades, ASRC has been the largest Alaskan-owned and operated company based on revenues. The corporation reached a gross revenue of $2.55 billion in 2011 (Harrington 2012).

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[5] A recent study on the economic benefits of the oil industry in Alaska estimated that the industry generated 5 direct jobs (oil companies), 165 indirect jobs (oil and gas support sector), and 1,330 induced jobs by residents of the NSB. In total, the industry generated 1,500 jobs held by NSB residents, with an annual payroll of $100 million (McDowell Group 2011). This study reflects data from a different year than the ADOLWD data reported above. In addition, this study uses different definitions and categories of jobs than ADOLWD.

Table 3.4-4. 2012 North Slope Borough Resident Employment by Industry

Industry	Number of workers	Total Employed (%)
Local Government	1,956	57.6
Trade, Transportation and Utilities	291	8.6
Professional and Business Services	261	7.7
Educational and Health Services	237	7
Construction	215	6.3
Financial Activities	182	5.4
Natural Resources and Mining	82	2.4
Other	68	2
Leisure and Hospitality	52	1.5
State Government	25	0.7
Information	18	0.5
Manufacturing	5	0.1
Unknown	3	0.1

Source: Alaska Local and Regional Information (ADOLWD 2014)

ASRC Energy Services, Inc. (AES), a wholly owned subsidiary of ASRC, provides an array of oilfield engineering, operations, maintenance, construction, fabrication, regulatory and permitting, and other services for some of the world's largest oil and gas companies. The company has emerged as one of Alaska's largest oilfield service providers and one of Alaska's largest private-sector employers (Fried et al. 2011, ASRC 2013). Petro Star, Inc., another subsidiary of ASRC, is the only Alaskan-owned refining and fuel marketing operation in the State (ASRC 2013).

Village ANCSA corporations in the NSB also are active in the oil and gas sector. The oilfield service company UMIAQ, LLC, a division of Ukpeagvik Iñupiat Corporation (the village corporation for Barrow), and Kuukpik Corporation, the village corporation for Nuiqsut, for example, provide camp services and catering to CPAI's Alpine development and BPXA's Northstar offshore field.

Local Economy: Community of Nuiqsut

Nuiqsut is served by scheduled and chartered flights from Barrow; and residents have access to the Dalton Highway four months of the year. Freight arrives year-round by air cargo (ADCCED 2013a).

Nuiqsut's economy, like other North Slope communities, is primarily based on subsistence hunting, fishing, and whaling. More recently, Nuiqsut and its village corporation have benefited economically from close proximity to oil production activities on the North Slope, particularly development of the Alpine field.

As noted in the 2004 ASDP (§ 2 p. 294), as a result of current development of the Alpine Field, Nuiqsut has received a number of economic benefits and employment opportunities, including contracts to several Kuukpik Corporation joint ventures/subsidiaries, including Nanuq (construction); Kuukpik/Arctic Services (camp and catering); Kuukpik/SAE (seismic); Kuukpik/LCMF (Umiaq) (surveying); Kuukpik/Carlisle (trucking), and Kuukpik/Nana Management Services (security). Other businesses that have benefitted include the Kuukpik Hotel, an office space lease from the City of Nuiqsut, and storage of ice road equipment.

The NSB reported that in 2010, there were 14 Nuiqsut residents working in the oil industry (see Table 3.4-5). The nearby Alpine development has also provided seasonal work opportunities to

Nuiqsut residents, including environmental monitoring. Nuiqsut also receives natural gas from the Alpine Field; access to natural gas has significantly reduced the cost of heat and power in the community.

The NSB government, Kuukpik Corporation (village corporation/subsidiary), and the NSB school district, are the top employers of Nuiqsut residents (CRA 2010).

Table 3.4-5. Total Employment by Employer, Nuiqsut

Employer	Total	Percent
City Government	18	11
NSB Government	49	30
NSB School District	27	16
Oil Industry	14	8
Private Construction	1	1
ASRC/Subsidiary	3	2
Village Corporation/Subsidiary	32	19
Transportation	4	2
Other	18	11
Total	**166**	**100**

Source: *North Slope Borough: Economic Profile and Census Report 2010* (CRA 2010)

Note: The numbers include only those individuals responding to the survey and the question about employment and employer.

The City of Nuiqsut's FY13 budget is about $1.96 million. Grants, revenue sharing, and mitigation funds account for approximately 76 percent of the City's operating income. Other revenue sources include bed tax receipts, bingo income, and rents (Table 3.4-6).

Table 3.4-6. City of Nuiqsut Fiscal Year 2013 Budget

Income	Amount	Percent
Grant Revenue [a]	$1,107,289	57
Grant Program Income	$23,500	1
State and Local Revenue	$150,000	8
Mitigation Funds	$200,000	10
Rents	$66,000	3
Contributions Income	$17,250	1
Other Income/Bed Tax	$151,500	8
Bingo Income	$145,000	7
USPS Nuiqsut CPU	$95,963	5
Total:	**$1,956,502**	**100**

Source: City of Nuiqsut Fiscal Year 2013 Adopted Budget (ADCCED 2013b)

[a] This includes grant funds from the NPR-A impact mitigation program.

Since leasing in the NPR-A was restarted in 1998, over $150 million has been awarded to NPR-A communities for various projects through the NPR-A Impact Mitigation Grant Program. Approximately $26 million in grants have been awarded for projects in Nuiqsut and $75 million to the NSB for projects benefiting the entire NPR-A region.

The NPR-A Impact Mitigation Grant Program provides eligible municipalities with grants to help mitigate significantly adverse impacts related to oil and gas development within the NPR-A. The fund is created from lease revenues including sales, rentals, bonuses, and royalties in the NPR-A. GMT-1 will add to the available funds each year. As required by Alaska Statute, priority is given to those communities experiencing or that will experience the most direct or severe impact from oil and gas development. As a result of the most recent fund allocation, the community of Nuiqsut received grants for the following projects: (ADCCED 2013d)

- Boat Ramp. $461,547 was appropriated to construct a seasonal removable boat ramp on the Nigliq Channel of the Colville River within the city limits of Nuiqsut. This boat ramp is intended to provide better summer and autumn access to subsistence hunting and fishing grounds; better ability to launch a number of first response Search and Rescue marine vehicles from Nuiqsut; and improved first response capability to mitigate potential oil spills.
- Nuiqsut Power Plant Generator Upgrade ($1,386,000). Installation of a new generator enables the utility to meet current demands for increased power generation during the winter.
- Colville River Road – gravel acquisition ($2,318,988). This project is to acquire the gravel that would be used to extend the existing road constructed and maintained by the NSB, which connects the City of Nuiqsut to Freshwater Lake. The Colville River Road project would extend the road approximately 4 miles to the Colville River. The most critical factor in construction of this road is availability of gravel at the time of construction. The large amount of gravel for this road is not stockpiled and will have to be mined and the excess moisture must be allowed to drain.
- Local Government Operations and Maintenance ($595,000). This project is to continue to fund operations so the city government may continue providing Title 29 governance. (Note: Since 2000, the City of Nuiqsut has received approximately $3.5 million in annual NPR-A impact grants for local government and operations and $1.2 million for the local youth center and programs.)

3.4.3.3 State Economy

The oil and gas industry continues to be an important contributor to the state economy. In 2011, oil and gas extraction generated 18 percent of the State's gross state product ($9.15 billion) (Bureau of Economic Analysis 2013). In April 2013, there were 14,100 direct oil and gas jobs in the state (ADOLWD 2013c). Besides the direct jobs, there are thousands of indirect jobs in security, catering, accommodations, facilities management, transportation, engineering services, and logistics, which support the oil and gas industry, but are not categorized as direct oil and gas jobs. The most recent estimate for total direct, indirect, and induced jobs[6] associated with the oil and gas industry in Alaska, was 44,800 jobs in 2010; these jobs contributed to just under $2.65 billion in annual payroll to Alaska residents that year (McDowell Group 2011).

Oil and gas industry jobs on the North Slope account for more than 62 percent of the direct oil and gas jobs in the state (ADOLWD 2013c). However, most of these workers commute to the North Slope on a rotational basis, but live outside of the North Slope - in Anchorage, Fairbanks, the Matanuska-Susitna Borough, and other population centers, and therefore contribute to these regions' economies as well, through spending of wages. In total, the oil and gas industry generated 1,500 jobs held by NSB residents, with an annual payroll of $100 million (McDowell Group 2011).

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[6] Direct jobs are those held by oil and gas workers who are employed by companies such as ConocoPhillips and BP. Indirect jobs are those held by workers who are employed by companies that support the oil and gas sector such as construction, engineering, transportation, and other technical and consulting services. Induced jobs are jobs generated in sectors such as retail, utilities, banking, real estate, and personal services. These jobs result from spending of wages.

The Alaska Department of Revenue anticipates that the state government's high level of dependence on oil revenue will continue, with revenues being very sensitive to oil price and oil production. In FY12, state revenues from the oil industry accounted for 65 percent of the total state revenue, and 93 percent (or $8.86 billion) of the General Fund. The general fund pays for almost every state service, including the education system, transportation infrastructure, public health and safety services, and a host of other programs throughout Alaska.

Unrestricted revenue from oil production is anticipated to be $6.9 billion in FY13, and $6.4 billion in FY14, a reduction due to declining expected production levels. In FY12, an average of 579,400 bopd was produced on the North Slope. The State of Alaska expects average daily production in FY13 to drop to 538,300 bopd and to 526,600 bopd in FY14 (Alaska Department of Revenue 2013).

With respect to the State of Alaska's 50 percent share of revenues from oil and gas activity in the NPR-A, the latest report indicates that the State's share of rents, royalties, and bonuses received from leases in the NPR-A in FY12 was $4.8 million (Alaska Department of Revenue 2013).

3.4.4 Land Use

Land Use is governed by a series of laws, regulations, and authorizations that apply to the NPR-A and the proposed GMT1 Project. The numerous NPR-A IAPs with their associated management tools, alternatives evaluation and mitigating measures, seek a balance between energy development and environmental protection. The key elements controlling land use are:

- Naval Petroleum Reserve Production Act of 1976;
- Management and Protection of the NPR-A, 43 CFR 2361;
- Surface and subsurface ownerships;
- Stipulations in federal oil and gas leases;
- IAPs established by BLM for the NPR-A;
- Land Use Plans established by the NSB;
- Critical Habitats and Threatened and Endangered Species designated under the Endangered Species Act;
- Wetlands; and
- Section 106 of the National Historic Preservation Act.

Land ownership in the project study area is both complex and evolving. As explained in the BLM (2004), BLM continues to manage with selections and land ownership options made under the provisions of the ANCSA and ANILCA. The result is a transfer of ownership and management by BLM as part of the NPR-A to private ownerships by the village and regional corporations established by ANCSA. Municipal boundaries exist for the NVN.

What has changed since BLM (2004) is the amount of federal land selected and conveyed to the respective village and regional Native corporations. In February 2010, 17,288 acres of land in the vicinity of the proposed GMT1 and CD5 pads were conveyed under ANCSA to Kuukpik Corporation (surface) and ASRC (subsurface). Due to that conveyance, land ownership in the GMT1 and CD5 project areas is now mixed, with BLM and Kuukpik owning and managing different portions of the surface of the lands involved, and BLM and ASRC owning and managing different portions of the subsurface mineral estate. Land ownership in the project area is presented in Map 1.1-1.

Federal oil and gas leases, permits, or rights of way on selected lands remain under BLM management until the land is transferred. Administration of federal oil and gas leases (subsurface) is waived when the affected subsurface is transferred. Lease stipulations continue to apply to the lessee on conveyed lands; however, only ASRC (as the new lessor) may enforce the lease stipulations on the conveyed lands; BLM no longer has jurisdiction to do so. The mix of land ownership and administration make land use in the project area more complex. See Section 1.1, *Project Location and Land Status*, above for more discussion regarding land ownership.

3.4.4.1 Local Transportation

Transportation facilities were described in BLM (2004, § 3.4.9), with information updated in BLM (2012, § 3.4.10). In the local area surface transportation includes local roads in Alpine and Nuiqsut and seasonal ice and snow roads from the existing oil field gravel road system to Alpine, which typically includes a spur to Nuiqsut. BLM has authorized numerous ice roads and snow trails from Alpine and Kuparuk to exploration drilling sites in the NPR-A. BLM also issues ROWs for NPR-A area wide winter use for transport of items across the tundra with tundra-approved vehicles.

Residents of Nuiqsut use snowmachines and ORV for off-road travel. Air travel is supported by an airport at Nuiqsut and airstrip at Alpine. Helicopter use in the area is an area of concern for the people of Nuiqsut. BLM permittees are required to report to BLM the number and location of take offs and landings made in the NPR-A at the end of the summer. The date, time and location of the take offs and landings are collected; however, BLM does not collect data on take offs or landings outside of the NPR-A, or for flight-tracking. Types of permitted activities in NPR-A include studies for wildlife, fisheries, vegetation, water quality, climate and weather, as well as oil and gas compliance work and cleanup and inspection of winter exploration sites and access routes. The number of permitted flights varies, but has generally risen over the past six years. Generally, the locations of aircraft landings were clustered around scientific and oil and gas development study areas and those areas are likely to change each year as projects are completed and new projects are started. See Map 2.5-5.

A summary of projected new aircraft traffic, including helicopter use, for all alternatives is presented in Chapter 2 flight requirements tables.

Local residents use small boats to access subsistence resources. An existing system of pipelines is associated with the Alpine oil field, including a pipeline spur to deliver natural gas to Nuiqsut.

3.4.4.2 Recreation

The recreation resources of the project study area are described in BLM (2004, § 3.4.7). BLM noted little specific recreation trends in the area. Public access to the project area in 2004 was limited to those who used aircraft to the Nuiqsut Airport or by local residents using snowmachine or all-terrain vehicle (ATV) for cross country travel. There are no federal, state, or NSB recreational developments or facilities. BLM considers the remote project study area to be well suited for non-winter outdoor recreation such as backpacking float boating, fishing, hunting, wildlife viewing, and birding. For recreation to take place or access to occur within the NPR-A it may not interfere with the purpose of the Naval Petroleum Reserves Production Act.

BLM managed lands outside of the boundaries of the NPR-A use a “Recreation Opportunity Spectrum” (ROS) to identify recreation resources. However, as a petroleum reserve this is not applicable to the project area and a class has not been designated. If a class were assigned, it was noted in 2004 that it would be “semi-primitive, motorized” (SPM), e.g., the recreation opportunities are characterized as located in a predominately natural or natural-appearing landscape that has a feeling of remoteness, few user facilities, low road density, and where visitors have infrequent interaction with other visitors. Most recreation uses at that time were directly associated with the Colville River. BLM estimated there were 150 recreation users annually to the project study area with little during the winter (BLM 2004, § 3.4.7, pp.352 and 353).

BLM (2008, § 3.4.6) addresses the reaction and wilderness characteristics of the entire 4.6-million-acre Northeast NPR-A Planning Area. That discussion confirmed the 2004 observations that there is little recreation use of the area other than that associated with the upper Colville River and to a lesser extent the Colville River between Umiat and Nuiqsut. No data specifically relevant to the study area considered in the SEIS were provided.

BLM (2012, § 3.4.6) notes the outdoor recreation resources of the roughly 22.8-million-acre NPR-A remain underused as result of the small resident population, costly access, and lack of facilities. No new data were provided that are specifically relevant to the study area considered in the SEIS.

Wild and Scenic Rivers

There are no designated or proposed Wild and Scenic Rivers located within the project study area (BLM 2012, Map 3.4.7-1).

Wilderness

Only federal ownerships are eligible for Federal Wilderness designation. The BLM (2012, § 3.4.8) describes the wilderness characteristics/values associated federal lands within the entire 22.8-million-acre NPR-A. BLM is required to manage all lands recommended for wilderness designation *"in accordance with the applicable land use plans and applicable provisions of law"* (BLM 2012, § 1.5.1, p. 6).

The project study area is:

- Not located within or near any federally designated Wilderness area; and
- Not located within or near any federal lands previously recommended for Wilderness designation.

BLM concluded that most federal lands further than 5 miles from local communities offer the wilderness characteristics of solitude, opportunities for primitive and unconfined recreation, and that are for the most part natural (BLM 2012, § 3.4.8, p. 451). Wilderness Evaluation Area NPR-A H (Map 3.4.8-1) includes federal lands located in the drainages flowing into the Colville River from the vicinity of Umiat to the vicinity of Nuiqsut. The western parts of the Alpine Field with its associated production facilities are located in the northeastern most of this Wilderness Evaluation Unit.

BLM established a series of planning criteria that includes a determination that the planning effort will not *“consider recommendations for legislation to allow...wilderness designation in NPR-A”* (BLM 2012, § 1.5.2, p. 7). However, the BLM (2013, p. 22) noted that for the benefit of caribou it would not issue oil and gas leases in the southwestern NPR-A and even though wilderness characteristics was not the justification, it would also provide protection for important wilderness character of that area. The project study area is in an area with existing valid federal oil and gas leases. The ROD did not make any recommendations that existing oil and gas leases be cancelled or other wised modified because of wilderness values/character in the project study area.

BLM (2012, § 2.4.1, p.35) notes the planning effort may identify and/or make recommendations regarding possible areas appropriate for Wilderness designation independent of the planning effort. There are no new data on the wilderness values associated with study project study area since completion of the ROD (BLM 2013). The BLM is not considering the NPR-A for wilderness designation.

3.4.4.3 Visual Resources

The visual resources inventory of the project study area described in BLM (2004, § 3.4.8) BLM (2012, § 3.4.9) describes the visual resources of the entirety of the NPR-A in terms of scenic quality, visual sensitivity, and distance zones. The current Visual Resource Management (VRM) Classes of the NPR-A were assigned in BLM (2013). There has been no new data since the ROD was signed in 2013. The VRM system provides a way used by the BLM to analyze potential visual impacts and an opportunity to apply visual design techniques to ensure that any surface-disturbing activities are compatible with the surroundings. The VRM classification system applies only to federal land managed by the BLM and to lands selected but not yet transferred from federal ownership. Although the BLM cannot apply stipulations to non-BLM ownerships, all ownerships outside of villages were included in the VRM Classes and are considered in this SEIS. The project area falls within VRM Class IV with the exception of about 10 acres at the southern most point, which was classified as VRM Class III. Management of visual resources on BLM ownerships are guided by the following objectives:

Class III Objectives

- Partially retain the existing character of the landscape
- Level of change to the landscape can be moderate
- Management activities may attract attention, but should not dominate the view of the casual observer
- Change should repeat the basic elements found in the natural landscape (form, line, color and texture)

Class IV Objectives

- Provide for activities that require major modification of the landscape
- Level of change to the landscape can be high
- Management activities may dominate the view and be the major focus of attention
- Minimize impacts through location and design by repeating form, line, color and texture

Visual modifications in the project study area include the existing oil and gas infrastructure associated with the Alpine Field with buildings, pipelines, a private airfield supporting oil and gas development, and roads. The community of Nuiqsut also has substantial modifications to the visual resources from the homes, businesses, internal community roads, and roads to the dump and the water supply lake, and a public airport. In addition a proposal to construct a spur road connecting Nuiqsut to the existing roads in the Alpine Field and a road to a proposed boat launch on the Colville River are in the permitting process that if approved will further expand modifications to the existing visual resources. It should be noted that the modifications to the visual resources associated with Nuiqsut Spur Road are all on land owned by Kuukpik and not subject to the BLM management objectives described above.

Oil and gas activities considered in the GMTU include winter exploratory drilling from ice pads with primary access supported by ice roads and ice air strips, production facilities on gravel pads, and elevated pipeline systems; all of which would change the existing undeveloped visual character of federal land in the project study area but still be consistent with a VRM Class III and IV. The BLM (2004a) authorized the approval of the proposed GMT1 Project, and BLM (2013) assumes that GMTU and specifically the GMT 1 would be developed under the Stipulations, ROPs, and BMPs described in Section 4.7, *Mitigation Measures and Monitoring*. There has been little change in the existing or prospective use of the project study area for oil and gas or other uses that could impact visual resources of federal land in the project study area that were not considered in BLM (2004; 2004a) and the subsequent authorizations for construction and operation of production facilities in the Alpine Field that were contemplated in 2004. The BLM (2012; 2013) considered the visual resources associated with: the development facilities constructed since 2004, and assumed the GMTU would be developed by both the GMT 1 Project and the conceptual GMT 2 Project. The proposed GMT 1 Project has only been slightly modified since 2004 (see Section 2.1.1, *Summary of Proposed Project Changes from 2004*).

3.4.4.4 Nuiqsut Cultural Landscape

According to the *Guide to Cultural Landscape Reports*, cultural landscapes are *"a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or that exhibit other cultural or aesthetic values"* (Page et al. 1998:12). The Nuiqsut Cultural Landscape, reported by the Iñupiaq village of Nuiqsut and documented by Brown (1979), is a cultural resource that encompasses the proposed GMT1 project study area and was not included in the 2004 ASDP or 2012 NPR-A IAP/EIS. During the late 1970s, Brown (1979, 2001) worked with the village of Nuiqsut to document this landscape described as an "approximation of their core ideas" and representing their "geographic and spiritual homeland." According to Brown (1979), the Nuiqsut cultural landscape has multiple defining characteristics. These characteristics include (Brown 1979:9):

- an area of historical extended use;
- aboriginal trade routes;
- TLUI sites; and
- an area of current (e.g., 1970s) intensive subsistence use.

Regarding the importance of this cultural landscape, Brown (1979:12) stated:

> *"The Nuiqsut cultural landscape is the territory established by ancestors and passed-on by today's families to those of tomorrow. It is a complicated geography that can be shown on a map only if the boundary is a shifting horizon. It is a composite of places and events that people have directly experienced or heard about in songs and stories passed down through generations. Here, in this landscape - recalled in memory culture - is the history, the knowledge, the spirit of thousands of years of Iñupiat experience."*

SRB&A (2013a)[7] reviewed the Nuiqsut Paisanich Cultural Landscape to incorporate new information that contributes to the cultural landscape since Brown's 1979 work. SRB&A (2013a) assessed these characteristics using current documentation standards for cultural landscapes reported in Page et al. (1998). SRB&A chose the following document standards terminology as the equivalent of Brown's landscape characteristics:

- Land Use;
- Circulation;
- Archaeological Sites and Places Associated with Cultural Beliefs or Practices (i.e., Cultural Sites); and
- Cultural Traditions.

SRB&A (2013a) also added "Natural Systems and Features" as they are integral in defining the other landscape characteristics.

Land use includes both historic territories and historic use areas. Circulation features show the historical continuity of movement throughout the landscape by the Iñupiat. Cultural sites consist of locations defined by one or more of the following descriptors: archaeological, ancestral, historic, traditional, sacred, camp, cabin, birthplace, harvest, and subsistence. In addition to artifacts, oral histories, subsistence interviews, and ethnographic narratives, Iñupiaq place names demonstrate cultural ties to these specific locations. Cultural traditions such as subsistence, passing of Traditional Knowledge, trade, and oral histories/storytelling that occur across the landscape are just as integral to community identity as are the locations in which they take place. Natural systems and features (e.g., rivers, bluffs, pingos, wildlife) provide the setting in which cultural activities take place and heavily influence the characteristics of a cultural landscape.

The geographic extent of the cultural landscape is based on the "Historical Extended Use" area documented by Brown (1979) (Map 3.4-3). Cultural sites are identified in Table 3.4-1 and Table 3.4-2 in addition to historic and traditional trails, travel/trade routes, and subsistence use areas.

The cultural resources that comprise the Nuiqsut Cultural Landscape are primarily located along river corridors, particularly Colville River, Itkillik River, and Fish Creek; in an overland area extending west of the community to Fish Creek and beyond to Teshekpuk Lake, and in coastal locations both west and east of the community.

Map 3.3-10 focuses on the proposed GMT1 project study area and the Nuiqsut Cultural Landscape characteristics. As shown in the figure, several important components of the Nuiqsut Cultural Landscape are located within the project study area. These include trails or travel routes extending north and east from the community along Nigliq Channel and Colville River and various sites located along those overland trails and surrounding the Nigliq Channel and Fish Creek. Many of the Iñupiaq cultural sites, trails, travel/trade routes, and other cultural features within the landscape are associated with ongoing multi-generational customary practices that generally occur in similar locations as past historic or traditional practices. The

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[7] SRB&A's (2013a) analysis included data (i.e., trails, travel/trade routes, traditional use areas) from the community of Anaktuvuk Pass because of the cultural relationship between the two communities and overlap of the two communities' traditional use areas in the interior Arctic Coastal Plain and Foothills. However, the cultural resources analysis for the proposed GMT1 project does not include the Anaktuvuk Pass data because it is not a study community for this project.

continuation of these customary practices into current times and at modern sites within the landscape help maintains the Iñupiaq cultural identity and ties to the cultural landscape.

3.4.5 Subsistence

This section describes the affected environment for subsistence resources and traditional land use by the community of Nuiqsut whose residents harvest in and/or rely on resources in the vicinity of the GMT1 development. Because the proposed GMT1 Project has already been evaluated within earlier NEPA documents, namely the BLM (2004), and BLM (2012), this section is tiered off of those documents and focuses on information that is new or updated since those previous EISs. This section includes a general overview of subsistence use patterns for Nuiqsut, including the importance of subsistence, the seasonal round, harvest estimates, and subsistence use areas. Additional detail regarding Nuiqsut subsistence uses, including additional figures and tables, is provided in Appendix G.

3.4.5.1 Study Area

The study area for subsistence includes all areas used by the community of Nuiqsut for subsistence activities because these areas may be directly or indirectly affected by the proposed project. The project study area is defined as a 2.5-mile buffer surrounding the GMT1 Project footprint and is the area where direct impacts may occur, particularly in overland areas where project components are proposed. Indirect impacts may occur in the project study area but may also extend outside the project study area for impacts related to resource availability or hunter avoidance. Additional North Slope communities including Anaktuvuk Pass, Atqasuk, and Barrow also have subsistence use areas located within or near the project study area; however, these use areas within the project study area are located on the periphery of these communities' overall subsistence use areas and the affected environment and environmental consequences for those communities related to broader development are discussed and analyzed in BLM (2004, §§ 3.4.3 and 4A.4.3) and BLM (2012, §§ 3.4.3, 4.3.13, 4.4.13, 4.5.13, 4.6.13, and 4.7.13).

3.4.5.2 Subsistence Definition and Relevant Legislation

Both BLM (2004, §3.4.3.1) and BLM (2012, § 3.4.3.1) provide an overview of the importance of subsistence, definition of subsistence, and relevant legislation governing the regulatory environment in which subsistence activities are permitted under state and federal regulations. In summary, subsistence is recognized as a central aspect of North Slope culture and life and is the cornerstone of the traditional relationship of the Iñupiat people with their environment. Residents of the North Slope of Alaska rely on subsistence harvests of plant and animal resources for nutritional sustenance and cultural and social well-being. Subsistence is not only a source of food for North Slope residents, but the activities associated with subsistence strengthen community and family social ties; reinforce community and individual cultural identity; and provide a link between contemporary Iñupiat and their ancestors. Subsistence customs and traditions encompass processing, sharing, redistribution networks, and cooperative and individual hunting, fishing, gathering, and ceremonial activities. These activities are guided by Traditional Knowledge based on a long standing relationship with the environment. Both federal and state regulations define subsistence uses to include the customary and traditional uses of wild renewable resources for food, shelter, fuel, clothing, and other uses (ANILCA, Title VIII, Section 803, and AS 16.05.940[33]). The Alaska Federation of Natives views subsistence to not only encompass the practices of hunting, fishing, and gathering, but as a way of life that has sustained Alaska Natives for thousands of years and a set of values associated with those practices (Alaska Federation of Natives 2012). A recent U.S. Army Corps of Engineers study (Corps Forthcoming) conducted a literature review of existing subsistence definitions and provided a proposed definition of subsistence, which addressed the economic, social, cultural, and nutritional elements and components of subsistence that have not been emphasized in previous definitions. In part, this definition reads as follows:

> *"Subsistence refers to a way of life in which wild renewable resources are obtained, processed, and distributed for household and communal consumption according to prescribed social and cultural systems and values….*
>
> *…. The subsistence way of life satisfies to various degrees and in various contexts, the economic, social, cultural, and nutritional needs of subsistence-based communities."* (Corps Forthcoming)

The proposed project is located primarily on federal lands within the northeast NPR-A. The pipeline and road components cross federal and Kuukpik Corporation lands, and the ancillary water pipeline between CD1 and CD4 crosses State and Kuukpik Corporation lands. In addition, resources that migrate through the study area, such as caribou, waterfowl, and migratory fish, may be harvested outside of the study area on other state, federal, or private lands. In Alaska, subsistence hunting and fishing are regulated under a dual management system by the State of Alaska and the federal government. Federal subsistence law regulates federal subsistence uses; state law regulates state subsistence uses. The federal government recognizes subsistence priorities for rural residents on federal public lands, while Alaska considers all residents to have an equal right to participate in subsistence hunting and fishing when resource abundance and harvestable surpluses are sufficient to meet the demand for all subsistence and other uses. Subsistence activities on all lands in Alaska, including private lands, are subject to state and federal subsistence regulations. Because the project is located on federal lands, Section 810 of ANILCA is applicable and requires a subsistence evaluation. This evaluation includes findings on the following:

- The effect of such use, occupancy, or disposition on subsistence uses and needs;
- The availability of other lands for the purpose sought to be achieved; and
- Other alternatives that reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 USC §3120).

3.4.5.3 Overview of Subsistence Use Areas

Table 3.4-7 presents a summary of the available subsistence harvest, use area, and seasonal round data for the community of Nuiqsut. Both BLM (2004, § 3.4.3.2) and BLM (2012, § 3.4.3.3) provide a description of Nuiqsut subsistence uses including harvest data, subsistence use areas, and seasonal round. Additional subsistence harvest and use area data not addressed in either of the previous EISs include the NSB subsistence harvest data report for the 1995-1996 and 2000-2001 Nuiqsut study years (Bacon et al. 2009) and Stephen R. Braund & Associates' (SRB&A) (2010b, 2011a, 2012, and 2013b) caribou use area and harvest data from the *Nuiqsut Caribou Subsistence Monitoring Project*. The following sections summarize the BLM (2004) and BLM (2012) descriptions of Nuiqsut's subsistence use area, harvest, and seasonal round data as well as incorporating new information that were not included in the previous EISs. More detailed information on Nuiqsut subsistence use areas, harvest data, and seasonal round are presented in Appendix G.

Table 3.4-7. Data Sources, Subsistence, and Traditional Land Uses

	Harvest Data			Subsistence Use Area Data			
Community	**Study Year**	**Resource**	**Source***	**Study Year**	**Resource**	**Source***	**Seasonal Round**
Nuiqsut	1985	All Resources	ADF&G 2013c	Lifetime to 1979	All Resources	Pedersen 1979	Bacon et al. 2009; Brower and Hepa 1998; Brown 1979; EDAW Inc. 2008; Fuller and George 1999; IAI 1990a; Libbey et al. 1979; RFSUNY 1984 SRB&A 2010a
	1992	All Resources	Fuller and George 1999	Early 1970s	All Resources	Brown 1979	
	1993	All Resources	ADF&G 2013c	1973-1986	All Resources	Pedersen 1986	
	1994-1995	All Resources	Brower and Hepa 1998	1994-2003	Non-Marine	SRB&A 2003	
	1995-1996	All Resources	Bacon et al. 2009	1995-2006	All Resources	SRB&A 2010a	
	2000-2001	All Resources	Bacon et al. 2009	2003-2007	Caribou	Braem et al. 2011	
	2003-2007	Caribou	Braem et al. 2011	2008-2011	Caribou	SRB&A 2010b, 2011a, 2012, 2013b	
	2010- 2011	Caribou	SRB&A 2012, 2013b				

Subsistence Use Area

Map 3.4-1 depicts Nuiqsut contemporary subsistence use areas for several time periods, as documented by Pedersen (1986), SRB&A (2003), and SRB&A (2010a). All three study periods cover a similar area ranging from between Barrow in the west and Kaktovik in the east, and as far south as Anaktuvuk Pass. SRB&A's (2010a) most recent use areas document Nuiqsut residents traveling beyond Atqasuk to Barrow in the west, offshore more than 50 miles northeast of Cross Island, to Camden Bay in the east, and beyond the Colville River in the south. The majority of Nuiqsut 1995-2006 use areas are concentrated around the Colville River, overland areas to the south and southwest of the community, offshore areas north of the Colville River delta, and northeast of Cross Island. Pedersen (1986) and SRB&A (2003) use areas for Nuiqsut are all within the extent of SRB&A (2010a) use areas described above with the exception of the 1973-1986 data extending as far as Kaktovik in the east and Anaktuvuk Pass in the south. All three study periods overlap with the project study area. New subsistence use area data from CPAI's *Nuiqsut Caribou Subsistence Monitoring Project* (SRB&A 2010b, 2011a, 2012, and 2013b) are presented in Map 3.4-2. These four-year data show high use of the Colville River and areas west of the community for caribou hunting during the 2008-2011 study years. Appendix G, Figures G-1 through G-9 display individual, resource-specific, subsistence use areas for available study years in Nuiqsut.

Pedersen's (1979) lifetime (pre-1979) use areas (Map 3.4-3) show Nuiqsut residents utilizing a smaller area than the contemporary subsistence use areas shown on Map 3.4-1 but still an extensive area centered around the community to harvest subsistence resources; reported use areas extended offshore approximately 15 miles offshore, as far east as Camden Bay, south along the Itkillik River, and west as far as Teshekpuk Lake. As part of *Nuiqsut Paisaŋich - Nuiqsut Heritage: a Cultural Plan*, Brown (1979) recorded all resources use areas (Map 3.4-3). For all subsistence resources, the study documented early 1970s use areas that extended south around the Colville and Itkillik river drainages, offshore between Cross Island and Cape Halkett, and in overland areas east and west of the community. Both studies documented a similar extent of use areas as they were conducted during the same study year for the relatively same time period.

Harvest Data

According to the available data, in 1985 and 1993, 100 percent of Nuiqsut households reported using subsistence resources (i.e., harvesting, processing, storing, distributing, preparing, and consuming) and over 90 percent of households participated in subsistence activities (i.e., attempted harvests of subsistence resources). During both years, households most commonly participated in harvests of non-salmon fish, large land mammals, and migratory birds (Appendix G, Table G-1). Data on per capita pounds are available for two study years and range from 399 pounds in 1985 to 742 pounds in 1993. Resources providing the highest percentage of the total harvest vary over the study years; marine mammals (primarily bowhead whale) contributed the highest amount to the total subsistence harvest during 1992, 1995-1996, and 2000-2001; non-salmon fish were the top harvested resource during the remaining three study years (1985, 1993, and 1994-1995). Large land mammals (primarily caribou but also moose) were generally the second or third most harvested resource during all study years. In terms of species, bowhead whales (*aġviq*), caribou (*tuttu*), Arctic cisco (*qaaqtaq*), broad whitefish (*aanaaqłiq*), and moose (*tuttuvak*) were generally the top harvested species during most study years (Appendix G, Tables G-1 and G-2). Other subsistence species that have contributed highly to Nuiqsut subsistence harvests over the study years include seals, geese, Arctic grayling (*sulukpaugaq*), and burbot (*tittaaliq*). Salmon harvests are relatively minor in Nuiqsut; however, according to a recent study sponsored by the Bureau of Ocean Energy Management there is evidence that suggests salmon catches in Nuiqsut are increasing (Carothers et al. 2013).

Seasonal Round

Table 3.4-8 provides seasonal round data based on reports from the 1980s and 1990s; in several cases, the data in Table 3.4-8 conflict with more recent data regarding the timing of subsistence activities. Where applicable, this discussion supplements the data in the table with more recent available data. During the spring (April and May), Nuiqsut residents shift their focus from hunting furbearers to harvesting waterfowl. Beginning in May, residents travel along local rivers to hunt for caribou and offshore from the Colville River delta looking for seals (Table 3.4-8). Caribou harvests occur throughout the year, but with the most intensity during the summer months of June, July, August, and September (Braem et al. 2011; SRB&A 2013b). In addition to traveling inland along the Colville River during the summer for fishing and caribou hunting, residents continue to travel to the ocean to hunt for ringed seals (*qaiġulik*), bearded seals (*ugruk*), and king and common eiders (*qiŋalik, amauligruaq*) during the months of June, July, and August (SRB&A 2010a). Berry and plant gathering also occur during the summer months (Table 3.4-8). Moose hunting takes place, alongside caribou hunting, in August and September along river hunting areas south of Nuiqsut (Fuller and George 1999). Bowhead whaling usually occurs in September when whaling crews are stationed at Cross Island with preparations for the whaling season beginning in August. The fall month of October is spent fishing and harvesting caribou close to the community. Gill netting, primarily for Arctic cisco, is most productive between October and mid-November. During the winter months, furbearer hunters pursue wolves (*amaġuq*) and wolverines (*qavvik*), target caribou and ptarmigan (*aqargiq*) as needed and available, and fish for burbot through the ice (Table 3.4-8).

Table 3.4-8. Nuiqsut Annual Cycle of Subsistence Activities

	Winter										Spring				Summer						Fall			
Resource	Nov		Dec		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct	
Bowhead Whale	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	■	■	■	■	□	□
Seals	░	░	░	░	□	□	□	□	░	░	■	■	░	□	□	□	□	□	░	░	░	░	□	□
Polar Bear	░	░	░	░	░	░	░	░	░	░	□	□	□	□	□	□	□	□	□	□	░	░	░	░
Birds/Eggs	░	░	░	░	░	░	░	░	░	░	░	░	░	░	■	■	░	░	░	░	░	░	░	░
Caribou	░	░	░	░	░	░	░	░	░	░	■	■	■	■	■	■	░	░	░	■	■	■	■	░
Moose	░	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	░	■	■	■	■
Grizzly Bear	□	□	□	□	□	□	□	□	□	□	□	□	□	░	░	░	░	░	░	░	░	□	□	□
Furbearers	░	░	░	■	■	■	■	■	■	■	■	■	■	■	░	□	□	□	□	□	□	□	░	░
Small Mammals	□	□	□	□	□	□	□	□	□	□	□	□	░	░	░	░	░	░	░	░	░	░	░	□
Freshwater Fish	■	■	■	□	░	░	░	░	░	░	░	■	■	■	□	□	□	□	░	░	░	░	░	■
Berries/Roots/Plants	□	□	□	□	□	□	□	□	□	□	□	□	□	□	░	░	░	░	░	░	□	□	□	□
	□		No to Very Low Levels of Subsistence Activity																					
	░		Low to Medium Levels of Subsistence Activity																					
	■		High Levels of Subsistence Activity																					

Source: IAI 1990a and RFSUNY 1984

3.4.5.4 Subsistence Uses in the Project Study Area

This section describes Nuiqsut's subsistence uses that have been documented within and near the project study area. Examples of subsistence baseline indicators that are useful in characterizing subsistence uses include:

- Subsistence use areas
- Travel method
- Travel routes
- Timing of harvest activity
- Duration and frequency of trips
- Observed change in resources
- Harvest diversity
- Harvest amount
- Harvest participation
- Harvest success
- Harvest sharing
- Harvest effort

The following discussion describes how these indicators can be used in characterizing subsistence uses under three primary categories: (1) Subsistence Use Areas and User Access, (2) Resource Availability, and (3) Community Participation. The data for these indicators are all drawn from information that has been presented in Section 3.4.5.4 and in Appendix G. Data specific to the project area (e.g., travel method by use area, timing by use area) are not available for all study years.

Subsistence use areas refer to the locations in which subsistence users search for and harvest subsistence resources. Use of an area for subsistence purposes is dependent on being able to access the area and have subsistence resources that are available in the area. Subsistence use areas can range from small fishing locations to expansive overland caribou hunting areas and vary greatly in size depending on the targeted resource. Besides mapped data of these use areas, other key subsistence baseline indicators that are useful in characterizing subsistence use areas include months of use, and frequency and duration of trips. User access refers to the method of transportation and travel routes that are used to access subsistence use areas. Methods of transportation and travel routes are factors in determining the size and location of areas that subsistence users harvest from. Communities with residents who can afford airplanes, for example, may access a larger area, while communities with residents with more limited means of transportation (e.g., four-wheelers) or less funds often subsist within a small use area near the community.

Resource availability describes the subsistence resources that are available within the study area or that move through the study area and are later harvested in other areas. Successful subsistence harvests depend on continued resource availability in adequate numbers and health in traditional use areas. Key subsistence indicators that characterize resource availability include per capita and household harvest amounts, harvest numbers, percent of households attempting to harvest and harvesting, and harvest diversity. Habitat areas for subsistence resources are also important in characterizing resource availability. In some cases, habitat areas may be located outside the range of a community's subsistence use areas, yet these areas are still important to resource availability because resources may move or migrate through these habitat areas and later be harvested within a community's subsistence use area. Traditional Knowledge is an important source of information that is useful in characterizing existing resource availability, resource changes, and habitat areas.

Community participation refers to the levels of existing community involvement in subsistence activities. Participation in subsistence activities promotes the transmission of skills from generation to generation, and sharing strengthens community cohesion within and among communities in the region and provides for an extensive distribution network of subsistence foods. Because Alaska Native culture is integrally tied to subsistence activities, higher levels of participation provide more opportunities for community members to pass on their Traditional Knowledge and cultural values to younger generations. These levels of involvement or participation are most often described using baseline indicators of percent of households or harvesters using, attempting to harvest, and sharing subsistence resources.

Sources of data that inform the above-described indicators for Nuiqsut include harvest data from the NSB, ADF&G, and SRB&A, and subsistence mapping studies such as Pedersen (1979), SRB&A (2003), SRB&A (2010a), and SRB&A (2010b, 2011a, 2012, and 2013b). Data from these harvest and subsistence mapping studies have been provided and/or discussed in the previous sections and selected indicators, based on data availability, are included in the following section as relevant to the project study area.

Subsistence Use Areas and Access

The project study area overlaps with the Nuiqsut subsistence use areas. Table 3.4-9 indicates which types of subsistence use areas for Nuiqsut overlap with the project study area by resource. According to these data, residents of Nuiqsut use the project study area for subsistence harvest activities for nearly all types of subsistence resources including large land mammals, furbearers and small land mammals, fish, migratory birds, ptarmigan, and vegetation. Marine mammals use areas also intersect the project study area; however, these use areas begin in the Colville River and extend to offshore areas. See Appendix G, Figures G-2 through G-9 for maps depicting resource category use areas overlapped by the project study area.

Table 3.4-9. Use Areas Overlapping Project Study Area by Resource Category

Resource Categories	Nuiqsut Use Areas Overlapping Project Study Area
Moose	X
Caribou	X
Other Large Land Mammals	X
Furbearers & Small Land Mammals	X
Marine Mammals[a]	X
Fish	X
Migratory Birds	X
Ptarmigan	X
Vegetation	X

Sources: Brown 1979, Pedersen 1979 and 1986, SRB&A 2003 and 2010a

Notes:

Not all studies addressed each of the resource categories listed in this table.

[a] Marine mammal subsistence use areas begin in Colville River and extend to offshore areas.

Several sources also provide specific data on the timing and method of transportation of Nuiqsut subsistence activities in the project study area. A subsistence mapping project conducted in Barrow, Kaktovik, and Nuiqsut provided data on all resources[8] subsistence use areas by month and travel method (SRB&A 2010a); in addition, an ongoing *Nuiqsut Caribou Subsistence Monitoring Project* (SRB&A 2010b, 2011a, 2012, and 2013b) provides similar data specific to caribou uses by month and travel method. The reader should keep in mind that the information presented in this *Subsistence Use Areas and Access* section is specific to activities that occur within the project study area (Maps 3.4-1 and 3.4-2). Thus, any activities that occur outside of the specific project study area polygon are not included in the discussion.

The project study area is a 2.5-mile buffer of the four project alternative footprints, including infrastructure that is east of the already–approved CD5 development and in areas of existing infrastructure between CD1 and CD2. Except for a new pipeline between CD1 and CD4N that is parallel to an existing pipeline, the only areas of new infrastructure proposed for GMT1 occur west of CD5, in an area that is not directly accessible by boat. The project study area includes a portion of the Colville River that is commonly accessed by boat and used for subsistence, but will not be directly affected by new infrastructure associated with GMT1. While boating activities may be affected indirectly through changes in resource availability (see the discussion of Resource Availability below), direct impacts (occurring at the same time and place) on subsistence use areas will be limited to inland areas that are not accessed during boating activities. Therefore, in order to focus on current subsistence uses within areas of new infrastructure associated with the proposed project and to most accurately represent the directly affected use areas by excluding boat based subsistence activities, the analysis of uses within the project study area for *Months of Use* and *Method of Transportation* excludes

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[8] SRB&A 2010a interviews reported information for the following resources: caribou, moose, bowhead whale, Arctic cisco, Arctic char/Dolly Varden, broad whitefish, burbot, geese, eider, ringed seal, bearded seal, walrus, wolf, and wolverine. Other resources such as ptarmigan, polar bear, vegetation, or other types of non-salmon fish and salmon were not documented and thus project area specific data are not available for these resources.

subsistence use areas that are accessed by boat. Instead, these sections provide data on subsistence use areas within the project study area that are accessed by other modes of transportation such as snowmachines and four-wheelers.

During their subsistence mapping project, SRB&A (2010a) documented a total of 758 use areas that characterized the 1995-2006 subsistence use areas of 33 active and knowledgeable Nuiqsut subsistence harvesters. In total, 335 of the 758 individual use areas (approximately 44 percent) documented for the 1995-2006 time period (SRB&A 2010a) overlapped with the project study area (Table 3.4-10). Excluding use areas accessed by boat, a total of 234 overland use areas (31 percent) overlapped with the project study area. Each use area represents the area in which an individual Nuiqsut respondent searched for a particular resource; areas vary in size depending on the resource being targeted and can range from a small net site for Arctic cisco to large overland areas covering many square miles in search of resources such as caribou or wolf and wolverine. Data from the *Nuiqsut Caribou Subsistence Monitoring Project* (SRB&A 2010b, 2011a, 2012, 2013b) recorded 733 caribou use areas over the four study years. Of these 733 use areas, 627 (86 percent) are overlapped by the project study area; 164 (22 percent) caribou use areas overlapped overland use areas (i.e., non-boat use areas) within the project study area.

Table 3.4-10. Sources of Project-Specific Subsistence Use Area Information

Source	Resource Type	Time Period	Total Number of Use Areas	Total Number (%) of Use Areas in Project Study Area	Total Number (%) of Overland Use Areas in Project Study Area
SRB&A 2010a	All Resources	1995-2006	758	335 (44%)	234 (31%)
SRB&A 2010b, 2011a, 2012, and 2013b	Caribou	2008-2011	733	627 (86%)	164 (22%)

Table 3.4-11 shows the percentage of Nuiqsut respondents reporting overland use areas within the project study area for the 1995-2006 time period (SRB&A 2010a). Overall, 100 percent of Nuiqsut active harvesters interviewed for the 1995-2006 time period reported overland use areas encompassed by the project study area. Of these respondents, 85 percent reported caribou hunting in the project study area, the highest of any single resource. Both Arctic cisco and geese use areas within the project study area were reported by 76 percent of respondents followed closely by wolf and wolverine (approximately 70 percent). Nearly half of respondents reported burbot use areas in the project study area. Both Arctic cisco and burbot use areas in the project study area are accessed by snowmachine along the Colville River or overland via the frozen tundra. No other resources documented during the study had greater than 10 percent of respondents reporting use areas within overland areas crossed by the proposed project.

Table 3.4-11. Percent of Nuiqsut Harvesters Using Project Study Area – Overland Use Areas Only

Resource Category	Percent of Nuiqsut Respondents
Caribou	85%
Arctic Cisco	76%
Geese	76%
Wolverine	70%
Wolf	67%
Burbot	45%
Broad Whitefish	9%
Eider	6%
Moose	3%
Arctic Char/ Dolly Varden	3%
Percent of Total Harvesters Using Study Area	100%
Total Number of Respondents Interviewed in Study	33%

Source: SRB&A 2010a

Note: SRB&A 2010a did not collect data on other resources except for marine mammals. Marine mammal subsistence use areas begin in Colville River and extend to offshore areas.

Months of Use

Figure 3.4-1 shows the percentage of overland use areas in the project study area, by month, as documented in SRB&A (2010a) for Nuiqsut. According to these data, overland uses of the project study area by Nuiqsut residents occur year-round, with the greatest peak of activity occurring in the winter from October to through May with lower levels of activity in June, July, August, and September.

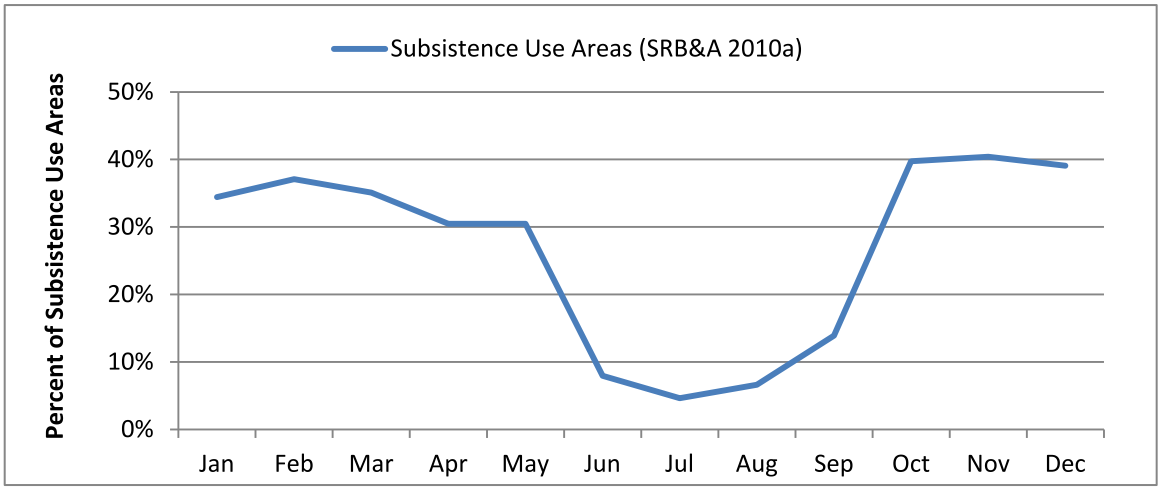


Figure 3.4-1. Overland All Resources Subsistence Use Areas by Month in Project Study Area – 1995-2006

Figure 3.4-2 and Figure 3.4-3 provides a specific depiction of the timing of caribou subsistence activities within the project study area (SRB&A 2010a, 2010b, 2011a, 2012, and 2013b). According to these data, Nuiqsut harvesters (similar to their all resources use areas) access the project study area for caribou hunting primarily during the winter months. Months of caribou hunting activities collected during the *Nuiqsut Caribou Subsistence Monitoring Project* (Figure 3.4-3) display a slight shift in the timing of caribou hunting activities in the project study area with a smaller percent of caribou use areas in the project study area accessed during the winter months, and a slightly higher percentage (from 25 percent to 30 percent) accessed in September. August caribou hunting activity also increased slightly during the study years for the caribou monitoring project (Figure 3.4-3) compared to the SRB&A 2010a study years (Figure 3.4-2). Possible explanations for this shift include documentation of the use of four-wheelers by younger Nuiqsut hunters, an activity that occurs primarily during August and September. Another possible explanation could be more caribou being available in the project study area during August and September. In either case, the available data do not provide a definitive answer as to the reason for the shift.

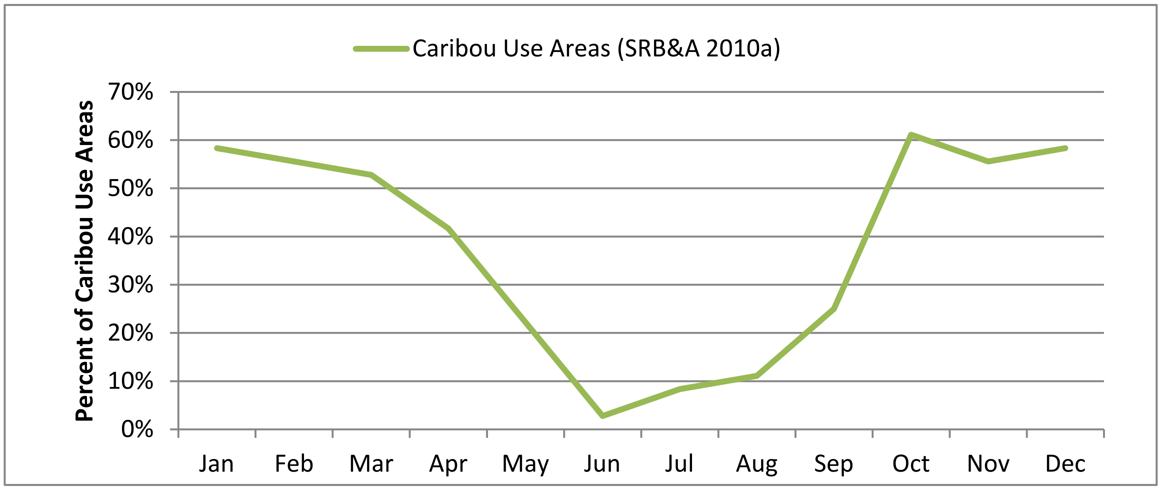


Figure 3.4-2. Overland Caribou Subsistence Use Areas by Month in Project Study Area – 1995-2006

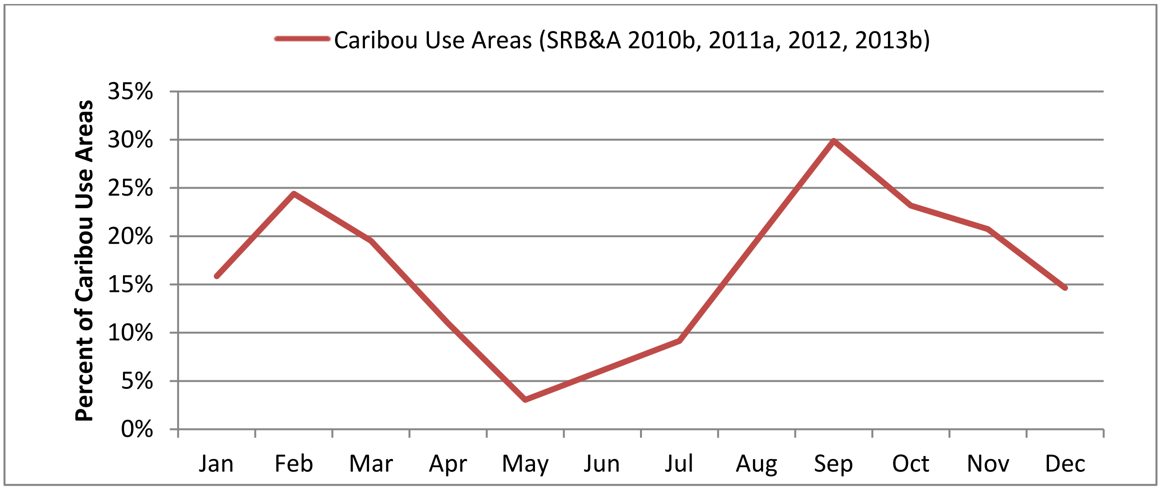


Figure 3.4-3. Overland Caribou Subsistence Use Areas by Month in Project Study Area – 2008-2011

As shown in Table 3.4-12, use of the project study area occurs for various resources at differing times of the year. As defined by total number of use areas, geese hunting, caribou hunting, Arctic cisco and burbot fishing, and wolf and wolverine hunting are the primary activities that occur in the project study area. As discussed above, overland caribou hunting occurs year-round in the project study area with the greatest number of use areas accessed during late fall and throughout the winter (September to April), when travel by snowmachine and four-wheeler is most common. Wolf and wolverine hunting also peaks during the winter particularly from January through March. Geese hunting within the project study area primarily occurs during May. Fishing primarily occurs for Arctic cisco and burbot with the peak of Arctic cisco harvesting occurring in October and November in the Colville River and burbot fishing occurring throughout the winter particularly from November through February. Other documented hunting activities are more limited within the project study area and include Arctic char and broad whitefish fishing (five use areas), eider hunting (two use areas), and moose hunting (one use area).

Table 3.4-12. Nuiqsut Months of Use in Project Study Area[1] - Overland Use Areas Only

Resource Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Use Areas
Arctic Char/ Dolly Varden							■	■	■	■	■		1
Arctic Cisco									░	■	■	▩	36
Broad Whitefish					▩	■	■	■	■	▩	▩		4
Burbot	■	■	▩	▩					░	▩	■	■	19
Caribou	■	■	■	▩	░	░	░	░	▩	■	■	■	36
Eider					■	■							2
Geese				░	■	░							42
Moose								■					1
Wolf	■	■	■	▩						░	▩	▩	27
Wolverine	■	■	■	▩						░	▩	▩	29
■	50-100% of Use Areas												
▩	25-49% of Use Areas												
░	1-24% of Use Areas												

Source: SRB&A 2010a

[1] Does not include use areas accessed by boat in order to capture the timing of overland travel in the project area.

Method of Transportation

Residents of Nuiqsut access the project study area using various modes of travel. Figure 3.4-4 shows the percentage of all resources use areas overlapping the project study area by reported method of transportation based on SRB&A 2010a. As shown in this figure, snowmachines are the most common mode of travel to the project study area. Less than 7 percent of use areas in the project study area were accessed by four-wheelers, planes, or foot. As mentioned above this analysis excludes use areas accessed by boat, as the area where new infrastructure is proposed is primarily accessed using overland methods of travel such as snowmachine and four-wheeler.

When viewing use area data specific to caribou for the same 1995-2006 study period, Nuiqsut residents reported using similar methods of transportation in the project study area, with snowmachine the primary mode of transportation and limited use of all other travel methods (Figure 3.4-5). During the Nuiqsut Subsistence Caribou Monitoring Project for the 2008 through 2011 study years, Nuiqsut residents reported the greatest percent of overland caribou use areas were accessed using snowmachine (approximately 60 percent); however, the study reported a much higher percent of use areas in the project study area were accessed using four-wheeler (36 percent) compared to the 1995-2006 study period (6 percent) (Figure 3.4-5). This is consistent with the higher percentage of caribou use areas accessed in September than in previous studies (Figure 3.4-3); overland travel in September is generally limited to four-wheeler.

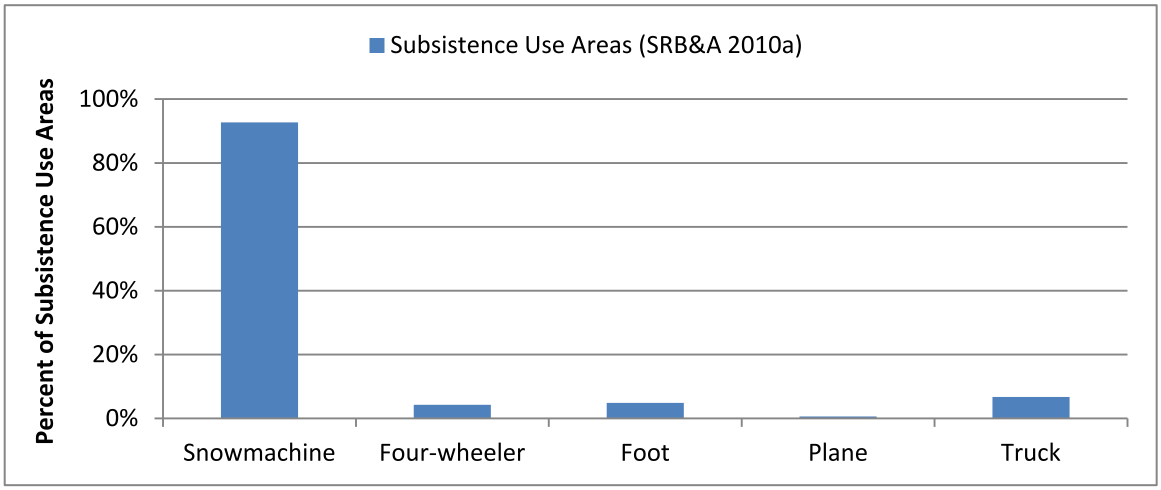


Figure 3.4-4. **All Resources Subsistence Use Areas by Method of Transportation in Project Study Area**

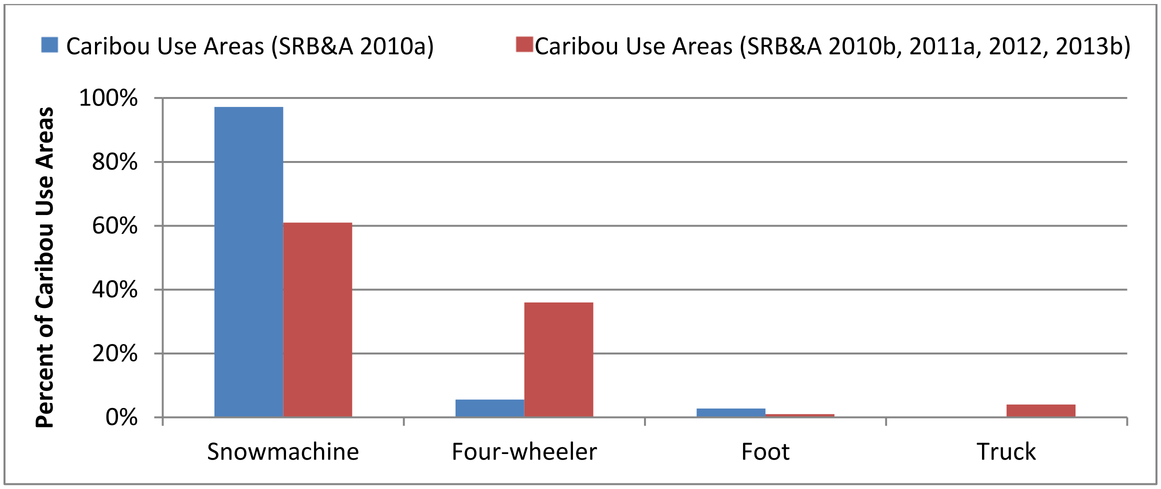


Figure 3.4-5. **Caribou Subsistence Use Areas by Method of Transportation in Project Study Area**

Figure 3.4-6 shows the types of travel method used to access caribou subsistence use areas within the project study area, by month. All resource travel method by month data are not available from the SRB&A 2010a study; however, as Figure 3.4-4 shows the majority of travel method to the project study area is by snowmachine, which typically occurs from October to May. Specifically for caribou, Nuiqsut respondents reported using snowmachine during the winter (October to April) and four-wheeler during the summer and fall (June to October) to access the project study area during the 2008 through 2011 study years (Figure 3.4-6).

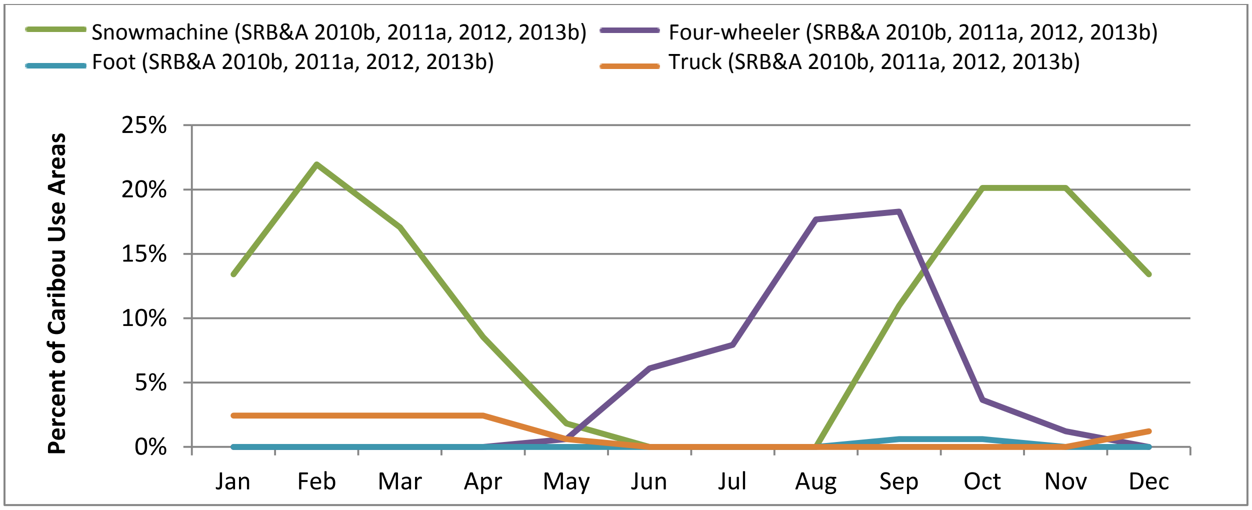


Figure 3.4-6. Travel Method by Month in Project Study Area – Caribou Only

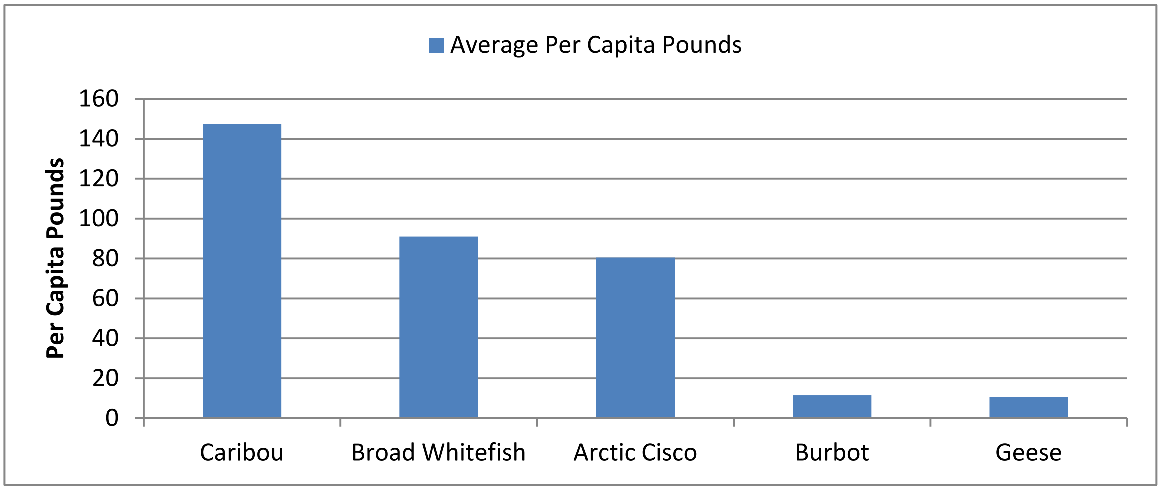
Map 3.3-10 depicts travel routes that have been documented for Nuiqsut based on SRB&A 2010a interviews. Multiple travel routes within the project study area have been reported by residents of Nuiqsut. The majority of these travel routes head northwest of the community towards the coast and Barrow. The Nigliq channel of the Colville River is also a heavily utilized travel corridor to access use areas in the Colville River delta, Beaufort Sea, and Fish and Judy creeks.

Resource Availability

As noted above, a key indicator of resource availability is per capita harvests within a community. Increases or decreases in these numbers may indicate an increase or decrease in the availability of subsistence resources to local harvesters. This discussion focuses on providing baseline indicator data for seven primary subsistence resources harvested within the entire project study area including the Colville River area. These resources are as follows: caribou, geese, Arctic cisco, burbot, broad whitefish, wolf, and wolverine.

Figure 3.4-7 shows the average pounds per capita for five of the key resources (caribou, geese, Arctic cisco, broad whitefish, and burbot). These data represent total harvest from all subsistence areas based on data presented in Appendix G; per capita data are not available specifically to the project study area. Because pounds per capita are generally not applied to furbearers and small land mammals, wolf and wolverine were excluded from the figure. Despite the limitations, these data are still useful for describing the relative importance of these key subsistence resources for Nuiqsut in terms of edible pounds.

According to Figure 3.4-7, the average per capita harvest of caribou was 147 pounds, the highest of the five key resources harvested in the project study area. Harvests of broad whitefish and Arctic cisco were similar with an average of 91 and 81 per capita pounds for each resource respectively. The Colville River is a particularly productive spawning and overwintering area for both broad whitefish and Arctic cisco. During years when the Arctic cisco run is strong, this resource may provide a substantial portion of the yearly harvest for Nuiqsut. Burbot and geese contributed a lower amount at just over 10 pounds per capita.



Source: See Appendix G, Table G-2 for individual data and references.

Figure 3.4-7. Per Capita Pounds Harvested for Key Resources – All Study Years

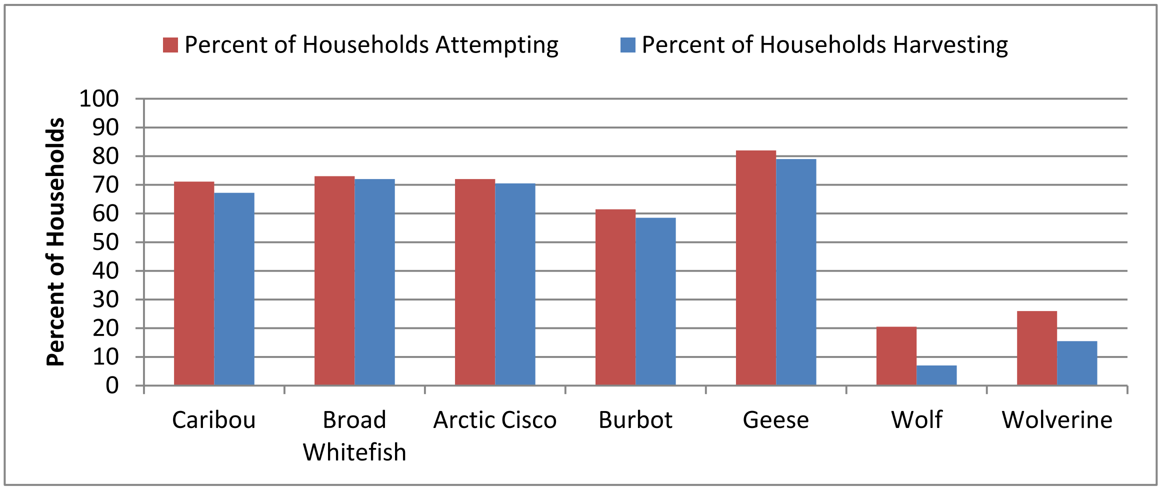
Data from the *Nuiqsut Caribou Subsistence Monitoring Project* provide project study area specific harvest data that show the percent of the caribou harvest that came from the project study area by study year (Table 3.4-13). These data only represent the harvests reported by the interviewed respondents and are not based on the total community harvest. For the four study years (2008-2011), 17 to 37 percent of the respondents' caribou harvest came from harvest sites located within the project study area. In general, the four years of data show an increasing percentage of the caribou harvest coming from locations within the project study area. One possible reason for this increase includes increased documentation of younger hunters over the study years (SRB&A 2012: Table 4). These younger hunters are more likely to access overland areas by four-wheeler, such as those areas located within the project study area. Another reason for this increase could be due to the effect of increased development activity in the Colville delta and a shift of residents hunting patterns to areas west of the community where the proposed project is located. Over the four study years (2008-2011), the *Nuiqsut Caribou Subsistence Monitoring Project* has documented an increase in the percentage of harvests occurring in the area west of Nuiqsut, and a decrease in the percentage of harvests occurring along Nigliq Channel (SRB&A 2013b). In 2011, nine percent of households in Nuiqsut said they avoided the Alpine area altogether because they believe they may experience impacts in the area (SRB&A 2012: 79, Table 41).

Table 3.4-13. Percent of Caribou Harvested in the Project Study Area

Caribou Study Year	Percent of Harvest in Total
2008	17%
2009	26%
2010	24%
2011	37%

Source: SRB&A 2010b, 2011a, 2012, and 2013b

Other indicators of resource availability include the percent of households attempting to harvest a particular resource and the percent of households that are successful. In general, the percentage of Nuiqsut households that successfully harvested a resource is comparable to the percentage of households attempting to harvest resources including caribou, broad whitefish, Arctic cisco, burbot, and geese (Figure 3.4-8). SRB&A (2013b:59) reported that data from the four year (2008-2011) monitoring study indicate an increase in the percentage of respondents who believed they had harvested enough caribou during the previous 12 months. Certain resources such as burbot and geese, although not yielding a high number of per capita pounds (12 and 11 pounds per capita, Figure 3.4-7), have a high percent of households (62 and 82 percent respectively) that participate in the activities. Wolf and wolverine show a greater disparity between the percentage of households attempting harvests and the percentage of households reporting successful harvests, indicating that overall success rates for these resources is lower than for other key resources harvested in the project study area (Figure 3.4-8), which is generally the case for wolf and wolverine in all harvest areas. However, the two indicators presented in Figure 3.4-8 do not provide information on whether the households harvested enough to meet their needs and/or how much effort (e.g., number of trips, duration of trip, costs) was expended in order to harvest the target resource. The table shows, in general, Nuiqsut households that attempt to harvest key resources are successful in doing so.



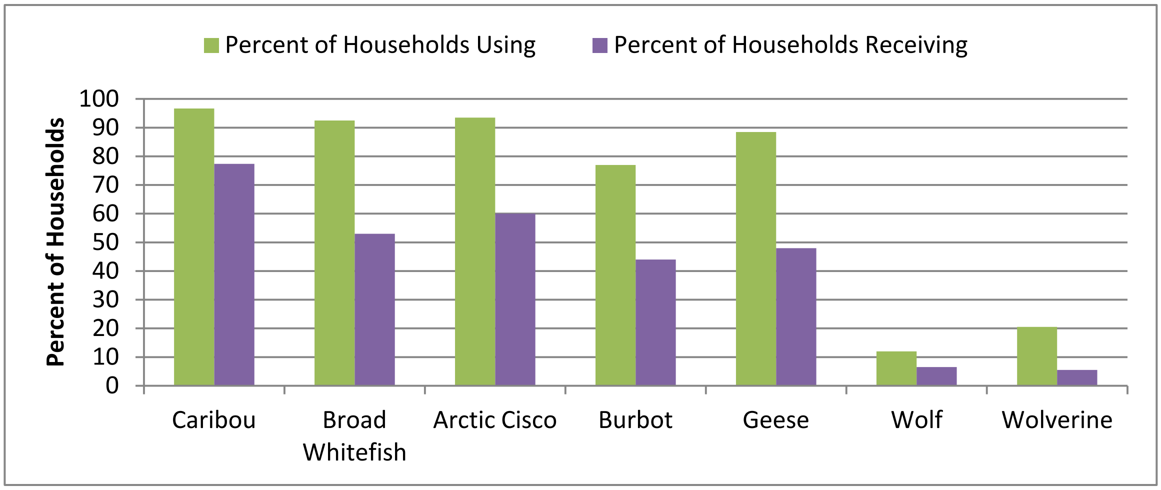
Source: See Appendix G, Table G-2 for individual data and references.

Figure 3.4-8. Harvesting and Attempting to Harvest for Key Resources – All Study Years

Community Participation

As noted above, key indicators of community participation include percent of households using, attempting to harvest, and sharing subsistence resources. This discussion focuses on providing community participation baseline indicator data for the seven key resources harvested within the project study area: caribou, geese, Arctic cisco, burbot, broad whitefish, wolf, and wolverine. Figure 3.4-9 shows the average percentage of households reporting using and receiving resources. Similar to per capita pound data, the data represent all community harvests; data for percent of households using and receiving resources are not available specifically to the project study area. According to the figure, the greatest percentage of households reported using caribou, broad whitefish, and Arctic cisco (greater than 90 percent). A high number of households also reported using geese (89 percent) and burbot (77 percent). Furthermore, caribou hunting, broad whitefish and Arctic cisco fishing, and geese hunting are subsistence activities that are conducted by a large percent of Nuiqsut households (between 70 and 80 percent, Figure 3.4-8). Among the key resources harvested in the project study area, wolf and wolverine use was reported among the fewest households.

Sharing of these key resources is high among all households, particularly for caribou which had an average of nearly 80 percent of households receiving the resource. Fish and geese are also shared among an average of 40 to 60 percent of households. Wolf and wolverine, which are not harvested primarily for consumption, are shared less often.



Source: See Appendix G, Table G-2 for individual data and references.

Figure 3.4-9. Percent of Households Harvesting Key Resources – All Study Years

3.4.6 Public Health

3.4.6.1 Community Health and Welfare

The BLM (2012) contains a detailed discussion regarding analysis of public health status in the NSB based on demographic and health information through 2010. The following discussion of community health and welfare is tiered to BLM (2012, § 3.4.12, Public Health). The BLM (2012) considers all eight villages of the NSB as well as other villages of the Northwest Arctic Borough. Therefore, the focus was broader than for the proposed GMT1 Project, which is more narrowly focused on the community of Nuiqsut.

Concurrently, in 2012 the NSB released the Final Baseline Community Health Analysis Report (McAninch 2012). The information contained in the Analysis Report was incorporated into BLM (2012), thus the BLM (2012) represents the most current published information on community health in the NSB. The McAninch (2012) report provided the basis for the following discussion, which augments BLM (2012, Public Health).

The earlier EIS prepared by BLM (2004) provides a community health and welfare discussion that is brief and of relatively broad scale, yet it provides relevant general information when evaluating trends over time. This discussion is provided in BLM (2004, § 3.4.1.5).

The BLM (2012) relied on three major sources of data:

- 2010 North Slope Borough Economic Profile and Census;
- 2012 Final Baseline Community Health Analysis Report (McAninch 2012); and
- Alaska Native Epidemiology Center 2008 Regional Health Profile, Maniilaq service area (Alaska Native Tribal Health Consortium 2008).

Based on information in these sources, the population of Nuiqsut is approximately 424, of which 89 percent are Iñupiat or other Native Alaskan. The median age of residents of Nuiqsut is 23.8 years, which is younger than all but two North Slope villages, and more than eight years younger than the median age of Kaktovik residents, the village with the oldest median age (BLM 2012, Table 3-44, page 490).

The BLM (2012) addressed the community health status for each of the eight North Slope villages for many parameters, including:

- Biomedical Health Outcomes
  - general health indicators
  - chronic diseases
  - infectious diseases
  - nutrition
  - injuries
  - social pathologies and mental health
  - maternal and child health
  - health disparities
- Health Determinants
  - income and employment
  - subsistence participation and diet
  - housing
  - education
  - health care services
  - motor vehicle safety
  - public utilities and services
  - alcohol and drug misuse
  - smoking
  - physical activity
  - culture and language
  - environmental contamination
- Public health and climate change.

As stated in BLM (2012, p. 487):

> *"…the main health conditions that burden the population in the affected environment are the same ones that are seen elsewhere in Alaska and the U.S.: cancer, heart disease, respiratory diseases and intentional and unintentional injury, overweight/obesity and diabetes. Overall, the rates of these illnesses are higher in the affected environment than elsewhere in Alaska and the U.S., although conditions have been improving over the last few decades, and gains continue to be made."*

The document makes an important clarification on p. 488:

> *"what is important to note…is that the factors that are most relevant for disease generation in this population are not necessarily the same as those that apply to populations elsewhere. The unique physical, cultural, and social environment of northern Alaska determines the level of health of the population and of individuals."*

The health determinants bulleted above represent those that play a critical role in supporting or undermining the health of the population (McAninch 2012).

In both Alaska overall and the NSB specifically, the leading causes of death are cancer, heart disease and accidents/injuries. Among chronic diseases, high blood pressure (20 percent) and arthritis (21 percent) are the most frequently reported across the NSB. This is a lower rate of high blood pressure than across all Alaska (26 percent). Infection rates of sexually transmitted diseases (STDs) have increased recently, and the rates are substantially higher in the NSB than the Alaska average. The rates are higher for Native Alaskans than for non-Natives (BLM 2012, p. 495). Motor vehicle accidents represent the single leading cause of unintentional injury deaths in the NSB, with a rate three times that for all of Alaska (BLM 2012, p. 508). Lung cancer incidence is exacerbated by the high smoking rate in the NSB; 49 percent of adults smoke tobacco compared to 21 percent for all Alaska (BLM 2012, p. 510).

The highlights of *Final Baseline Community Health Analysis Report* (McAninch 2012) relevant to the Nuiqsut community are provided below.

- More than three-quarters (79 percent) of Nuiqsut heads of household reported their health to be at least good, with 21 percent reporting fair to poor health, generally consistent with the other North Slope villages. The percentage of Nuiqsut adults reporting to have very good to excellent health (39 percent) was lower than adults statewide (56 percent) (BLM 2012, Table 3-45, p. 492).
- General health status as reported among Nuiqsut children was worse than among children in the other North Slope communities overall, and this difference persisted when looking only at Iñupiat children. 16 percent of Nuiqsut children had fair to poor health, relative to the NSB average of 6 percent. The percentage of Nuiqsut children with reported very good to excellent general health (55 percent) was less than the North Slope average of 63 percent (McAninch 2012, p. 297) and considerably lower than the statewide estimate of 89 percent (BLM 2012, Table 3-45, p. 492), but higher than the

North Slope communities of Atqasuk (38 percent), Anaktuvuk Pass (41 percent), and Wainwright (54 percent; McAninch 2012).

- A recent study on air quality in Nuiqsut, the village closest to oil development activity, did not report evidence of air pollution at levels expected to have significant health impacts. This information is based on annual data compiled by the EPA, which lists the air quality index for Nuiqsut of 99 (on a scale of 100). This indicates that air quality in Nuiqsut is extremely good. However, many residents believe that Nuiqsut has higher rates of asthma than other communities due to industry. These data do not support such concerns.
- Rates of chronic ear infections and breathing problems among Nuiqsut children were not significantly different from other NSB communities combined (McAninch 2012, p. 297).
- Tobacco smoking among teens (as reported by the household) was notably and significantly more common in Nuiqsut (43 percent) than the rest of the North Slope communities overall (16 percent; McAninch 2012, p. 297).
- Reported adult tobacco smoking was high, significantly higher than in the rest of the North Slope communities combined and almost three times the statewide adult smoking rate (McAninch 2012, p. 297).

Oil and gas revenues have created jobs, provided money for essential services and infrastructure, and raised the average household income. However, the influx of outsider interests and money can create conflict, alter social structure, and divide communities, affecting community health.

Almost half (44 percent) of Iñupiat village residents have reported concerns that fish and animals may be unsafe to eat due to environmental contamination. Regardless of the actual exposure, if any, to environmental contamination, the perception of contamination may result in stress and anxiety about the safety of subsistence foods and avoidance of subsistence food sources, with potential changes in nutrition-related diseases as a result. These health impacts (perceived or real) arise regardless of whether or not there is any contamination at levels of toxicological significance; the impacts are linked to the perception of contamination, not to measured levels. This important discussion (BLM 2012, p. 512) suggests that impacts can occur in the absence of significant chemical release, based only on perception of a potential threat.

The *Final Baseline Community Health Analysis Report* (McAninch 2012) provides an extensive discussion of factors that are anticipated to impact the health of NSB residents. These factors are categorized as likely having either positive, negative, or mixed impacts on public health. Those considered to have positive impacts include:

- Participation in subsistence lifestyle and diet;
- Support and promotion of Iñupiaq culture and language;
- Increase in education levels;
- Availability of health, social, emergency, and public safety services, and having health insurance coverage;
- Improvements in water and sanitation infrastructure;
- A local economy with below-average unemployment and poverty rates, and above-average median household income;
- Self-determination: civic participation and advocacy;

- Restrictive alcohol policies;
- Tobacco taxes and indoor air quality laws (i.e., second-hand smoke); and
- Youth that are connected and engaged with their schools and communities.

The first two bullets above are those health factors with the most potential to be negatively affected by local development that occurs within a community's subsistence harvest area. However, the next four bullets could also increase through development, leading to positive impacts on health relative to baseline conditions. The other three bullets are unlikely to be substantially affected by development.

Conversely, several factors are anticipated to negatively impact public health:

- High rates of tobacco use;
- High levels of food insecurity and difficulty accessing food for healthy meals;
- Difficulty accessing health services;
- Historical and multi-generational trauma (such as epidemics, forced removal of children to boarding schools, and other traumatic events that lead to multigenerational grief and victimization);
- Drug and alcohol addiction;
- Child neglect and abuse;
- Education: high drop-out and low graduation rates;
- Environmental issues (e.g., climate change, contaminants);
- High consumption of sodas and sweetened beverages;
- Insufficient levels of physical activity;
- Low utilization of safety practices (e.g., helmets, seat belts); and
- Poverty and unemployment.

Most of the factors listed above are cultural, lifestyle, and rural living factors. The more a community can focus on facilitating efforts leading to positive factors, the greater the likelihood that negative factors will be reduced.

Climate change has also been shown to have some impact in the NSB, including erosion problems, less reliable ice conditions, and higher risk to hunters and spring whalers. The NPR-A IAP (BLM 2012 p. 513) concludes that climate change will likely result in rapidly changing physical environmental and health conditions for the NSB population in the coming years. Climate change may affect both subsistence food availability and storage and may increase risks associated with subsistence activities, which in turn may lead to dietary and cultural change. Climate change can also affect water, sanitation, housing, transportation infrastructure, cultural continuity, community stress levels, the spread of infection, and even the types of diseases and infections to which the population is susceptible (Arctic Climate Impact Assessment 2004, Brubaker et al. 2010, Brubaker et al. 2011).

Finally, the following factors are considered to likely have mixed impacts:

- Oil and gas development;
- Employment opportunities; and
- Income level and distribution.

Specific to oil and gas development, the McAninch (2012, p. 45) report provides the following commentary:

> *"The health impacts of oil and gas development in the NSB are complex, as it has touched many aspects of community life in the region. Following the formation of the North Slope Borough, oil and gas revenues have created employment opportunities, provided money for essential services and infrastructure, and raised the average household income. An influx of outside interests and money can also create conflict, alter social structure, and divide communities, affecting community well-being. Real and potential impacts to the environment and subsistence are also ongoing sources of tension and concern. Natural resource development and fossil fuel extraction worldwide has also contributed to the climate change that is disproportionately affecting arctic communities."*

Both positive and negative health factors can result from oil and gas development.

As of 2008, 94 percent of NSB households have modern water and sewer service (BLM 2012, Table 3-45, p. 509). This indicates that the great majority of households drink treated water rather than unfiltered surface water, which typically results in better water quality. This compares to almost 78 percent with modern service for rural communities within the State of Alaska. Of the more than 200 communities in rural Alaska, 34 unserved communities (communities where 55 percent or less of homes are served by a piped, septic and well, or covered haul system) are located mainly in western Alaska and along the Yukon River and its tributaries (ADEC 2014b).

New information not provided in either of the two previous EIS documents was obtained on water quality parameters for water used by the community of Nuiqsut and Alpine population (for comparison). The Alpine population represents a largely non-Native workforce that is located near of the project site, and thus provides a relevant comparison with the Nuiqsut community. The data were obtained for post-treated water rather than raw lake water. This treated water is the same quality as the water taken from the taps in homes. This new information was obtained from the ADEC through personal communication (SLR International, 2013). A summary of the new data obtained is provided below.

In the water supply for Nuiqsut, water quality data indicate sporadic samples of a few inorganic parameters (e.g., fluoride) and one metal (mercury) above the lowest relevant Alaska Water Quality Standards (WQS; 18 AAC 70). The water quality summary shown on Table 3.4-14 is based on the human health consumption of water plus aquatic organisms. This criterion has been revised to reflect the Environmental Protection Agency's RfD, as contained in the Integrated Risk Information System (IRIS) as of April 8, 1998. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case. (EPA's current fish tissue residue criterion [WQS] for methylmercury for human health is 0.3 mg/kg, which is based on a total fish consumption rate of 0.0175 kg/day.) This WQS assumes mercury is present in its more toxic methylmercury form, which is likely true in aquatic organism, but not in water. Data from analysis of one of 12 samples collected from the water supply for Nuiqsut reported a mercury concentration of 0.0002 mg/L.

In the water supply for Alpine, water quality data indicate sporadic samples of a few inorganic parameters (e.g., alkalinity, color) and copper above the lowest Alaska WQS (WQS; 18 AAC70). These elevated concentrations are limited to one or two samples for the inorganic parameters and five for copper (of five analyses).

Overall water quality for Alpine and Nuiqsut are similar, and with few exceptions meet water quality standards for human consumption.

Table 3.4-14. Nuiqsut Drinking Water Quality Summary

Analyte	Frequency of Detection (FOD)[1]	Percent Detected	Range of Detects[2] (Min - Max)	Median of Detected Values	Lowest Alaska Water Quality Standard (WQS)	Number of Samples Exceeding WQS
Gross Alpha						
Combined Uranium	0 / 1	0.0%	0 - 0	--	0.03	1
Gross Alpha, Excl. Radion & U (PCI/L)	1 / 3	33.3%	0.26 - 0.26	0.26	15	--
Gross Alpha, Incl. Radion & U (PCI/L)	1 / 1	100.0%	0.26 - 0.26	0.26	N/A	--
Radium-226 (PCI/L)	1 / 1	100.0%	0.24 - 0.24	0.24	5	--
Radium-228 (PCI/L)	1 / 1	100.0%	0.35 - 0.35	0.35	5	--
Inorganics						
Carbon, Total	0 / 2	0.0%	0 - 0	--	N/A	2
Chloride[3]	1 / 2	50.0%	1.1 - 1.1	1.1	230	--
Color[3] (CU units)	0 / 2	0.0%	0 - 0	--	15	--
Corrosivity[3] (Lang units)	0 / 2	0.0%	0 - 0	--	N/A	2
Cyanide	0 / 12	0.0%	0 - 0	--	0.001	--
Fluoride	7 / 14	50.0%	0.16 - 1.36	0.76	1	2
Foaming Agents (Surfactants)[3]	0 / 2	0.0%	0 - 0	--	N/A	2
Nitrate	2 / 21	9.5%	0.08 - 0.09	0.085	10	--
Nitrate-Nitrite	0 / 14	0.0%	0 - 0	--	10	--
Nitrite	0 / 12	0.0%	0 - 0	--	1	--
pH[3] (pH units)	2 / 2	100.0%	6.1 - 7.1	6.6	5	2
Sulfate[3]	0 / 2	0.0%	0 - 0	--	250	--
TDS[3]	1 / 3	33.3%	602 - 602	602	500	1
Metals						
Antimony, Total	2 / 12	16.7%	0.000171 - 0.004	0.0020855	0.006	--
Arsenic	1 / 21	4.8%	0.000176 - 0.000176	0.000176	0.01	--
Barium	9 / 12	75.0%	0.000434 - 0.05	0.04	2	--
Beryllium, Total	0 / 12	0.0%	0 - 0	--	0.004	--
Cadmium	1 / 12	8.3%	0.0001 - 0.0001	0.0001	0.005	--
Chromium	0 / 12	0.0%	0 - 0	--	0.1	--
Copper, Free[3]	6 / 7	85.7%	0.0031 - 0.119	0.09405	0.0031	6
Iron[3]	0 / 2	0.0%	0 - 0	--	1	--
Mercury	1 / 12	8.3%	0.0002 - 0.0002	0.0002	0.00077	--
Nickel	0 / 12	0.0%	0 - 0	--	0.0082	--

Table 3.4-14. Nuiqsut Drinking Water Quality Summary (Continued)

Analyte	Frequency of Detection (FOD)[1]	Percent Detected	Range of Detects[2] (Min - Max)	Median of Detected Values	Lowest Alaska Water Quality Standard (WQS)	Number of Samples Exceeding WQS
Selenium	1 / 12	8.3%	0.003 - 0.003	0.003	0.005	--
Thallium, Total	0 / 12	0.0%	0 - 0	--	0.0017	--
Zinc[3]	2 / 2	100.0%	0.25 - 0.321	0.2855	0.081	2
Volatile Organic Compounds						
1,1,1-Trichloroethane	0 / 23	0.0%	0 - 0	--	0.2	--
1,1,2-Trichloroethane	0 / 23	0.0%	0 - 0	--	0.005	--
1,1-Dichloroethylene	0 / 23	0.0%	0 - 0	--	0.007	--
1,2,4-Trichlorobenzene	0 / 23	0.0%	0 - 0	--	0.26	--
1,2-Dichloroethane	0 / 23	0.0%	0 - 0	--	0.005	--
1,2-Dichloropropane	0 / 23	0.0%	0 - 0	--	0.005	--
Benzene	1 / 27	3.7%	0.00218 - 0.00218	0.00218	0.005	--
Carbon Tetrachloride	0 / 23	0.0%	0 - 0	--	0.005	--
Chlorobenzene	0 / 23	0.0%	0 - 0	--	0.68	--
cis-1,2-Dichloroethylene	0 / 23	0.0%	0 - 0	--	0.07	--
Dichloromethane	0 / 23	0.0%	0 - 0	--	0.005	--
Ethylbenzene	21 / 27	77.8%	0.00023 - 0.069	0.00867	0.7	--
o-Dichlorobenzene	0 / 23	0.0%	0 - 0	--	0.6	--
p-Dichlorobenzene	0 / 23	0.0%	0 - 0	--	0.075	--
Styrene	3 / 23	13.0%	0.00077 - 0.00198	0.00131	0.1	--
Tetrachloroethylene	0 / 23	0.0%	0 - 0	--	0.005	--
Toluene	4 / 27	14.8%	0.00021 - 0.00123	0.000235	1	--
trans-1,2-Dichloroethylene	0 / 23	0.0%	0 - 0	--	0.1	--
Trichloroethylene	0 / 23	0.0%	0 - 0	--	0.005	--
Vinyl Chloride	0 / 23	0.0%	0 - 0	--	0.002	--
Xylenes, Total	21 / 27	77.8%	0.00041 - 0.2506	0.0415	10	--
Synthetic and Other Organic Compounds						
2,4,5-TP	0 / 3	0.0%	0 - 0	--	0.05	--
2,4-D	0 / 3	0.0%	0 - 0	--	0.07	--
BHC-Gamma	0 / 3	0.0%	0 - 0	--	0.00016	--
Endrin	0 / 3	0.0%	0 - 0	--	0.0000023	--
Ethylene Dibromide	0 / 5	0.0%	0 - 0	--	0.00005	--
Methoxychlor	0 / 3	0.0%	0 - 0	--	0.00003	--
Toxaphene	0 / 3	0.0%	0 - 0	--	0.0000002	--
TTHM and HAA5						
Total Haloacetic Acids (HAA5)	9 / 10	90.0%	0.00338 - 0.0076	0.0055	0.06	--
TTHM	35 / 37	94.6%	0.00201 - 0.279	0.111	0.08	18

[1] Frequency of detection (FOD) = Number of detected samples / total number of samples in dataset.

[2] Units of measure are milligrams per liter (mg/L) unless otherwise noted in the analyte column.

[3] Analyte listed as Secondary Criteria.

New information was also reported for fish tissue concentrations of a group of ubiquitous organic pollutants known as polynuclear aromatic hydrocarbons (PAHs). These chemicals are a product of incomplete combustion (e.g., forest fires, barbeques, vehicles) and also are a component of crude and refined oil products. Data were obtained from fish tissue samples collected from the 2012 fall under-ice fishery in the Nigliq Channel and represent only a few (five) fish. The samples were muscle fillets from Arctic cisco obtained from the fishermen as part of an annual study on this subsistence fishery supported by CPAI (Seigle and Gottschalk 2013). The results of this small sampling event indicate that only two PAHs were detected above minimum detection limits (anthracene and naphthalene). The other reported values were all estimated (i.e., J-qualified) concentrations because they were detected at levels below the practical limit of quantitation. These results indicate that PAHs in Arctic cisco fish tissues are rarely detected in the Nigliq Channel and likely not of consequence to human health. It is difficult to extrapolate from this small sample to fish populations and to other species, but the few samples indicate PAHs are not currently a human health issue for fish from the channel.

No new information was available for the local area with regard to other media, including air quality and wildlife. Descriptions and further information on these two topics is provided in Sections 3.2.3.2, *Air Quality*, and 3.3, *Biological Resources*.

3.4.7 Environmental Justice

3.4.7.1 Environmental Justice

Environmental Justice is defined in EO 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which requires that proposed projects be evaluated for *"disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."*

EPA defines environmental justice as *"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."* From the EPA website, http://www.epa.gov/environmentaljustice/ (EPA 2013b).

EPA policy guidelines for evaluating the potential environmental impacts of projects require specific identification of minority populations when either: 1) the minority population of the affected area exceeds 50 percent or; 2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The community of Nuiqsut is identified as being the closest community to be potentially affected by the project study area. The State of Alaska socioeconomic characteristics were selected as the reasonable reference population (BLM 2004, p. 327).

According to 2010 Census data about 87 percent of the population of Nuiqsut is Alaska Native or American Indian (specifically Iñupiat), an identified minority group. The ethnic composition of Nuiqsut compared with the State of Alaska is shown in 53.4-12. Based on the census data, the minority population in Nuiqsut is well above the 50 percent threshold specified in the EPA guidelines, so it is appropriate to consider potential environmental justice issues in evaluating the impacts of the proposed plan. Nuiqsut has an American Indian/Alaska Native membership of 87.1 percent. The statewide population is 14.8 percent American Indian or Alaska Native.

Based on the census data, the minority population in Nuiqsut is well above the 50 percent threshold specified in the EPA guidelines, so it is appropriate to consider potential environmental justice issues in evaluating the impacts of the proposed plan.

The CEQ guidance on environmental justice under the National Environmental Policy Act (CEQ 1997a) directs federal agencies to apply CEQ guidance with flexibility and to consider them a point of departure rather than conclusive direction in applying the terms of the Executive Order on Environmental Justice.

Table 3.4-15. Ethnic Composition of Nuiqsut Compared with State of Alaska

Category	State of Alaska		Nuiqsut	
	Population	Percent	Population	Percent
Total	**710,231**	**100.0**	**402**	**100.0**
Hispanic or Latino	39,249	5.5	0	0.0
Not Hispanic or Latino	670,982	94.5	402	100
Population of one race	658,356	92.7	391	97.3
White	473,576	66.7	40	10.0
Black or African-American	23,263	3.3	1	0.2
American Indian or Alaska Native	104,871	14.8	350	87.1
Asian	38,135	5.4	0	0.0
Native Hawaiian and Pacific Islander	7,409	1.0	0	0.0
Some other race	11,102	1.6	0	0.0
Two or more races	51,875	7.3	11	2.7

Source: The 2010 population numbers are actual counts from decennial censuses (ADOLWD 2013a).

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential impacts that could result from the selection of any of the GMT1 Project alternatives presented in this SEIS, including the No Action Alternative (Alternative E). This chapter is organized by specific resources. Each resource section addresses methodology definitions for the impact criteria used for analysis of impacts to the resource. The potential direct and indirect impacts on the resources are discussed separately for the two primary phases of the project:

- Construction – Includes year-round activity, building ice roads, gravel infrastructure (depending on alternative), facilities, and pipeline.
- Drilling and Operation – Drilling would be year-round (except for Alternative D2). "Operation," for purposes of impact analyses for the SEIS, means production (i.e., oil is being produced and in the pipeline from GMT1). This distinction is important in understanding the activities or aspects of each action alternative during the project life (e.g., number of personnel, vehicle traffic, aircraft traffic).

The potential impacts are characterized and compared among the alternatives, followed by a summary of mitigation measures in place, including project design features and BLM Lease Stipulations and BMPs, as well as a description of potential new mitigation measures where relevant. A conclusion discussion for each resource summarizes the nature of the potential impacts and comparison of the alternatives, followed by a brief statement of how climate change may affect the resource within context of the predicted impacts.

Section 4.5 addresses potential impacts of oil, saltwater, and hazardous material spills comprehensively for all affected resources. The analysis of cumulative impacts of the alternatives is discussed in Section 4.6, which considers other reasonably foreseeable activities in the region. Section 4.7 summarizes the mitigation measures applicable to the project, and the chapter concludes with discussion of unavoidable adverse impacts (Section 4.8), the relationship between local short-term uses and long-term productivity (Section 4.9), and irreversible and irretrievable commitment of resources associated with proposed development (Section 4.10).

4.1 Introduction

Comprehensive analyses of environmental consequences of development of the entire Alpine Field, including GMT1 as it was designed in 2004, were performed in the program-specific BLM (2004). Environmental impacts of anticipated oil and gas development in the NPR-A, also including GMT1, were analyzed in BLM (2012). The analyses of potential environmental consequences of the proposed GMT1 Project provided in this section are tiered to, and incorporate by reference these previous analyses, with specific references cited in the discussions in the following sections.

Alternative D2 was not analyzed in the Draft SEIS, but was added to the Final SEIS in response to public comments received on the Draft to include a seasonal drilling alternative. Impact analysis for Alternative D2 was conducted and results are reported herein.

Alternative A (Applicant's proposed project) and four other action alternatives for project development were carried forward through impact analysis. All action alternatives and the No-Action Alternative (E) are described in Chapter 2.

Two gravel supply options were originally considered for each alternative in the Draft SEIS: Clover site and ASRC Mine site. The Applicant has since made a decision to use the ASRC Mine site as a material source. Discussions regarding the Clover site have been removed from SEIS because it is no longer being considered as a gravel source.

4.1.1 Major Project Components

Major project components of each action alternative are listed in Table 4.1-1. The project component values, such as road lengths and pad acreage, are approximations based on best available data. Due to differences in data processing systems (e.g., GIS) and methodologies (e.g., number rounding), the values presented in the Final SEIS may differ slightly from values presented in other project-related documents such as permit drawings. These differences have been reviewed and determined to be insignificant to the analysis as well as to the overall permitting process.

Table 4.1-1. Major Project Components of the Action Alternatives

Component	Alternative A	Alternative B	Alternative C	Alternative D1[a,d]	Alternative D2[a,d]
Drill pad	11.8 acres	11.8 acres	11.8 acres	15.7 acres	15.7 acres
Road (CD5-GMT1 gravel road)	7.6 miles; 60.1 acres	8.6 miles; 67 acres	7.6 miles; 60.1 acres	1.3 miles (airstrip to drill pad)	1.3 miles (airstrip to drill pad)
Additional road access to Nuiqsut	0	0	5.8 miles (Nuiqsut Spur Road upgrade); 16.3 acres	0	0
Bridge(s)	2 (Tiŋmiaqsiġvik [Ublutuoch] River and Crea Creek)	1 (Tiŋmiaqsiġvik [Ublutuoch] River)	2 (Tiŋmiaqsiġvik [Ublutuoch] River and Crea Creek)	Seasonal ice bridge at Tiŋmiaqsiġvik [Ublutuoch] River and Nigliq Channel	Seasonal ice bridge at Tiŋmiaqsiġvik [Ublutuoch] River and Nigliq Channel
Pipeline System GMT1 to CD5[b]	8.3 miles	8.6 miles	8.3 miles	8.4 miles	8.4 miles
Water Injection Pipeline CD1 to GMT1	18 miles	17.6 miles	18 miles	18 miles (also for drill site water and diesel supply line)	18 miles (also for drill site water and diesel supply line)
Pullouts / VSMs	0.9 acre / 0.1 acre	0.9 acre / 0.1 acre	0.9 acre / 0.1 acre	0.9 acre / 0.1 acre	0.9 acre / 0.1 acre
Ancillary Pads, east and west	East and west valve pads (0.7 acre)	East and west valve pads (0.7 acre) + CD5 tie in pad (0.7 acres)	East and west valve pads (0.7 acre)	East and west valve pads (0.7 acre)	East and west valve pads (0.7 acre)
Air Access Facilities [c]	0	0	Nuiqsut airport access road, taxiway and turnaround; runway extension; corridor; 400 ft x 400 ft pad (16.7 acres)	Airstrip and apron, Airstrip access road, Occupied pad (70.5 acres)	Airstrip and apron, Airstrip access road, Occupied pad (69.2 acres)
Culverts	81	91	81	13	13
Ice roads	45 miles - Year 1 36 miles -Year 2 6 miles (every 5 years post drilling) Years 3-30	43 miles - Year 1 36 miles - Year 2 6 miles (every 5 years post drilling) Years 3-30	50 miles - Year 1 30 miles - Year 2 2 miles (every 5 years) post drilling Years 3-30	33 miles - Year 1 36 miles - Year 2 15 miles - Years 3-30	33 miles - Year 1 36 miles - Year 2 15 miles - Years 3-38 (36 years of 15-mile ice road)
Total Fill	628,050 cubic yards	684,550 cubic yards	862,250 cubic yards	845,600 cubic yards	830,800 cubic yards
Total gravel Footprint [e]	72.7 acres	80.4 acres	105.8 acres	87.4 acres	85.8 acres

[a] In Alternatives D1 and D2 ice bridges would be constructed at the following drainages: Tiŋmiaqsiġvik (Ublutuoch) River and Nigliq Channel.

[b] Produced fluids pipeline, miscible injectant (MI) pipeline, injection water pipeline, lean gas pipeline, and messenger cable, and space for 24-inch future pipeline. In all alternatives, the 14-inch injection water pipeline extends 3.1 miles from CD1 to CD4N on new VSMs and 6.5 miles from CD4N to CD5 on existing VSMs.

[c] Includes additional facilities required for access by aircraft (e.g., airstrip; airstrip improvements; ancillary pads depending on action alternative).

[d] Same pipelines footnoted in “b” above, with an additional 2-inch diesel line and 2-inch waterline from CD1 to GMT1 pad.

[e] Totals may be slightly different than noted elsewhere in this document because of internal rounding for calculations. In addition, footprints were included in GIS analysis to include features such as VSMs, and water injection line. These minor differences do not affect the results of impact analysis or determination of impact level.

4.1.2 Impact Criteria

For this SEIS, criteria were developed to guide the analyses of potential impacts from GMT1 development. Impact criteria were based on recent NEPA analyses of oil and gas development on the North Slope and adjacent marine waters. The documents providing results of analyses considered in developing impact criteria were: Draft SEIS on the Effects of Oil and Gas Activities in the Arctic Ocean (NOAA 2013a), BLM (2012), Alaska Stand Alone Gas Pipeline (Corps 2012a), Point Thomson EIS (Corps 2012), and BLM (2004). The initial development of impact criteria used in this SEIS was based on the methods described in NOAA 2013a, then refined for the GMT1 project as the other documents became available.

Using the impact criteria as a guide, analysis of the impacts of GMT1 development are based on previous related NEPA analyses, best available new information, and best professional judgment. This SEIS considers both the nature and degree of expected impact as described below.

In this SEIS, the nature of an impact is generally defined by the magnitude of the intensity of the impact, the duration, the context, and geographic extent of the resource defined as follows:

Intensity

Low: A change in a resource condition is perceptible, but it does not noticeably alter the resource’s function in the ecosystem or cultural context.

Medium: A change in a resource condition is measurable or observable, and an alteration to the resource’s function in the ecosystem or cultural context is detectable.

High: A change in a resource condition is measurable or observable, and an alteration to the resource’s function in the ecosystem or cultural context is clearly and consistently observable.

Duration

Temporary: Impacts would be intermittent, infrequent, and typically last less than a month.

Interim: Impacts would be frequent or extend for longer time periods (an entire project season).

Long-term: Impacts would cause a permanent change in the resource that would perpetuate even if the actions that caused the impacts were to cease.

Context

Common: The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation. The portion of the resource affected does not fill a distinctive ecosystem role within the locality or the region.

Important: The affected resource is protected by legislation (other than the ESA). The portion of the resource affected fills a distinctive ecosystem role (such as an important subsistence resource) within the locality or the region.

Unique: The affected resource is listed as threatened or endangered (or proposed for listing) under the ESA or is depleted either within the locality or the region. The portion of the resource affected fills a distinctive ecosystem role within the locality or the region.

Extent

Local: Impacts would be limited geographically (e.g., within the indirect impact zone, or within the SEIS project study area), depending on the resource; impacts would not extend to a broad region or a broad sector of the population, such as the entire ACP.

Regional: Impacts would extend beyond a local area, potentially affecting resources or populations beyond the SEIS project study area (e.g., the entire ACP) depending on the resource.

Statewide: Impacts would potentially extend beyond the SEIS project study area and region (e.g., ACP) to include the entire State of Alaska or other relevant, resource-specific geographic regions, depending on the resource.

4.1.3 Impact Levels

For impact analysis of each resource, a separate impact criteria table was developed and used to guide the analyses. The impact criteria tables present terms and relative thresholds that are quantified for some components and qualitative for other components (depending on resource characteristics). Summary impact levels were then determined using the following guidance:

- Negligible: Impacts are generally extremely low in intensity (often they cannot be measured or observed), are temporary, localized, and do not affect unique resources.
- Minor: Impacts tend to be low in intensity, of short duration, and limited extent, although common resources may experience more intense, longer-term impacts.
- Moderate: Impacts can be of any intensity or duration, although common resources may be affected by higher intensity, longer-term, or broader extent impacts while important and/or unique resources may be affected by medium or low intensity, shorter duration, local or regional impacts.
- Major: Impacts are generally medium or high intensity, long-term or permanent in duration, a regional or statewide extent, or affect important or unique resources.

The potential impacts were analyzed by reviewing the Applicant's project description and design components intended to reduce impacts, data collected by the Applicant, and other information provided by the Applicant. Previous publications and data collected within and near the project study area by state, federal, and local agencies were also reviewed. The Applicant's information was verified by independently reviewing reference sources and previous publications on these resources. The information regarding existing conditions as presented in Chapter 3, *Affected Environment*, was assessed relative to the Applicant's proposed action and the other alternatives described in Chapter 2, *Proposed Project and Alternatives*, to assess impacts.

4.1.4 BLM Protective Measures

BLM (2013) includes a number of protective measures that would be imposed on activities permitted by the BLM in the NPR-A. These protective measures are in the form of Lease Stipulations and BMPs, provided in Appendix E. As explained further in Section 4.7, *Mitigation Measures and Monitoring*, stipulations are specific to oil and gas leases, and describes objectives for protection of certain resources and management of certain activities. BMPs apply to all activities in the NPR-A. Stipulations and BMPs also provide a basis for analyzing potential impacts of an activity (BLM 2012, § 2.3.5). Other agencies with permitting authority for the proposed project include protective measures and regulatory requirements as part of their permit processes, as described in Table 1.4-1.

4.1.5 Summary of Impact Levels for Alternatives

A summary of the potential impact levels for all the alternatives is presented in Table 4.1-2, with the exception of potential spills impacts, which is a not considered a resource, but is a topic relevant to the impact analysis, and is presented without impact level ratings.

4.1.6 Potential New Mitigation Measures

In addition to project design features and BLM Lease Stipulations and BMPs already applicable to the project, this chapter also considers several potential new mitigation measures designed to further avoid, reduce or compensate for impacts from the proposed action. These measures are discussed in the relevant resource sections that follow, and were developed based on suggestions from cooperating agencies, stakeholders, the public, and BLM staff. As with existing BLM Lease Stipulations and BMPs, an objective and proposed requirement/standard are identified for each potential new mitigation measure and potential benefits and residual/unavoidable impacts are evaluated. Except where otherwise eliminated from further consideration herein, the decision to adopt or eliminate each new mitigation measure will be made in the Record of Decision.

Some potential new mitigation measures would require the permittee (CPAI) to provide funding to carry out compensatory mitigation. In lieu of providing separate funding streams for multiple specific measures, the permittee might instead contribute funds to a new Compensatory Mitigation Fund. The Fund would be administered by BLM or through other arrangements if appropriate, in consultation with relevant stakeholders, and would be used to implement a variety of new mitigation measures as described further in the various resource sections that follow. The Fund would give BLM flexibility to direct expenditures towards those mitigation measures determined to be most appropriate and effective, and to better coordinate compensatory mitigation efforts with other regulatory agencies such as the Corps. The dollar amount that would be contributed by the permittee would be identified in the Record of Decision.

Table 4.1-2. Summary of Impact Levels for Alternatives

Affected Resource	Intensity Low (L), Medium (M), High (H)						Duration Temporary (T), Interim (I), Long-Term (L)						Context Common (C), Important (I), Unique (U)						Extent Local (L), Regional (R), Statewide (S)						Summary Negligible (N), Minor (M), Moderate (D), Major (J)					
Alternative:	**A**	**B**	**C**	**D1**	**D2**	**E**	**A**	**B**	**C**	**D1**	**D2**	**E**	**A**	**B**	**C**	**D1**	**D2**	**E**	**A**	**B**	**C**	**D1**	**D2**	**E**	**A**	**B**	**C**	**D1**	**D2**	**E**
Physiography and Geomorphology	H	H	H	H	H	--	L	L	L	L	L	--	C	C	C	C	C	--	L	L	L	L	L	--	M	M	M	M	M	N
Soils and Permafrost	H	H	H	H	H	--	L	L	L	L	L	--	C	C	C	C	C	--	L	L	L	L	L	--	M	M	M	M	M	N
Geology and Mineral Resources	H	H	H	H	H	--	L	L	L	L	L	--	C	C	C	C	C	--	L	L	L	L	L	--	M	M	M	M	M	N
Petroleum Resources	H	H	H	H	H	--	L	L	L	L	L	--	C	C	C	C	C	--	R	R	R	R	R	--	J	J	J	J	J	N
Sand and Gravel Resources	H	H	H	H	H	--	L	L	L	L	L	--	C	C	C	C	C	--	L	L	L	L	L	--	M	M	M	M	M	N
Paleontological Resources [a]	L	L	L	L	L	--	L	L	L	L	--	--	C	C	C	C	--	--	L	L	L	L	--	--	N	N	N	N	N	N
Water Resources	L	L	L	L	L	--	L	L	L	L	L	--	I	I	I	I	I	--	L	L	L	L	L	--	M	M	M	M	M	N
Climate and Meteorology [b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	N	N	N	N	N
Air Quality	M	M	M	H	H	--	I	I	I	I	I	--	I	I	I	I	I	--	L	L	L	L	L	--	D	D	D	J	J	N
Noise	M	M	M	H	H	--	T	T	T	T	T	--	I	I	I	U	U	--	L	L	L	R	R	--	M	M	M	D	D	N
Climate Change[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	N	N	N	N	N	N
Vegetation and Wetlands	M	L	M	L	L	--	I	I	I	I	I	--	I	I	I	I	I	--	L	L	L	L	L	--	D	M	D	M	M	N
Fish	M	M	M	M	M	--	L	L	L	I	I	--	I	I	I	I	I	--	L	L	L	L	L	--	M	M	M	M	M	N
Birds	L	L	L	L	L	--	L	L	L	L	L	--	I	I	I	I	I	--	L	L	L	R	R	--	M	M	M	M	M	N
Terrestrial Mammals	L	L	L	M	M	--	L	L	L	L	L	--	I	I	I	I	I	--	L	L	L	R	R	--	M	M	M	D	D	N
Threatened and Endangered	L	L	L	L	L	--	L	L	L	L	L	--	U	U	U	U	U	--	L	L	L	R	R	--	N	N	N	N	N	N
Sociocultural Resources	H	H	H	H	H	--	L	L	L	L	L	--	I	I	I	I	I	--	L	L	L	L	L	--	J	J	J	J	J	N
Economy[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	M	M	M	M	M	N
Subsistence	H	H	H	H	H	--	L	L	L	L	L	--	I	I	I	I	I	--	R	R	R	R	R	--	J	J	J	J	J	N
Environmental Justice	H	H	H	H	H	--	L	L	L	L	L	--	U	U	U	U	U	--	R	R	R	R	R	--	J	J	J	J	J	N
Cultural Resources	M	M	M	M	M	--	I	I	I	I	I	--	I	I	I	I	I	--	R	R	R	R	R	--	D	D	D	D	D	N
Land Use and Ownership	M	M	M	M	M	--	L	L	L	L	L	--	C	C	C	C	C	--	L	L	L	L	L	--	D	D	D	D	D	N
Recreation	L	L	L	L	L	--	T	T	T	T	T	--	C	C	C	C	C	--	L	L	L	L	L	--	N	N	N	N	N	N
Visual Resources	M	M	M	M	M	--	L	L	L	L	L	--	C	C	C	C	C	--	R	R	R	R	R	--	M	M	M	M	M	N
Transportation Systems	M	M	M	M	M	--	L	L	L	L	L	--	C	C	C	C	C	--	R	R	R	R	R	--	M	M	M	D	D	N

"--" = Not applicable or not ranked. See Section 4.1.3.

[a] Paleontologic resources are not expected to be impacted by the project. Results of previous surveys were reviewed and no paleontological resources were documented that would be directly impacted by the project (Section 3.2.1.6, Paleontological Resources)

[b] Only summary impact ratings are provided for these resources.

4.2 Physical Characteristics

The following discussion regarding impacts on or by the physical environment is generally categorized and organized as it is in BLM (2004).

4.2.1 Terrestrial Environment

The action alternatives would result in impacts to the terrestrial environment. The impacts are discussed in this section, organized by the two primary phases of the project: 1) construction and 2) drilling and operation. These impacts are described in detail by BLM (2004, § 4F.2.1) and generally for the Northeast NPR-A (BLM 2008, §§ 4.3.2 – 4.3.3) and the entire NPR-A (BLM 2012, § 4.3.2 – 4.3.3). The following discussion provides a summary of the impacts and is supplemented with information from the Point Thomson FEIS related to potential impacts to the terrestrial environment (Corps 2012, §§ 5.1 – 5.2). In addition, impact analysis was conducted for Alternative D2 and results are included in this SEIS.

Impacts to the following resources of the terrestrial environment were analyzed:

- Physiography/Geomorphology
- Soils and Permafrost
- Geology and Mineral Resources
- Petroleum Resources
- Sand and Gravel Resources
- Paleontological Resources

The impact criteria for resources of the terrestrial environment are defined in Table 4.2-1, and each alternative has been evaluated to determine the potential impact levels of project activity on each resource (Table 4.1-2).

Table 4.2-1. Impact Criteria — Terrestrial Resources

Impact Category	Magnitude	Definition
Intensity	High	Adverse impacts to physiographic, geological, or paleontological resources for which no mitigation is available. Adverse impacts to soils or permafrost such that the resulting ground surface is below tundra grade and backfilling with overburden is required to prevent ponding and/or flow of water for restoration to be successful.
	Medium	Adverse effects to physiographic, geological, or paleontological resources that could be mitigated. Disturbance to soils or permafrost is such that revegetation by seeding or sodding with native tundra is required to prevent degradation of the thermal regime, erosion, or ponding or water flow for restoration to be successful.
	Low	Changes to physiographic, geological, or paleontological resource conditions with no adverse impact. The thermal regime is maintained and disturbance of vegetative cover such that successful site rehabilitation can be accomplished through natural recolonization.
Duration	Long-term	Impacts exceed the life of the project.
	Interim	Impacts last the life of the project.
	Temporary	Impacts last during a phase of the project.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Statewide	Extends beyond the project study area.
	Regional	Extends beyond project components but within project study area.
	Local	Within footprint of project components and extending up to 165 feet beyond the footprint of project components.

4.2.1.1 Construction

Direct impacts to some terrestrial resources (physiography, geomorphology, geology, soils and permafrost, and sand and gravel resources) would occur during construction.

Causes of direct impacts by construction generally include installation of gravel pads, gravel roads, gravel airstrip, and pipeline supports (VSMs); excavation of material sites; and construction of ice roads and ice pads. Direct impacts would be localized to the footprint of the facilities and gravel material site(s) and their immediate surroundings.

Buried pipelines in permafrost are not included in the project designs, thus avoiding impacts of thermokarst and subsidence that can be associated with such installations. However, pipelines would cross under the CD5-GMT1 road at one or two locations, depending on alternative (no pipeline crossings in Alternatives D1 or D2).

In Alternatives A, B, and C the CD5 pipeline would cross under the CD5-GMT1 road just south of the CD5 pad (Appendix A, Sheet 11). In Alternatives A and C, the GMT1 pipeline would cross under the CD5-GMT1 road about a mile east of the GMT1 pad (Appendix A, Sheet 7).

To ensure that the existing thermal regime (i.e., permafrost) is maintained at these crossings, the pipelines would be installed as shown in Appendix A, Sheet 22 (CD5-GMT1 road at CD5 pipeline crossing) and Sheet 23 (CD5-GMT1 road at GMT1 pipeline crossing), with an impermeable membrane and rigid insulation installed under the pipelines, between the pipelines and the existing ground surface. Section 2.5.2, *Infrastructure Development*, describes the installation of the pipeline for these locations.

Indirect impacts may be caused during construction including gravel spray or dust deposition caused by vehicle activity or aircraft traffic (landing, takeoff, taxiing) in the vicinity of the gravel structures (e.g., road, airstrip).

Physiography and Geomorphology / Soil and Permafrost

Physiography and geomorphology are closely related to soil and permafrost conditions in the project area and impacts are addressed together in this section. Direct impacts are related to the footprint of gravel fill for each action alternative. The footprint for each alternative is listed in Table 4.2-8.

Ground-impacting activities of the action alternatives could alter permafrost as described in BLM (2004, § 4F.2.1.3) and BLM (2012, § 4.5.3.2). The thermal regime of permafrost is the dominant control on soil formation and soil properties on the ACP. Placement of gravel on the tundra for roads, pads, and airstrip would directly impact the thermal regime of permafrost. Impacts to permafrost stem from alteration of ground temperature that can be caused by construction of infrastructure (e.g., gravel pads). Any disturbance that removes the insulating surface organic layer or decreases the solar reflectance of the surface may result in differential thawing of the permafrost and cause thermokarst, subsidence, and increased potential for soil erosion and sedimentation (BLM 2012, § 4.3.3.2, p. 105). Thermokarst often results where permafrost thawing occurs in ice-rich, fine-grained sediments (BLM 2004, § 4A.2.1.3, p. 416). Soils in the project study area are subjected to cold and anoxic conditions that retard soil formation, allowing exposed mineral soil layers to persist for decades.

Characteristics of the material used for gravel fill could also impact soil near gravel structures. For example, saline material used as fill increases the salinity of water draining off of or leaching through the structure. Increased salinity at a site could alter the soil properties in the immediate vicinity of the gravel structure.

Snowdrifts caused by gravel structures would increase the soil surface temperature in winter and increase thaw depth in the soil near the structures. Blockage of natural drainage patterns can lead to the formation of impoundments or redirection of surface water flow and may cause deposition or erosion of sediment. The use of adequate cross-drainage structures in gravel roads and attention to the natural drainage patterns during design of developments could help reduce impacts to soils from impoundments. (See also Section 4.2.2, *Water Resources,* and Section 4.3.1, *Vegetation and Wetlands*.)

Construction of ice roads and pads would locally cause compression of soils and vegetation (see also Section 4.3.1, Vegetation and Wetlands). A recent BLM study of ice road impacts found that the wetter the area (evaluated during summer), the less damage to insulating vegetation and soils from large-tired vehicles. Recovery of vegetation would be expected within a few years after ice roads and pads are no longer constructed. Impacts from long-term disturbance from ice pads, ice roads, and snow trails would be negligible to the health of the soils and proper functioning of the landscape. Although some evidence of crushed tussocks may still be apparent, new growth would preclude any exposed soils or extensive changes in the active layer (BLM 2012, § 4.3.3.2, p. 107). A summary of ice road construction and associated water use for the project alternatives is presented in Section 2.5.4.1 and Table 2.3-2. Discussion of impacts to water resources and hydrology, vegetation, and wetlands is presented in Section 4.2.2 and Section 4.3.1, respectively.

Pipeline construction would displace soil during installation of VSMs and would disturb a zone around the VSM that is approximately 24 inches in radius. VSMs would be installed in winter and spoils material would be collected at the surface for proper disposal. Approximately 0.007 acre of soil would be disturbed per pipeline mile for gathering lines. Pipelines could also impact soils indirectly by altering snow accumulation patterns and by shading vegetation, which may decrease soil temperatures and could potentially affect plant growth. Soil under a pipeline receives less direct sunlight during the growing season than does the soil that is not under a pipeline. Therefore, there could potentially be a reduction in heat absorption by the ground cover, leading to a shallower active layer. Shading from pipelines was not part of the evaluation of indirect impacts.

Low-ground-pressure vehicles may be permitted to travel on the tundra during periods other than when the ground is frozen and covered with snow, as authorized by BLM. Because of restrictions that would be placed on this activity, impacts to soil should be limited to the compression (reduction) of the insulating mat, similar to what happens during winter following traffic by low-ground-pressure vehicles.

Impacts caused by spills during construction (e.g., diesel fuel) would have the potential to impact the terrestrial environment as described in Section 4.5.

Geology and Mineral Resources

During construction (no drilling), there would be no impact to bedrock geology or mineral resources for all action alternatives.

Petroleum Resources

During construction there would be no impact to petroleum resources for all action alternatives.

Sand and Gravel Resources

Under all action alternatives, the primary terrestrial resource directly impacted long-term by the project construction would be sand and gravel resources.

Gravel would be mined to support construction of features such as pads, roads, or airstrip. The proposed material source (ASRC Mine site) is described in Section 2.4.4. The volume of gravel required for each action alternative is listed in Table 4.1-1. Gravel would be extracted from areas designated and permitted for such activity. Impact level on sand and gravel resources would be moderate for all action alternatives. Mined gravel would be transported from the ASRC Mine site to the project area over ice roads during Year 1 (January – April 2016 and June – August 2016). Approximately 14,000 trips would be required to transport the gravel. Average trip length would be 17.1 miles for Alternatives A, B, and C and 17.4 miles for Alternatives D1 and D2.

Gravel extraction at the material site would impact the tundra surface by requiring the complete removal of surface vegetation, and overburden and extraction of the underlying gravels. Depending on site-specific conditions, a large disturbance such as this could cause thawing of the permafrost around the mine site perimeter, which would create additional landform changes. Gravel mining could result in the creation of shallow or deep water habitats. If ponds are created, they would likely be much deeper than a typical North Slope lake, and as is normal under a water body that does not freeze completely during winter, thaw bulb formation likely would follow (BLM 2004, § 4A.2.1.1, p. 414). Excavation of the gravel source would require removal of overlying soils and create long-term impacts to soil productivity in the footprint of gravel-extraction sites. Stockpiling of overburden mixes organic and mineral horizons with the parent material from below.

Paleontological Resources

Results of previous paleontological surveys were reviewed and no paleontological resources were documented that would be impacted by the project. Paleontologic resources are not expected to be impacted by the project, during either the construction or drilling and operation phase. Should a possible site be discovered, proper protocol for notification would be followed and setbacks established.

4.2.1.2 Drilling and Operation

The drilling and operation phase of the project would have direct impacts on resources of the terrestrial environment (physiography and geomorphology, geology, petroleum resources, soils and permafrost, and sand and gravel resources). Direct impacts to the terrestrial environment may be caused by (depending on alternative): maintenance grading of the surfaces of pads, roads, and airstrip which would modify the surface, but the general shape of these features would be the same throughout the life of the facilities; drilling into bedrock and hydrocarbon zone; extracting petroleum hydrocarbon; and annual construction of ice road(s) for life of project.

Indirect impacts to the terrestrial environment would be essentially the same as for construction (e.g., gravel spray/dust deposition in vicinity of roads, pads, and airstrip).

Physiography and Geomorphology / Soil and Permafrost

Direct impacts to physiography and geomorphology are closely related to impacts on soil and permafrost and are addressed together in this section. These impacts are essentially the same as during construction, except for differences in duration of activities or structures among the alternatives. For example, through drilling and operation, Alternative D2 would require ice road access for 36 years (six seasons to first oil, then 30 years of operation). Comparison of alternatives is presented in Section 4.2.1.3.

Indirect impacts to soil and permafrost would occur for all alternatives during drilling and operation. The passage of vehicle traffic over gravel pads, roads, and airstrip (depending on alternative) would result in a gravel spray/dust shadow with measurable impacts on soil, vegetation, and permafrost extending out to 300 feet from the edge of the gravel feature (Auerbach et al. 1997). Within gravel spray and dust deposition areas, soil properties such as moisture, temperature, chemistry, and nutrient regimes could be altered. In extreme instances, this deposition may bury the existing organic horizon of the soil with a new layer of higher bulk density that would restart the soil-forming processes. For this analysis, the area of potential indirect impact from gravel spray and dust deposition was evaluated by calculating the acreage within 300 feet of the edge of gravel roads, pads, and airstrip, as appropriate for each alternative.

Spills during drilling and post-drilling operation (e.g., diesel fuel) would have the potential to impact soil and permafrost as described in Section 4.5.

Geology and Mineral Resources

Bedrock geology would be locally impacted by drilling of production wells at GMT1. A minor amount of bedrock would be disturbed and relocated to the surface during drilling. Annular disposal and injection of fluids could have impacts on subsurface geology; however regulations and permits control both types of activities, minimizing potential adverse impacts. In addition to the BLM, the Alaska Oil and Gas Conservation Commission (AOGCC) has regulatory oversight of all oil and gas drilling, production, and well abandonment for the protection of oil and gas resources (20 AAC 25.005 – 25.990). Impacts to bedrock geology would be negligible for all alternatives.

Petroleum Resources

Direct impacts to petroleum resources would occur primarily from extraction of petroleum hydrocarbon; however that is the purpose of the proposed project. In context, this would constitute a loss of the committed resources, but result in beneficial economic impacts described in Section 4.4.3.

Sand and Gravel Resources

During drilling and operation impacts to sand and gravel resources would be negligible because the features requiring gravel would be built during the construction phase.

Paleontological Resources

There are no documented paleontological resources in the proposed project area. Therefore, impacts to this resource by project development are not expected.

4.2.1.3 Comparison of Alternatives

This section is a summary of comparison of alternatives for both the construction, and drilling and operation phases.

Physiography and Geomorphology / Soil and Permafrost

The areal extent of direct and indirect impact to soil and permafrost resulting from gravel fill for each action alternative is provided in Table 4.2-2. The geomorphic units directly and indirectly impacted by gravel footprint for the alternatives are listed in Table 4.2-3 and Table 4.2-4, respectively.

Table 4.2-2. Area of Direct and Indirect Impacts of Construction for Action Alternatives

	Acres of Impact per Alternative				
Impact Type	A	B	C	D1	D2
Direct	72.7	80.4	105.8	87.4	85.8
Indirect [a]	587.3	659.2	1,196.1	275.9	275.9

[a] Indirect impacts caused by gravel spray and (or) dust deposition evaluated by GIS as a 300-foot margin surrounding gravel infrastructure (Auerbach et al. 1997).

Table 4.2-3. Direct Impacts of Construction on Geomorphic Units for Action Alternatives [a]

Geomorphology [b]	Mapped Project Study Area		Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
	Acres	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**
Alluvial-Marine Deposit	14,644.4	13.2	50.4	0.3	41.0	0.3	50.4	0.3	43.9	0.3	43.9	0.3
Fill and Embankments	225.8	0.2					1.9	0.8				
Delta Inactive Channel Deposit	901.3	0.8	--	--	--	--	--	--	--	--	--	--
Delta Inactive Overbank Deposit	16,881.0	15.3	--	--	--	--	--	--	--	--	--	--
Delta Thaw Basin, Ice-Poor	3,721.9	3.4	--	--	--	--	--	--	--	--	--	--
Lower Perennial River, non-glacial	292	0.3	0.1	--	0.1	--	0.1	--	--	--	--	--
Lowland Headwater Floodplain	332.9	0.3	0.3	--			0.4	0.1	--	--	--	--
Meander Active Overbank Deposit	18.7	--	0.3	1.6	0.3	1.7	0.3	1.6	--	--	--	--
Meander Inactive Overbank Deposit	1,471	1.3	0.5	--	0.5	--	0.5	--	--	--	--	--
Old Alluvial Terrace	7,004	6.3	0.2	--	0.9	--	21.1	0.3	--	--	--	--
Shallow Isolated Riverine Lake	45.4	--			--	--						
Shallow Isolated Thaw Lake	1,987.0	1.8	--	--	--	--	--	--	0.8	--	0.8	--
Shallow Tapped Riverine Lake, High-Water Connection	318.1	0.3	--	--	--	--	--	--	--	--	--	--
Thaw Basin, Ice-Poor Margin	1,221.6	1.1			0.3	--	--	--	--	--	--	--
Thaw Basin, Ice-Rich Center	8,305.9	7.5	6.9	--	15.7	0.2	8.8	0.1	18.3	0.2	17.8	0.2
Thaw Basin, Ice-Rich Margin	16,950.2	15.3	14.0	--	21.5	0.1	19.8	0.1	23.9	0.1	23.1	0.1
Total [c]		**47.4**	**72.7**		**80.2**		**104.7 [d]**		**87.0**		**85.6**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded areas indicate the geomorphic unit would not be impacted by an alternative.

[a] Geomorphic classification and mapping from Jorgenson et al. 2003a.

[b] Percentages for each geomorphic unit based on the 110,605.3 acres with the geomorphology mapped within the project study area.

Note that the study area is 116,447.7 acres and that 5,842.4 (5 percent) acres of the project study area extends outside of the vegetation map coverage. All the project facilities under all the alternatives are within areas of mapped geomorphology.

[c] Totals may be slightly different than noted elsewhere in this document because of internal rounding for calculations and do not affect the results of impact analysis or determination of impact level.

[d] This value is one acre less than the direct impacts footprint because the airstrip extends (by one acre) into unmapped area not covered by the integrated terrain units.

Table 4.2-4. Indirect Impacts of Construction on Geomorphic Units for Action Alternatives [a]

	Mapped Project Study Area		**Alternative A**		**Alternative B**		**Alternative C**		**Alternative D1**		**Alternative D2**	
Geomorphology [b]	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**	**Acres**	**(%)**
Alluvial-Marine Deposit	14,644.4	13.2	344.1	2.4	276.1	1.9	344.1	2.4	111.9	0.8	111.9	0.8
Deep Connected Riverine Lake	24.0	--	1.5	6.3	1.2	5.1	1.5	6.3	0.3	1.1	0.3	1.1
Fill and Embankments	225.8	0.2					20.2	8.9				
Deep Isolated Thaw Lake	7,190.8	6.5	0.7	--	2.5	--	0.7	--				
Lower Perennial River, non-glacial	292.0	0.3	1.2	0.4	1.2	0.4	1.2	0.4				
Lowland Headwater Floodplain	332.9	0.3	3.6	1.1			6.7	2.0				
Meander Active Overbank Deposit	18.7	--	2.1	11.1	2.1	11.1	2.1	11.1				
Meander Fine Inactive Channel Deposit	96.7	0.1			0.6	0.6						
Meander Inactive Overbank Deposit	1,471.1	1.3	5.9	0.4	5.6	0.4	5.9	0.4	0.6	--	0.6	--
Old Alluvial Terrace	7,004.4	6.3	4.9	--	16.5	0.2	377.1	5.4				
Sewage Lagoon (a man-made lagoon, not a geomorphic unit)	3.1	--					0.8	25.5				
Shallow Isolated Riverine Lake	45.4	--	0.6	1.3	1.6	3.5	0.6	1.3				
Shallow Isolated Thaw Lake	1,987.0	1.8	5.1	0.3	6.0	0.3	5.2	0.3	3.2	0.2	3.1	0.2
Thaw Basin, Ice-Poor Margin	1,221.6	1.1			3.6	0.3						
Thaw Basin, Ice-Rich Center	8,306.9	7.5	62.2	0.8	133.7	1.6	121.4	1.5	77.0	0.9	77.2	0.9
Thaw Basin, Ice-Rich Margin	16,950.2	15.3	155.5	1.0	208.6	1.2	308.8	1.8	82.9	0.5	82.8	0.5
Total [c]		**53.9**	**587.3**		**659.2**		**1,196.1**		**275.9**		**275.9**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded areas indicate the geomorphic unit would not be impacted by an alternative.

[a] Geomorphic classification and mapping from Jorgenson et al. 2003a.

[b] Percentages for each geomorphic unit based on the 110,605.3 acres with the geomorphology mapped within the project study area.

Note that the study area is 116,447.7 acres and that 5,842.4 (5 percent) acres of the project study area extends outside of the vegetation map coverage. All the project facilities under all the alternatives are within areas of mapped geomorphology.

[c] Totals may be slightly different than noted elsewhere in this document because of internal rounding for calculations and do not affect the results of impact analysis or determination of impact level.

Chapter 2 provides descriptions of all alternatives including project plans, footprint, major facility components (e.g., roads, pads, airstrip, pipelines), project schedules (e.g., years of construction, drilling and operation), and vehicle and aircraft traffic data, among other aspects.

As listed in Table 4.2-2, Alternative A has the smallest gravel footprint, whereas Alternative C has the largest. Alternatives B, D1, and D2 fall in between with respect to direct impacts resulting from gravel fill.

Differences in potential impacts specific to terrestrial resources between the alternatives with the CD5-GMT1 road and those alternatives without the road are described below along with other comparisons between alternatives. General comparison of alternatives and impacts to other resources (e.g., vegetation and wetlands, noise, subsistence) are addressed in separate sections of the SEIS by resource subject.

In Alternatives A, B, and C, construction of the CD5-GMT1 road would cause impacts to physiography along the route. The gravel road thickness would be 5 feet above the tundra surface after grading, compaction, and settling of the road. Under Alternatives A and B the project footprint would cross eight different geomorphic units; under Alternative C, nine geomorphic units would be crossed. Under Alternative D1 or Alternative D2 (no CD5-GMT1 road), the project footprint would cross four geomorphic units (Table 4.2-3) and impacts would be concentrated around GMT1, not across the tundra to CD5. Additional units may be directly impacted crossed by these alternatives, but the areas are extremely small (less than 0.1 acre, based on GIS analysis) and noted by a dash (--) on Table 4.2-3.

The CD5-GMT1 road would bury at least 60 acres of tundra, causing direct impacts to soil and permafrost (see Section 4.2.1.1, *Construction*, and 4.2.1.2, *Drilling and Operation*). Alternatives D1 and D2 do not include the road, but include a 5,000-foot airstrip and parking apron, an additional occupied structure pad, and a 1.3-mile gravel access road between the GMT1 pad and the airstrip; thus, have greater footprint overall than Alternative A or B (Alternative C includes other road enhancement resulting in the largest footprint of all action alternatives).

Soil disturbance during road and bridge construction and installation of culverts could cause temporary, local increase in sediment load in a stream as well as other impacts described in Section 4.2.1.1, *Construction*. Other potential impacts of culverts are addressed in other resource sections (e.g., Section 4.2.2, *Water Resources*; Section 4.3.1, *Vegetation and Wetlands*; Section 4.3.2, *Fish*).

Although Alternatives D1 and D2 would not have a permanent road, these alternatives would require more years of ice roads (especially D2, with seasonal drilling, see Chapter 2 for description of alternatives), thus compressing the soil and vegetation year after year (impacts to vegetation and wetlands are addressed in Section 4.3.1). The effects of seasonal ice roads that are constructed within the same footprint each year may have additive effects, although there is limited documentation of this occurring (Corps 2012, p. 5-149).

Year-round vehicle traffic (described by alternative in Chapter 2, including specific trip frequency, vehicle type, location of travel, and purpose) along the road would cause gravel spray/dust deposition. There would be some gravel spray/dust deposition in Alternatives D1 and D2, but it would be less because the areas available for vehicle traffic are less and traffic would travel slower than along the major CD5-GMT1 road. Other impacts by vehicle and aircraft traffic are addressed in each resource section of Chapter 4.

Without a CD5-GMT1 road, Alternatives D1 and D2 would create smaller areas of indirect impacts caused by gravel spray/dust deposition as compared to Alternative C which has the largest area of indirect impact caused by gravel spray/dust deposition (Table 4.2-4). However, for Alternatives D1 and D2 there is proportionally a larger footprint in the immediate project area of GMT1, because of the need for the occupied structure pad and an airstrip as compared to other alternatives. Thus, gravel spray and dust deposition in Alternatives D1 and D2 would be primarily along the access road between the GMT1 pad and the airstrip (Alternative 1: year-round through life of the project; Alternative D2: seasonal drilling until first oil, seasonal drilling and year-round operation would be conducted 2023 to 2042, then post-drilling operation would occur year-round through the life of the project).

All action alternatives would require helicopter flights for special studies to land in the NPR-A with the potential to create areas of indirect impacts caused by gravel spray/dust. For Alternatives D1 and D2 NPR-A helicopter landings would also occur to transport gravel-working crews during construction and crews for ice road cleanup and inspections.

Development of the ASRC Mine site would impact soil and permafrost by excavation and removal of the overburden material to access the underlying gravel. Table 4.2-5 lists the geomorphic units that would be disturbed and excavated by the development of the ASRC Mine site.

Sand and Gravel Resources

Impacts to a gravel resource under all the action alternatives are expected to be of high intensity (e.g., extraction of a portion of the resource) and long term in duration, but of local extent.

Table 4.2-5 lists the geomorphic units that would be impacted by the development of the ASRC Mine site.

Table 4.2-5. Area of Geomorphic Units Impacted at the ASRC Mine Site for All Action Alternatives

Geomorphic Unit (acres within mapped project study area) [a]	Direct Impact				
Alternative:	A	B	C	D1	D2
Total Gravel Requirement (cubic yards)	628,050	684,550	862,250	845,600	830,800
Estimated area impacted (acre) [a]	26.0	28.3	35.7	35.1	34.5
Delta Inactive Overbank Deposit [b]	26.0	28.3	35.7	35.1	34.5
Percentage Impacted [c, d]	0.15%	0.17%	0.21%	0.21%	0.20%

[a] It is assumed that the gravel resources in Phase 3 of the ASRC Mine site are similar to those in Phase 2 of the ASRC Mine site. Estimated area impacted by gravel extraction are based on the Phase 2 permit: 83 acres of surface disturbance for 2 million cubic yards of gravel (Corps 2013a).

[b] The entire Phase 3 of the ASRC Mine site is the same geomorphology type.

[c] Percentages for geomorphic units based on mapped acreage of the unit within the project study area. A total of 16,881 acres of Delta Inactive Overbank Deposit are within the mapped project study area.

[d] Percent of project area based on mapped area of 110,605.3 acres.

Geology

Direct impact to bedrock during construction is negligible under the action alternatives. The volume of bedrock impacted by drilling is inconsequential compared to the total volume of bedrock in the project study area.

Petroleum Resources

Impacts to petroleum resources under all alternatives are expected to be major because GMT1 will result in the irreversible and irretrievable commitment of petroleum hydrocarbon resources of the GMTU; however, this is the Applicant's stated purpose for the project. Impacts to petroleum resources would be the same for all action alternatives. Under Alternative E, there would be no impacts to petroleum resources.

4.2.1.4 Mitigation

Avoidance or reduction of impacts is provided through design features, mitigation described in Section 4.7, and by following protective measures of BLM (2013: A-7, A-10, C-2, E-4, E-5, E-6, E-8, E-12, and L-1. Impacts are expected to be minor and within the range described in BLM (2004, § 4F.2.1.1).

Facility design and construction of pipelines, roads, pads, airstrips, and other facilities, are expected to effectively minimize the amount of habitat that would be altered by gravel pads and other surface disturbances.

Avoidance or reduction of potential impacts to permafrost is provided through geotechnical studies, design and operation features, and mitigation described in Section 4.7. Insulated conductors will be used to minimize subsidence issues and provide near well bore protection. Thermosyphons would be installed adjacent to certain infrastructure components to protect the permafrost conditions and the infrastructure. Additional design measures required by state and federal permit conditions would contribute toward the avoidance and minimization of impacts on soils and permafrost include the following:

- Placing a minimum of 5 feet of gravel fill, to insulate the underlying permafrost.
- Elevating heated buildings or structures on pilings, to prevent or reduce heat transfer to underlying soils and preserve the thermal integrity of the permafrost.
- Elevating all on- and off-pad pipelines above grade on VSMs.
- Minimizing or avoiding impoundments (which can act as thermal sinks and create thermokarst) by maintaining natural drainage.
- Designing bridges and culverts to maintain existing surface drainage patterns, prevent erosion, and ensure adequate water flow to maintain soil ice features.
- Installing thermosyphons around wells to remove unavoidable heat transfer from wellbore fluids. Additionally, well conductor piles will be insulated.
- Requiring workers to stay on gravel surfaces unless their job duties require them to be on the tundra, to minimize compaction and disturbance to surface insulating vegetation or snow.
- Applying dust control measures to roads, pads, and summer mining activities to protect insulating vegetation, and minimizing dust settlement on vegetation or snow which could increase thermal conductivity and promote earlier spring thaw in affected areas.
- Reducing surface discharge of wastewaters through use of a disposal well, including zero discharge of produced water and drilling wastes. Surface discharges could erode surface soil, create drainage patterns, and initiate thermokarst erosion.
- Implementing operating procedures and maintenance programs to ensure the design measures remain in effect throughout the life of the project. These include maintaining

gravel depth according to design measurements, maintaining culverts and bridges to provide unimpeded water flow, and maintaining the well thermosyphons.

- Implementing spill prevention and response programs.
- Overburden for gravel mining is either placed on previously disturbed area within the pit or on an ice pad.

Erosion control measures would be included in the project SWPPP. Several of the mitigating measures designed to protect vegetation and wetlands would reduce impacts to soils and permafrost.

Impacts from gravel extraction from the ASRC Mine site may be minimized by use of design features. It is assumed that gravel extraction from Phase 3 of the ASRC Mine site would include measures currently required under the existing permit (Phase 2, Corps 2013a), such as the following:

- Imposing a 500-foot buffer along the Colville River, and a 200-foot buffer around large lakes.
- Requiring all temporary stockpiled material that is placed on the tundra be placed on an ice pad and removed prior to spring breakup.
- Prohibiting excavation and high-noise activities, such as blasting between May 20 and August 1 to avoid disturbances to spectacled eiders during pre-nesting and nesting seasons. If activities must be conducted during nesting season, a USFWS nest survey will be required.
- Performing reclamation in accordance with an approved plan.
- Requiring submission of an annual report of all activities conducted in the previous year and planned for the following year.
- Requiring that the top 12 to 18 inches of organic overburden be stockpiled separately from other overburden and used as the top layer in mine site rehabilitation at the end of each winter.

Potential New Mitigation Measure 1: Development of a Regional Mitigation and Monitoring Strategy

Objective: Permittee would contribute funds to BLM for the development and implementation of a landscape-level conservation plan and regional mitigation strategy. The strategy would help maintain functioning habitat necessary to sustain fish and wildlife species abundance and distribution in support of subsistence way of life activities; and, ensure continued access to subsistence use areas.

Requirement/Standard: The permittee will contribute funding the BLM to develop a Regional Mitigation and Monitoring Strategy (RMMS) as a tool to develop, identify, and communicate the mitigation needs in the NPR-A in accordance with the integrated a plan, in order to implement mitigation for future proposed development activities as part of a transparent and meaningful stakeholder engagement process and based on the best available science. The permittee may provide in-kind support via time from a CPAI employee to help expedite this process. The RMMS would consider foreseeable land uses, including oil and gas development and related infrastructure, as well as associated foreseeable impacts to resources, values, and functions in NPR-A, including socioeconomic impacts. The plan and strategy would be developed in consultation with federal, state, and local cooperators and interested stakeholders.

The BLM will define the geographic region for the RMMS with consideration to: 1) the scientifically-based distribution of the resources, values, and functions that will be foreseeably impacted by future land uses, including oil and gas development; 2) the land uses considered in the RMMS (e.g. species' ranges, subsistence use areas); 3) the geographic extent of land uses (e.g. oil and gas lease tracts, units and participating areas); and, 4) existing mitigation programs (e.g., Corps Clean Water Act Section 404 permitting). The region may be defined as a whole or part of the NPR-A and may include areas located outside NPR-A on the North Slope and off-shore.

The RMMS will include:

- Baseline conditions and trends (including consideration of change agents, e.g. climate change) of the region's resources, values, and functions that may be impacted by foreseeable land uses in the NPR-A and may warrant application of the mitigation hierarchy (avoidance, minimization, and compensation).
- Foreseeable impacts (including direct, indirect, and cumulative impacts) to resources, values, and functions, and the consequences that these impacts are expected to have on baseline conditions and trends.
- Appropriate measures to avoid, minimize, rectify, and reduce/eliminate over time the foreseeable impacts to the region's resources, values, and functions.
- Foreseeable residual impacts to regional resources, values, and functions.
- Resources, values, and functions that warrant compensatory mitigation due to foreseeable residual impacts.
- Compensatory mitigation obligations for resources, values, and functions that warrant compensatory mitigation.
- Evaluation and prioritization of compensatory mitigation sites and actions that will support achievement of the region's resource, value, and function goals and objectives, including considerations of each site's ability to provide benefits to multiple resource, value, and function goals and objectives, importance in the region, durability, and the additionality of actions. This prioritization will primarily aid in determining investment priorities for in lieu fee funds and permittee-responsible actions; though the siting and work plan for mitigation banks could also benefit from this effort.
- Compensatory mitigation investment options in the region (e.g. mitigation banks, in lieu fee funds, permittee-responsible actions).
- Durability, maintenance, compliance monitoring, effectiveness monitoring, and adaptive management strategies to maximize the effectiveness of mitigation actions.

Potential Benefits and Residual/Unavoidable Impacts: The RMMS will allow for meaningful, strategic, and deliberative engagement from all stakeholders on how best to achieve the sustained yield of the resources, values, and functions, in balance with the potential impacts of foreseeable land uses, particularly future permitted oil and gas development in NPR-A. BLM will be able to reach across ownership/jurisdictional boundaries to provide opportunities for consistent and strategic application across the North Slope. The strategy will help increase permitting efficiency and financial certainty for future oil and gas authorization applicants; identify compensatory mitigation actions and sites across the north slope to provide opportunities for more effective outcomes for impacted resources, values, and functions; and enhance the ability of federal agencies, tribal, state, and local governments, and, Alaska Native corporations, as well as private entities to invest in more effective and larger-scale mitigation efforts to achieve multiple objectives through transparent prioritization of investments and pooling of resources.

Potential New Mitigation Measure 2: Legacy Well Remediation Fund

Objective: Compensate for impacts to surface resources, including wetlands and soils, impacts to surface travel and traveler safety, and impacts to subsistence use resulting from the GMT1 project.

Requirement/Standard: The permittee will contribute funds to BLM for cleanup of legacy well sites associated with historic exploration programs conducted by the Navy and USGS, and other appropriate contaminated sites.

Potential Benefits and Residual/Unavoidable Impacts: The GMT1 project will create unmitigated impacts to surface resources, travelers, visual resources and subsistence use on the NPR-A landscape. The BLM has identified numerous legacy well sites within and near NPR-A, and other areas such as drum caches and former camps and disposal areas that were created during the historic exploration of NPR-A. These sites pose ongoing adverse impacts and hazards to surface resources, wildlife, public health and safety, and subsistence use. Cleaning up such sites will contribute to compensating for ongoing impacts to similar resources and users caused by the GMT1 project in the project area by improving habitat, reducing the potential for contamination of soils, surface waters, and the active layer, as well as eliminating hazards to travel caused by potential leaks, debris accumulations and structures that are concealed by snow or vegetation and pose collision hazards to winter travelers.

4.2.1.5 Conclusion

Impact levels to physiography/geomorphology and soils/permafrost would be high-intensity and long-term, localized and these resources are considered common in the project area. Therefore, impact to these resources is expected to be minor for all action alternatives.

Impact to geology (i.e., bedrock) would be high-intensity, long-term, local, and common. Therefore impacts to geology would be minor for all action alternatives.

Impacts to petroleum resources under all the action alternatives are expected to be major because GMT1 will result in the irreversible and irretrievable commitment of petroleum hydrocarbon resources of the GMTU as this is the Applicant’s stated purpose for the project. Alternative E would have no impacts to petroleum resources.

Impacts to sand and gravel resources would be high in intensity and long-term (extraction and use of a portion of the resource) but local and are these resources are considered common at the material sites. Therefore the impact to sand and gravel resources is minor for all action alternatives.

There are no documented paleontological resources that would be impacted by the project for any of the alternatives; therefore, no impact to these resources is expected.

Alternative E, No Action, would cause no impact to the resources of the terrestrial environment.

Climate change may have several impacts on the soil profile over time, exacerbating the loss of permafrost and soil insulation from activities associated with any of action alternatives. The depth of the active layer is expected to increase as permafrost is degraded over time, resulting in water accumulations or excessive drainage from organic soils, depending on the topography and drainage patterns. Warming temperatures may also accelerate the rates of decomposition of organic matter, accelerating the loss of soil insulation. Bacteria and microbial activities in soils would be expected to increase substantially with rising soil temperatures, which may accelerate the rate of biological soil development and aid in recovery of soils after damage. Increased rates of erosion and soil subsidence from warming temperatures, as permafrost melts could also occur.

4.2.2 Water Resources

The water resources evaluated in this section include the available quantity, quality, and use of groundwater and surface water (lakes/ponds, streams/rivers, estuaries, and near shore environments (Map 4.2-1), and the hydrologic regime.

The potential project-related impacts on water resources were evaluated in BLM (2004, § 4F2.2) for the proposed activities in the project study area. In addition, BLM (2012, § 4.3.4) provides a recent and thorough update of the potential impacts of oil and gas development on water resources, as does the Point Thomson Final EIS (Corps 2012, § 5.6). The methodology of analysis of impacts for water resources in these documents was adopted into the analysis for the SEIS. In addition, impact analysis of Alternative D2 for water resources was conducted and results are presented herein.

Potential impacts to surface water quality are described in BLM (2012, § 4.5.4.2) and BLM (2004, § 4F.2.2.2). Hydrology and surface water quality are closely linked and the discussion regarding potential impacts to water resources is combined in this section, with respect to both hydrology and surface water quality.

Impact criteria used to analyze potential impacts to hydrology and surface water quality from project alternatives are presented in Table 4.2-6. Impact levels are noted on Table 4.1-2.

Project development activities that have the potential to impact water resources include, but are not limited to:

- Gravel mining
- Placement of gravel fill for infrastructure (e.g., roads, pads, airstrip)
- Installation of bridge(s) and culvert(s)
- Construction of pipeline
- Construction of ice roads and pads
- Extraction of water supply from local lakes (for ice roads, construction, drilling, and operation)
- Groundwater well reinjection

Potential impacts are generally categorized as follows (BLM 2004, § 4F.2.2):

- Shoreline disturbances and thermokarst
- Blockage or convergence of natural drainage
- Increased stages and velocities of floodwater
- Increased channel scour
- Increased bank erosion

- Increased sedimentation
- Increased potential for overbank flooding
- Removal or compaction of surface soils and gravel, and changes in recharge potential
- Produced-water spills
- Petroleum hydrocarbon spills
- Demand for water supply

Major areas of concern for surface water impact are described in BLM (2004, § 4F.2.2.2) and BLM (2012, § 4F.5.4.2).

Avoidance or reduction of potential impacts to water resources would be provided through siting and design and mitigation (Section 4.2.2.5, *Mitigation*). In addition to the stipulations and BMPs, project activities that could impact water resources will be subject to federal, state, and local permit requirements. As a result, impacts to water resources are expected to be minor and within the range described in BLM (2004).

Table 4.2-6. Impact Criteria — Water Resources

Impact Category	Magnitude	Definition
Intensity	High	Changes to the hydrologic regime that require rehabilitation or cannot be rehabilitated to maintain pre-project hydrologic function. Changes in water quality such that protected water use classes are violated to the extent that mitigation measures would not be effective and remediation measures would be necessary, or changes in water quality that result in a new environment in which new water classes are achieved.
	Medium	Changes to the hydrologic regime are measurable, yet do not require rehabilitation to maintain pre-project hydrologic function. Examples per type of impact: • Drainage patterns change, yet impoundment and draining are similar to annual flooding and seasonal inundation extents. • Streamflow or stage changes, yet seasonal and annual base flow and peak events are preserved, and flood inundation limits are similar. • Stream velocity changes, but erosional and depositional characteristics are preserved and increases are not compounded. • Lake levels change seasonally but recharge annually. Changes in water quality based on protected water use classes predicted but can be mitigated.
	Low	Slight changes to the hydrologic regime that are not measurable. Slight changes in water quality that do not violate protected water use classes.
Duration	Long-term	Impact to hydrologic regime would exceed four years. Impact to water quality would exceed the life of the project.
	Interim	Impact to hydrologic regime would last beyond a season but less than four years. Impact to water quality would last the life of the project.
	Temporary	Impact to hydrologic regime would be seasonal and associated with only the construction or drilling phases. Impact to water quality would last a short period during a phase of the project.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Statewide	Changes to hydrologic regime extend beyond the immediate water body affected, or affect a large portion of an individual water body of great size or critical value. Impacts beyond the immediate water body are due to hydrologic connections such as downstream, upstream, lakes feeding stream, stream feeding lakes, and shallow groundwater connections between lakes and other lakes or streams. Water quality changes occur in the water bodies adjacent to project component footprint and associated waters that are hydraulically connected to those resources across a large portion of the project study area.
	Regional	Changes to hydrologic regime are limited to areas without stream connections or water bodies of great size or critical value that are discernible from either aerial photographic interpretation or a GIS hydrography dataset. Water quality changes are confined to the area within and around a project component footprint and the water bodies directly surrounding the project component.
	Local	Changes to hydrologic regime are limited to areas without lakes or stream connections that are discernible from either aerial photographic interpretation or a GIS hydrography dataset. The area of water quality changes is small and could be easily contained from moving downstream or throughout a water body for mitigation purposes.

4.2.2.1 Construction

Several activities during construction have the potential to impact water resources. These activities are described below and include gravel mining, placement of gravel fill for infrastructure (e.g., roads, pads, airstrip), installation of bridge(s) and culvert(s), construction of pipeline, water supply extraction, and groundwater well reinjection. Oil spills during construction could impact water resources and are addressed in Section 4.5.

Gravel Mining

The preferred source of gravel for the GMT1 Project is the existing ASRC Mine site. The footprint of impact would vary by gravel demand for each action alternative (Section 2.4.4, *Gravel Supply Options*).

During gravel mining, it is probable that shallow taliks and supra-permafrost water zones would be temporally eliminated in the immediate vicinity of the gravel mine. However, the effect of this loss on water resources would be negligible, because the area of impact would be localized and supra-permafrost zones would re-establish over time once the mine pit is filled with water. The subsurface water-bearing zone would be permanently eliminated in the immediate footprint of the mine, but would be replaced by surface water that is connected to the shallow groundwater.

Removal of gravel from areas near (or within) streams and lakes can result in changes to stream or lake configurations, stream-flow hydraulics, lake shoreline flow patterns, erosion, sedimentation, and ice damming (NRC 2003). Gravel extraction could produce sedimentation as discussed in BLM (2012, § 4F.5.4.2, pp. 12 and 13).

Groundwater impacts associated with gravel mining are likely to be moderate to major, but limited in area and temporary, only extending for the period of use and rehabilitation. Long-term impacts of gravel extraction from the ASRC Mine site on the drainage pattern would be medium intensity and local extent. The water in the flooded pit would likely remain unfrozen near the bottom, altering the thermal regime, and creating a thaw bulb around and beneath it, potentially resulting in localized thermokarst. The steep side slopes of the excavation will likely slough as they thaw, becoming more gradual over time, and causing slight infilling. A Reclamation Plan is in place for the ASRC Mine site to reclaim the areas mined under Phase 1 and Phase 2. A Long-Term Adaptive Management Plan was developed to ensure that the project will be managed to ensure long-term sustainability of the reclamation and the enhanced waterfowl habitat resource values that are created. It is expected that similar plans to ensure the reclamation and management of future mined areas will be permit requirements.

Construction of Infrastructure

Construction associated with the action alternatives (e.g., the placement and construction of gravel pads, roads, bridge[s], airstrips, and culvert[s]) could affect natural drainage patterns (creation of new channels and inundation of dry area), stream stage (water level) and streamflow (volume), stream velocity (which influences erosion and sedimentation rates), groundwater flow, and lake levels. Modification of the natural surface water drainage patterns may result from blockage or redirection of flow. Disruption of streambeds and stream banks can also remove protective shoreline vegetation and lead to channel erosion and sedimentation, formation of meltwater gullies, plunge pools from perched culverts, and formation of alluvial fans in streams and lakes (BLM 2012, 4.4.4.2, p. 377).

A few examples of construction activities that could impact hydrology include displacement of a lake or pond by fill or placing fill (such as for an airstrip or road) transversely across grade, thereby blocking the natural drainage of sheet flow runoff, shallow groundwater, stream input, or rain catchment. Placing fill transversely across grade would also change snow accumulation patterns, which, in turn, would change drainage patterns once the snow melts. Placing fill transversely across grade or the predominant wind direction may also change snow accumulated patterns, which, in turn, may change drainage patterns once the snow melts. Impacts to drainage patterns may result in increased inundation (flooding) or drying of affected areas. Increased inundation may in turn increase thermokarst action in the affected area.

Gravel fill on tundra could potentially change recharge potential, block natural drainage and change existing hydrologic regime; erosion of roads and pads could increase sedimentation into waterways. During construction, sediments and dust could be disturbed and deposited on snow and ice during the winter or on tundra and open water during the summer. The sediments and dust could be introduced into the water column, causing an increase in turbidity. Snow roads, ice roads, and ice pads are temporary structures and impacts, if any, are expected to be minor and short term. Details related to erosion and sedimentation during the construction phase is provided in BLM (2004, § 4F.2.2.2).

Where gravel fill is placed in wet areas to construct a road, pad, or airstrip, the receiving waters could temporarily have higher suspended solids concentrations and greater turbidity. Fugitive dust which enters surface water bodies can also increase turbidity. Further information regarding turbidity during the construction phase is provided in BLM (2004, § 4F.2.2.2).

A road or airstrip aligned perpendicular to stream channels and the direction of sheet flow have a greater potential to impound sheet flow and shallow groundwater, than a road or airstrip aligned generally parallel to existing drainage patterns. The CD5-GMT1 gravel road (7.6 miles in Alternatives A and C and 8.6 miles in Alternative B) transverses the hydraulic gradient and potentially could result in increased inundation (flooding) upgradient of the road, and decreased inundation down gradient of the road as discussed in BLM (2012, § 4.3.4). In Alternatives D1 and D2, the airstrip would also be oriented generally cross-gradient. The airstrip would be wider than the road, but is not as long. Prolonged inundation could impact vegetation and result in thermokarst.

A direct impact from winter road and pipeline construction is the potential disturbance of tundra vegetation and soils (Sections 4.2.1 and 4.3.1). Disturbed and exposed soils are more susceptible to erosion and subsequent sedimentation during spring breakup than non-impacted areas. Fugitive dust from construction can also be deposited on snow and ice during the winter. When melting occurs, this dust can enter surface water bodies, increasing turbidity.

The proposed pad(s), airstrip, and roads (depending on alternative) have been designed to account for thermal criteria (minimum thickness to prevent permafrost degradation) and hydrologic criteria (50-year flood plus 3 feet) for minimal impact to the surrounding tundra. However, the construction of permanent gravel roads and pads will compact underlying soil, potentially impact thaw depths, and reduce infiltration. Locally, this may result in inundation of previously dry areas during breakup, changes in stream flow, and potential lake recharge. The duration of impacts will be long-term because the roads and pads will remain during the period of operation.

Increased or decreased stream velocities could result in increased erosion or sedimentation. Generally, increases in velocity result in increased erosion, and decreases in velocity result in increased sedimentation. Flow constrictions such as through culverts or bridges would most likely lead to increased stream velocity, which may increase erosion. Similarly, flow blockages or other obstructions can lead to decreased velocity, potentially resulting in inundation and potentially increased sedimentation. Diversions may also affect erosion and sedimentation. Decreasing the volume of water flowing in a stream typically decreases velocity and sediment transport capacity, while increasing streamflow typically increases velocity and erosive capacity.

The impacts that could be caused by the construction and continued presence of a road (drilling, operation and possibly permanently) are addressed together in this section.

Potential impacts to drainage that may be caused by the CD5-GMT1 road (common to Alternatives A and C) were evaluated using a preliminary inundation analysis with conservative assumptions. The methods followed the general approach described in the Point Thomson Project EIS (Corps 2012, Appendix S). In the analysis (modeling), the maximum headwater depth at each road crossing is assumed to equal the height of the culvert. Culverts were assumed to be 4 feet in diameter and installed every 500 feet along the ground surface. Thus, the maximum water depth immediately upstream of each road crossing (culvert) is 4 feet. This hypothetical water surface was used to estimate the inundated area, by projecting the upgradient of the road until a 4 foot elevation rise occurred. Areas with the flattest topography experience the greatest ponding, and steeper areas less ponding.

The extent of downstream indirect impacts was calculated by assuming a typical hydraulic expansion angle of 2:1 from each culvert and spacing between culverts of 500 feet. The 2:1 ratio results in a downstream impact zone of 500 feet. In this 500-foot zone, the area directly downstream of the culvert would potentially be inundated with flow while the area between culverts, downstream of the road embankment, would receive less flow and be somewhat drier. It is not possible to determine an amount or percentage of how much wetter or drier the areas would be without a detailed modeling exercise.

Based on these methods and assumptions, the potential upstream inundation area was calculated to be the area shown on Map 4.2-2, which is approximately 2,600 acres (Table 4.2-7). This value is considered a preliminary worst-case scenario. Elevation data was derived from *Google Earth Pro 2013\Shuttle Radar Topography Mission Digital Elevation Model*[9], which has relatively low resolution and likely results in over-estimates of the inundation areas. In addition, a 4-foot diameter thin edge projecting culvert under inlet control conditions can convey 66 cfs. Based on the USGS regression equations for Region 7, a contributing drainage area of approximately 435 acres is required to generate a 50-year design flow of 66 cfs. Many of the projected culvert locations have contributing areas less than 435 acres. Despite these shortcomings, the crude model does provide a mechanism for estimating the maximum extent of increased inundation that potentially could occur under worst-case conditions. A similar analysis for Alternative B is presented in Map 4.2-3 and for Alternatives D1 and D2 is presented in Map 4.2-4.

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[9] A component of Google Earth Pro®; Shuttle Radar Topography Mission, http://www2.jpl.nasa.gov/srtm/.

Table 4.2-7. Potential Altered Inundation Area by New Roads

Alternative	Area of Potential Increased Stage (ponding) Upstream of Gravel Road (acres) [a]	Area of Potential Decreased Stage (Drying) Downstream of Gravel Road (acres) [b]
A	2,630	470
B	2,939	525
C	Similar to Alternative A	Similar to Alternative A
D1	Negligible [c]	Negligible [c]
D2	Negligible [c]	Negligible [c]

[a] Analysis follows methods established in Point Thomson EIS. Method assumes a maximum water depth of 4-feet at the base of the road, based on the assumption a 4-foot culvert would be installed every 500 feet along roads. Method is considered a rough order of magnitude estimate of the maximum inundation area per alternative.

[b] Area is a 500-foot zone on the downgradient side of the roadway.

[c] Gravel roads constructed under Alternatives D1 and D2 are limited (e.g., 1.3-mile access road between GMT1 pad and occupied structure pad) and generally not located cross gradient to established drainage pattern, so inundation is assumed to be negligible. There may be localized inundation adjacent to gravel embankments.

Pipeline construction within the project study area would have minor impacts on water resources and are related to the ice road during construction and associated water withdrawals from local lakes. Narrow streams would be crossed using elevated pipelines on suspension spans. All pipelines would be routed to avoid lakes. Once installed, suspended pipelines would have no impact on water flow characteristics, but would cause potential impacts related to oil spills (as discussed under Section 4.2.2.2). Buried pipelines are not included in the project designs, avoiding the potential impacts of thermokarst and subsidence associated with such installations. However, pipelines would cross under the CD5-GMT1 road at one or two locations, depending on alternative (Appendix A, Sheets 7 and 11).

In Alternatives A, B, and C the CD5 pipeline would cross under the CD5-GMT1 road just south of the CD5 pad (Appendix A, Sheet 11). In Alternatives A and C, the GMT1 pipeline would cross under the CD5-GMT1 road about a mile east of the GMT1 pad (Appendix A, Sheet 7).

To ensure that the existing thermal regime (i.e., permafrost) is maintained at these crossings, the pipelines would be installed as shown in Appendix A, Sheet 22 (CD5-GMT1 road at CD5 pipeline crossing) and Sheet 23 (CD5-GMT1 road at GMT1 pipeline crossing), with an impermeable membrane and rigid insulation installed under the pipelines, between the pipelines and existing ground surface. Section 2.5.2, *Infrastructure Development*, describes the installation of the pipeline for these locations.

Water Withdrawal and Ice Road Construction

Water withdrawal to support components of each alternative (e.g., ice roads for winter construction and camp water use) could affect the water levels of lakes used as water sources, and any connected water body, such as streams or wetlands. Only permitted lakes, rivers, or reservoirs (under ADNR Temporary Water Use Permit (TWUP) and if required, ADF&G Fish Habitat Permit) would serve as water sources. Excessive water withdrawal could result in a reduction of available overwintering habitat, reduced space, reduced oxygen availability, and could potentially result in mortality of fish. The results from water withdrawals under permits, as a result, are anticipated to be minor, temporary impacts to groundwater levels (shallow or deep), surface water levels, or drainage patterns associated with groundwater withdrawals during the summer season. Lakes would be the principal supply for fresh water during construction. Water demand is listed in Table 2.3-2.

Ice roads and ice pads would be used extensively during the winter season for access. Ice bridges at Tiŋmiaqsiġvik (Ublutuoch) River and Nigliq Channel would be required to be breached at stream crossings, especially where fish passage is a concern or the quantity of expected flow is substantial during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads, or ice bridges as discussed in BLM (2012, § 4F.5.4.2, pp. 12 - 13).

Ice road construction over lakes deep enough not to freeze to the bottom could affect dissolved oxygen (DO) concentrations. Many of these lakes are just a foot to a few feet deeper than the minimum 6-foot depth necessary to maintain some unfrozen bottom water in winter. An ice road across such an intermediate-depth lake could freeze the entire water column below the road, isolating portions of the lake basin and restricting circulation. With mixing thus reduced, isolated water pools with low oxygen could result. Dissolved oxygen concentrations could be reduced below the 5 parts per million (ppm) DO standard needed to protect resident fish (ADEC 2003b). Details related to DO concentrations during the construction phase are provided in BLM (2004, § 4F.2.2.2).

Ice roads built over creek and river crossings have the potential to restrict fish passage, resulting in mortality or redirection of fish. Water withdrawal and ice roads would support construction activities, and impact would therefore be temporary for all action alternatives. However, Alternatives D1 and D2 require seasonal ice roads to provide vehicle access to GMT1. For Alternative D1 ice roads would be used to support access during year-round drilling and post-drilling operation during the winter. For Alternative D2, with seasonal drilling, ice roads would be required for every drilling season (to support access and allow for transport the drill rig to and from GMT1 each season) and post-drilling operation (see also Section 4.2.2.2, *Drilling and Operation*). Under Alternative D2, an annual ice road would be necessary for 38 years (construction through operation). Treatment of surface water is required prior to use as a potable water source. A potable water treatment or domestic wastewater treatment system must undergo ADEC plan review and approval before use. Further information regarding drinking water sources during the construction phase is provided in BLM (2004, § 4F.2.2.2).

During the construction phase, temporary camps would be used. It is expected that sewage and all solid waste would be transported to CD1 for disposal in existing systems. Discharges of treated domestic wastewater to tundra, if needed, will be in accordance with the APDES permit as discussed in BLM (2004, § 4F.2.2.2, pp. 1086 and 1087). This applies for all action alternatives and will not be analyzed further for this SEIS.

No deep injections of waste material or water are proposed during the construction phase so impacts to the deep aquifer during construction would be minor to negligible.

The discussion in BLM (2004, § 3.2.2.2) and BLM (2012, § 3.2.10.2) regarding alkalinity and pH indicates that freshwater within the project study area is only weakly buffered with low alkalinities in ponds and lakes. Details related to how construction, and domestic needs could affect water quality, and specifically alkalinity and pH is discussed in BLM (2004, § 4F.2.2.2).

4.2.2.2 Drilling and Operation

The operation of the action alternatives could affect natural drainage patterns, stream stage and streamflow, stream velocity, groundwater flow, and lake levels as described for the construction phase. Locally, the gravel roads may result in inundation during breakup of previously dry areas, changes in stream flow, and potential lake recharge. In general, impacts are expected to be localized and somewhat proportional to the size of the pad, road, or airstrip. However, the configuration of gravel fill also affects impacts. For example, a linear road running perpendicular to the hydraulic gradient will result in a larger extent of hydrological impacts than a consolidated, square pad of similar acreage. The duration of impacts would be long-term because the roads (for Alternatives A, B, and C) and pads would remain during the period of operation.

Ice roads and ice pads would be used extensively for seasonal vehicle access. Ice roads may require breaching at stream crossings if fish passage is a concern during breakup. Under all of the alternatives, no long-term impacts are anticipated from ice roads, ice pads, or ice bridges as discussed in BLM (2012, § 4F.5.4.2, pp. 12 and 13).

The impacts of increased stream velocities beneath bridges and through culverts during flooding events were addressed in BLM (2004, § 4F.2.2.1). Constricting flows can result in increased stream velocities and a higher potential for ice jams, scour, and stream bank erosion. Impeding flows can result in a higher potential for bank overflows and floodplain inundation. These potential impacts need to be minimized by incorporating design features to protect the structural integrity of the road- and pipeline-crossing structures to accommodate all but the rarer flood events.

Once installed, suspended pipelines would have no effect on stream and water flow characteristics. Buried pipelines are not included in the project designs, avoiding the potential impacts of thermokarst and subsidence associated with such installations. The pipeline crosses under the CD5-GMT1 road in two locations for Alternatives A, B, and C. To ensure that the thermal regime (i.e., permafrost) is maintained, road/pipeline crossings will be installed with an impermeable membrane and rigid insulation installed under the pipelines, between the pipelines and existing ground.

Water withdrawal to support components of each alternative (e.g., operations, dust control, and camp water use) could affect the water levels of lakes used as water sources, and any connected water body, such as streams or wetlands. Only permitted lakes, rivers, or reservoirs (under ADNR Temporary Water Use Permit (TWUP) and if required, ADF&G Fish Habitat Permit) would serve as water sources. Water withdrawal in the summer from lakes could also result in a temporary lowering of the shallow groundwater in adjacent wetlands as the groundwater recharges the lake. The impacted area would be localized around the lakes' perimeters. Lakes would be the principal supply for fresh water during operation. Lakes could supply fresh water for (1) the seasonal construction of ice roads and pads; (2) drilling; (3) hydrostatic testing; (4) dust abatement on roads, pads, and airstrips during summer; (5) potable water; and (6) fire suppression and maintenance activities. There are no plans to install water production wells in the project study area. Temporary, minor impacts to groundwater levels (shallow or deep), surface water levels, or drainage patterns associated with deep groundwater withdrawals could occur during the summer season.

Water use for the operation period would be approximately 25 percent of that required during the construction period for Alternatives A, B, and C. Water withdrawals to support ice road construction would be necessary during drilling and operation of Alternatives D1 and D2. Details related to water withdrawal from lakes during the operation period is provided in BLM (2004, § 4F.2.2.2).

During drilling there would be deep injection of drilling fluids (as per approved permit). Drilling fluids are typically a preparation of water, clay, and chemicals circulated into a well during drilling, and must be disposed of when drilling operations cease.

As discussed in BLM (2004, § 4F.2.2.2), discharges of treated domestic wastewater in the operation period could occur to tundra in accordance with APDES permit requirements. This applies to all the action alternatives.

As stated in BLM (2004, § 4F.2.2.2), the following changes to water quality may occur during the drilling and operations phase of the project:

- Increased turbidity of water bodies in the project study area may result from dust fallout, flooding, erosion, or bank failure.
- Water withdrawals for drilling and/or operations may have short-term (lasting only one season) impacts on alkalinity, pH, or oxygen content in the project study area.
- No discharge of sewage directly to water bodies in the project study area would occur and therefore, it is not anticipated that there would be an increase in fecal coliform counts over the naturally occurring concentrations.
- Pipelines suspended over streams should have no effect on stream habitat and flow characteristics provided these are elevated sufficiently to avoid flooding (BLM 2012, § 4.3.7.2, p. 154).

Oil spills could occur from pipelines; storage tanks; production facilities/infrastructure; drill rigs; and vehicles during either the construction or drilling and operation phase. Spills occurring from pipelines or leaving pads and roadbeds could enter water sources reaching tundra ponds, lakes, creeks, or rivers. Spills can occur at any time during the year. The potential impacts from oil spills are described in BLM (2012, § 4.3.4.2) and in Section 4.5 of this SEIS.

4.2.2.3 Bridges and Culverts

Three primary stream crossings have been identified and extensively monitored for the proposed CD5-GMT1 road (Map 4.2-5). These sub-drainage basins are well defined and have been delineated through the available aerial photography and topographic maps, as shown in Map 3.2-2 (MBJ 2009a, Fig. 1.3 and Fig. 2.7). The current proposed project (Alternative A) proposes bridges over the two anadromous streams: Tiŋmiaqsiġvik (Ublutuoch) River and Crea Creek with a cross-drainage culvert at Barely Creek. Currently, design of the bridges and culvert installations are in the conceptual phase of the design process.

Bridges are proposed in areas where channelized flow occurs with a 50-year reoccurrence interval of 500 cfs or greater (BLM 2004, § 2.3.9.1). Bridge abutments and on-tundra aprons will be armored to protect the road and tundra from scouring. During break up when high flows are expected, the road will be frozen, reducing material for scour potential. Appropriate slope protection of armor rock, articulated concrete matting, and re-vegetation or other protection will be utilized where necessary. Piles will be set deep enough so that the bridge structures will remain stable for the designed scour event (BLM 2004, § 4F.2.2.1). Results of scour analyses will be incorporated into the final bridge design for both Tiŋmiaqsiġvik (Ublutuoch) River and Crea Creek (DeGeorge 2014a).

Culverts are considered for all water crossings that do not require a bridge. The design criteria for all culverts is such that they will prevent raising the water level on the upstream side of the crossings by more than six inches compared to the down gradient side for more than one week after peak discharge. Culverts will be installed at regularly spaced intervals to mitigate the risk of sheet flow interruption and thermokarst. Final design of the culverts for the CD5-GMT1 road will also depend on breakup characteristics for those drainages that could affect the roads (BLM 2004, § 4F.2.2.1). At this time, these crossings are not expected to present any technical challenges beyond what is currently practiced for the region.

For preliminary permit drawings, only the more evident culvert locations are identified from aerial photographs. During the preliminary road alignment, a field reconnaissance will be conducted to identify and mark as many obvious culvert locations as possible. With the combined ground survey of the road alignment, collected field data, and aerial photography, cross-drainage culverts will be identified and placed in the design drawings. After the road centerline has been staked, a final field visit will be conducted and additional cross-drainage culverts will be located as required. Thus far, detailed information regarding culvert placement and design has not yet been gathered, but will be done during final road alignment (Morris 2014). In conjunction to culverts placed in specific drainage locations, cross-drainage culverts will be placed under the road approximately every 500 to 1,000 feet. Cross-drainage culverts may be up to 48 inches in diameter (BLM 2004, § 2.3.9.1).

Tiŋmiaqsiġvik (Ublutuoch) River

The Tiŋmiaqsiġvik (Ublutuoch) River lies in the southeast portion of the FCB. The river is sinuous with a low flow gradient, flowing north into Fish Creek approximately 10 river miles (RM) upstream from Harrison Bay. The channel is characterized by numerous meander bends, often with undercut banks and associated bank sloughing along the edges. At the location of the proposed road crossing (CD5-GMT1 road), the drainage area comprises approximately 228 square miles (MBJ 2009a, § 2.1.1).

Based on data collected for ten years, the average date for peak discharge is June 4 followed by several days of elevated flows (MBJ 2013a, § 4.1). The average observed peak direct discharge in the vicinity of the proposed road alignment is 2,200 cfs (MBJ 2013a, Table 4.1). Historic peak flow observations ranged from 1,440 cfs to 5,360 cfs (MBJ 2013a, Table 4.1). Calculations from the 2009 flood frequency analysis estimated the 50-year and 100-year discharge events for the Tiŋmiaqsiġvik (Ublutuoch) River to be 8,800 cfs and 9,800 cf, respectively (MBJ 2013a, Table 4.2).

The currently considered design for the Tiŋmiaqsiġvik (Ublutuoch) River bridge is 350 feet long and constructed using five sets of 32-inch pilings positioned approximately 85 feet apart and a bridge deck elevated approximately 26 feet BP Mean Sea Level (BPMSL) made of 31–feet-wide precast concrete slabs. The bridge deck will have a removable guardrail and will be rig-capable. The pipelines will be located on the structural steel supports attached to the bridge girders, below the bridge deck. Sheet pile abutments for erosion protection will be located at each end of the bridge. The proposed 350-foot bridge would extend from bank to bank and is designed to span a 50-year discharge event. As such, there will be a span over the main channel of 93 feet on the eastern side. The bridge will be designed to have no piers located in the channel which is approximately 1 foot BPMSL during normal flows.

Hydraulic modeling of permanent structures was described in BLM (2004, § 4F.2.2.1). Assuming open water conditions, the impact from the proposed 350-foot bridge was evaluated with a 100-year discharge event and showed no measurable increase in surface water elevation on the upgradient side of the bridge (URS Corporation 2003). Based on the rating curves from this model, the current deck elevation is designed to be well above the 100-year water-surface of 12.1 BPMSL (MBJ 2011, Table 5.3). Though the upper portion of the west floodplain is inundated during high flows, the majority of the flow is conveyed along the lower west floodplain and main channel, neither of which will be constricted by the current design when ice jams are not present (see Map 4.2-6). Thus, stream velocity and channel scour is not expected to vary much from baseline conditions. Should an ice jam occur during moderate to large floods, it is possible some back water could result. However, significant ice jamming is not anticipated since the lower west floodplain could provide an alternative route for stream flow if the main channel is blocked (BLM 2004, § 4F.2.2.1). In addition, roads leading up to the bridge will be required to provide for natural flow during high-discharge events. The Tiŋmiaqsiġvik (Ublutuoch) River bridge design is shown in Appendix A, Sheets 27 through 29 of 33.

Though recommendations have been made for a 100-year flood event design, that design criterion is not considered an industry standard at this time). By increasing the overall length from the 120-foot minimum required by BLM (2004a) to 350 feet, some concerns regarding impacts to stream hydrology and habitat have been addressed by removing the abutments from the one-year and two-year flood levels (BLM 2004, § 2.4.6.5). It should also be noted the length of spans between piers in the current design have been extended (85 and 93 feet) from the approximately 50-foot spans in Alternative A, further reducing potential ice jamming (BLM 2004, Sheet 54 of 71). Though scour computations have yet to be conducted at crossings other than the Nigliq Channel, given the low velocities and frozen substrate, significant scouring is not expected. The concerns regarding the impacts of increased stream velocities beneath bridges and through culverts during flooding events during flooding events have been addressed in BLM (2004, § 4F.2.2.1).

Crea Creek

The 3.6 square mile drainage basin of Crea Creek flows northeast into the Tiŋmiaqsiġvik (Ublutuoch) River through a series of connected pools, ponds, and lakes (MBJ 2009a, § 2.1.2.5). The drainage is uniform in cross-section, having a firm channel bed with underlying sedges and the banks dominated by willows. Channelized flow was observed in 2005, 2006, 2010, 2011 and 2013 (MBJ 2011, § 2.2.2.3; MBJ 2013a, § 3.2.2). An aerial view of the Crea Creek is shown in Map 4.2-7. Observations during the 2011 monitoring event reported direct discharge of 61 cfs and peak indirect discharge of 84 cfs (MBJ 2011, §§ 4.2.7.1 – 4.2.7.2). In the 2009 flood frequency analysis, the 50-year and 100-year discharge event were calculated to be 269 cfs and 303 cfs, respectively (MBJ 2013a, Table 4.6).

The 40-foot-long Crea Creek bridge would be constructed using two sets of pilings positioned approximately 40 feet apart with sheet pile abutments for erosion protection located at each end of the bridge. The bridge deck would have a removable guardrail and will be designed to support a drill rig. The opening for water flow would be 25 feet wide with no piers located in the stream channel. The pipeline would cross Crea Creek on VSMs spanning the creek. The Crea Creek bridge design is shown in Appendix A, Sheet 30 of 33.

Unlike the Nigliq Channel crossing, the Tiŋmiaqsiġvik (Ublutuoch) River and Crea Creek crossings are designed to carry the load of a 1,400-ton drill rig module, requiring shorter spans than the other CD5 bridges. The Nigliq Channel crossing is a smaller single-lane structure that can only support 175-ton coil tubing rigs. The Applicant has indicated they are unable to move a drill rig over the CD5 bridges and will rely on ice roads in addition to the gravel roads and bridges for movement in the field (DeGeorge 2014a).

Barely Creek

Located between Crea Creek and the Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek bisects a channel of beaded streams that drain a small sub-basin comprising 0.7 square miles of ponds and marshes (MBJ 2009a, § 2.1.2.4). The channel is defined by connected pools that drain northeast into the Tiŋmiaqsiġvik (Ublutuoch) River. Native grass dominates the area with tussocks in regions bordering the channel reach. Channelized flow was observed at the proposed stream crossing during the spring breakup monitoring events in 2005, 2006, 2009, 2011 and 2013. This location was not monitored in 2010 (MBJ 2011, § 2.2.2.1; MBJ 2013a, § 3.2.2). Field observations in 2011 measured direct discharge of 4.4 cfs with a calculated indirect peak discharge of 16 cfs (MBJ 2011, §§ 4.2.5.1 – 4.2.5.2). The 50-year and 100-year discharge events were calculated at 68 cfs and 78 cfs, respectively (MBJ 2013a, Table 4.5). An aerial view of Barely Creek is shown in Map 4.2-7.

Because of the limited flow, this location has been selected for a cross-drainage culvert that will allow for fish passage. The typical design for fish passage culverts are shown in Appendix A. The final design will be implemented during the survey of the road alignment and installed prior to spring breakup which will be observed for changes in the hydrology. Additional culverts or changes in the design may be put into action as site-specific needs are further assessed.

4.2.2.4 Comparison of Alternatives

A major difference between Alternatives A, B, and C, as compared to Alternatives D1 and D2, is with regard to the proposed access (i.e., with or without the CD5-GMT1 gravel road). In general, the CD5-GMT1 road (Alternatives A, B, and C) could cause direct impacts to hydrology and water resources across the tundra; whereas, Alternatives D1 and D2 do not include the road, and impacts would be more focused around GMT1 pad and airstrip.

The impacts to rivers and drainage basins under Alternative D1 and D2 would be less than those for the other action alternatives. The 1.3-mile gravel access road (Alternatives D1 and D2) that would be constructed from GMT1 pad to the occupied structure pad and airstrip would be relatively short and, for the most part, is situated on topographically higher ground and does not traverse any major drainages, so the access road in Alternatives D1 and D2 would cause relatively minor impacts to the drainage patterns and associated ephemeral stream or sheet flow. There are no identified river or stream crossings along the route of the short access road. To the extent there are impacts to drainage patterns, they would be localized. Potential inundation caused by the presence of the 1.3-mile access road is likely to be negligible (Table 4.2-7).

Alternatives A and C propose two bridges for water crossings for the CD5-GMT1 road (Tiŋmiaqsiġvik [Ublutuoch] River and Crea Creek) and a cross-drainage culvert at Barely Creek. Alternative B would include one bridge at Tiŋmiaqsiġvik (Ublutuoch) River. Alternatives D1 and D2 would not require any permanent bridges.

For Alternatives A, B, and C, culverts are considered at all water crossings that do not require a bridge. Alternatives A and C would potentially require 81 culverts and Alternative B would potentially require 85 culverts (Table 4.2-8). Alternatives D1 and D2 would only have the 1.3-mile access road, which could require 13 culverts. Discussion of water crossings is included in Section 4.2.2.3.

In Alternatives A, B, and C, year-round vehicle traffic (described in Chapter 2, including specific trip frequency, vehicle type, location of travel, and purpose) along the CD5-GMT1 road would cause indirect impacts resulting from gravel spray/dust deposition onto adjacent water bodies. There would be some gravel spray/dust deposition associated with Alternatives D1 and D2, but it would be less because the areas available for vehicle traffic are less and traffic would travel slower than along the major CD5-GMT1 road.

Alternatives D1 and D2 would require more years of ice roads than Alternatives A, B, and C (especially Alternative D2 with seasonal drilling). Ice roads would be constructed within the same footprint each year and impacts may be additive, although there is limited documentation of this occurring (Corps 2012, p. 5-149). The ice roads could the alter drainage during spring breakup because the ice would melt more slowly than the surrounding tundra and streams. Blockage of streamflow and increased stream stage could occur over more years with Alternative D1, and especially Alternative D2 (seasonal drilling).

In Alternatives A and B, ice roads would be constructed every five years (for the period Year 5 through Year 30) to support resupply and transport of heavy equipment for the project. This would be necessary because the bridge at CD5 cannot support transport of the necessary heavy equipment.

Because of the reliance on an ice road for access to GMT1, the degree of ice road construction and water usage for ice road construction, drilling and camp use is greater in Alternatives D1 and D2 than in the other action alternatives. There are also more ice road miles during the construction phase under Alternatives D1 and D2. Alternative D2 would require the most water withdrawal because this alternative requires the most years of project operation – a function of seasonal drilling, not related to a CD5-GMT1 road. Therefore, the impacts of ice roads under Alternatives D1 and D2 could be greater and of longer duration compared to the other action alternatives. Water use per alternative is listed in Table 2.3-2.

Table 4.2-7 lists potential altered inundation areas that could be caused by roads (CD5-GMT1 road in Alternatives A, B, and C; 1.3-mile access road connecting GMT1 pad and the occupied structure pad and airstrip in Alternatives D1 and D2). For Alternatives D1 and D2, inundation caused by increased stage (ponding) upstream of the 1.3-mile access road would be negligible. Also, the area of decreased stage (drying) that could occur downstream of the 1.3-mile access road is also negligible in Alternatives D1 and D2. Conversely, Alternatives A, B, and C (with CD5-GMT1 road) could cause about 2,700 acres (or more, see Table 4.2-7) of upstream inundation across the tundra along the road route and more than 460 acres of drying area downstream of the road.

Alternatives A and B would have similar impacts from gravel extraction due to the similar amounts of gravel required (628,050 cubic yards and 684,550 cubic yards, respectively) for these alternatives. Alternatives C, D1, and D2 would also have similar impacts since these alternatives require roughly the same amount of gravel (between 830,800 cubic yards and 862,250 cubic yards). While the levels of impacts are different due to the amount of gravel required for each alternative, the types of impacts are expected to be similar.

The remainder of this section addresses the specific areas and types of impacts for each alternative and describes the impact levels on water resources for each alternative.

The differences in the size, location, and construction of infrastructure among the different alternatives generally correlate with impacts among the alternatives. The stipulations and design requirements, described in Section 4.2.2.5, *Mitigation*, and more comprehensively (for all resources) in Section 4.7, *Mitigation Measures and Monitoring*, specify measures to protect natural flow characteristics and water quality.

Ice roads built over creek and river crossings have the potential to restrict fish passage, resulting in mortality or redirection of fish. Impacts to fish are described in Section 4.3.2, including comparison of alternatives.

As described in BLM (2004, § 4F.2.2.1), adequate monitoring and adherence to pumping regulations would limit impacts on lake water levels to short-term duration. Long-term (longer than one year) impacts on lake water levels are likely to be minor because natural annual recharge processes are sufficient to fully recharge the lakes each year BLM (2004, § 4F.2.2.1). Thus impacts on lake water levels would be short-term and low intensity.

All action alternatives have the potential for spills to water resources including tundra ponds, lakes, creeks, and rivers resulting from pipelines; storage tanks; production facilities/infrastructure; drill rigs; vehicles; and/or vessels. Because the location and length of oil transit pipelines under the action alternatives are similar, the potential risk to water resources from a pipeline spill is also expected to be similar. Each of the action alternatives would cross the Tiŋmiaqsiġvik (Ublutuoch) River at the same location with block valves at each side of the crossing. Alternative D1 and D2 would also require a diesel pipeline to provide fuel to the GMT1 pad, which would pose incremental spill risk along the pipeline system. Spills are discussed further in Section 4.5.

Project activities under Alternative B that could impact the hydrologic regime and surface water quality are essentially the same as Alternative A. The primary change in project components of Alternative B versus A with potential to alter the impact to hydrology is difference in location of a portion of the GMT1 access road further south and outside of the Fish Creek setback (Alternative B). As shown on Table 4.2-8 (Summary of Major Components Potentially Impacting Hydrology), this causes a slight increase in length of the road and eliminates the stream crossings of Crea Creek and Barely Creek. Alternative B would avoid pipeline crossings of two Tiŋmiaqsiġvik (Ublutuoch) River tributary streams, potentially reducing the likelihood of a large spill reaching the river compared to Alternatives A, C, D1, and D2. The Fish Creek setback is avoided and therefore any erosion and sedimentation that could be caused in or around water bodies within the setback, would not occur. The Tiŋmiaqsiġvik (Ublutuoch) River crossing would be in the same location as Alternative A. The impacts to groundwater would be the same type and intensity as discussed for Alternative A.

Table 4.2-8. Summary of Major Components Potentially Impacting Hydrology [a]

Alternative	Total Gravel Fill Footprint (acres)	Total Length of New Roads (miles)	Number of Constructed Bridge Crossings	Potential Number of Culverts [b]
A	72.7	7.6	2	81
B	80.4	8.6	1	91 [c]
C	105.8	7.6 [d]	2	81
D1	87.4	1.3	0	13
D2	85.8	1.3	0	13

[a] All values are estimates subject to change in final design.

[b] Culvert would be installed along gravel roads to drain sheetflow between streams. The number of potential culverts to be installed assumes one culvert per 500 linear feet of new road. More may be necessary for drainage depending on local conditions, and placement would be determined during road layout to coincide with low areas to maximize drainage.

[c] Due to the greater amount of thaw basin geomorphology and associated wet ground crossed by the Alternative B road route, more culverts would be required to maintain adequate drainage, which would be determined prior to the road construction.

[d] Does not include widening of Nuiqsut Spur Road or addition of 1.2-mile airport road in Nuiqsut.

The impacts to rivers and drainage basins under Alternative B would be similar to Alternative A. The slightly longer road (approximately 1 mile) would incur incremental impacts associated with road construction. These impacts are principally changes in the drainage pattern, stream flow and erosion or sedimentation. Additional culverts will be required due to the traverse of the thaw basin. Inundation analysis of the GMT1 access road was performed as described for Alternative A. This analysis indicated a slight increase in the areas of inundation as shown on Map 4.2-2 and Table 4.2-7. The more southern route of the access road causes it to cross an area with thaw basins and generally wetter conditions (tundra) than Alternative A. Therefore, the road may restrict the flow of water more than in Alternative A. In addition, there could be increased localized sedimentation and erosion along the road corridor due to poor soils and associated increase in road maintenance. But these impacts are estimated to be negligible for Alternative B overall. The elimination of the river crossing at Crea Creek would eliminate the associated impacts of bridge construction to stream flow, sedimentation, and erosion. However, this is a minor crossing so the reduction in impact is minor.

Water withdrawal from lakes and ice roads would support construction activities, and would therefore be temporary under Alternative B. Erosion of roads and pads could increase sedimentation into waterways. However, based on results of prior sampling and analyses, this is not expected to have a measurable effect on water quality, such as turbidity, as reported in MJM Research (2007d), MBJ (2009b), and MBJ (2010).

Alternative C: Project activities under Alternative C that could impact the water resources are generally the same in the nature of impact as Alternative A, and include placement of gravel for pads and roads, construction of ice roads and ice pads; construction of pipelines; construction of a new gravel mine site; water withdrawal from area lakes and reservoirs for construction of ice roads, pads, and other temporary ice infrastructure, and drilling. The extent of the impact is greater with Alternative C, which would incur more direct gravel footprint and more indirect gravel spray, and more gravel dust impact as estimated by GIS analysis of the project components. The impact to the water quality would generally be the same types and intensity, but extended over a greater distance compared to Alternative A. With the increase of roads and airport infrastructure, there is a higher likelihood of erosion and sedimentation than with Alternatives A and B. Other water quality criteria would be similar as to that described in Alternatives A and B.

The impacts to rivers and drainage basins would be the same type as discussed for Alternative A. The degree of impact would also be similar except for the impacts associated with the construction of the partial airstrip extension in Nuiqsut. The 500-foot extension runs perpendicular to the hydraulic gradient in the area and crosses a pronounced low-lying area which serves as a drainage to the south. This extension would have localized, low impacts to the drainage pattern and any associated stream flow in the drainage. The gravel fill would intercept (block) movement of sheet flow runoff and possibly shallow groundwater. There may be ephemeral stream flow in this drainage, at least during breakup. Changing orientation to avoid these impacts would not be feasible because of existing orientation of the airstrip. Culvert placement beneath the airstrip to allow some cross drainage would be problematic because the airstrip would be 100 feet wide. Therefore, the flow of water would need to be diverted around the west end of the airstrip where it could be reconnected with the original drainage, or a bridge across the drainage would need to be constructed.

The additional roadway constructed on the west side of Nuiqsut to bypass the village and reach the airstrip would also have some impacts to the drainage pattern. However, it will run close to existing roads orientated in the same direction so the additional impacts are minor. The total potential inundation area for the new road construction under Alternative C is considered approximately equivalent to Alternative A (Table 4.2-7). This is because the majority of the new roadway to be constructed is the GMT1 access road, which is the same for both alternatives.

The impacts to lakes and ponds would be the same type and intensity as discussed for Alternative A. Alternative C does require 37 percent increase in gravel than Alternative A.

Project activities under Alternatives D1 and D2 that could impact the hydrologic regime are of similar type to the other alternatives, and include placement of gravel infrastructure for pads and road (access road between GMT1 pad and airstrip); construction of pipelines; gravel extraction; water withdrawal from area lakes and reservoirs for construction of temporary ice infrastructure.

The 5,000-foot airstrip and associated GMT1 pad and occupied structure pad would not cross any major drainages or streams. However, because the gravel footprint is relatively large, it would have minor impacts to the localized drainage pattern. To minimize surface water ponding adjacent to the gravel embankments, the gravel surface may need to be contoured to direct surface water runoff (from precipitation and snow melt) to the down-gradient edges of the pad. The width of the pads and airstrip are too large to traverse with culvert. If ponds develop, runoff may need to be routed along the edges of the airstrip and pads. Over the compacted gravel surface there will be less infiltration of precipitation which may reduce the recharge of shallow groundwater in the immediate area. However, this impact will be localized and of low intensity.

The ice roads could alter the drainage pattern, stream stage, and streamflow during spring breakup because the ice would melt more slowly than the surrounding tundra and streams. Blockage of streamflow and increased stream stage could occur due to ice roads that are not adequately slotted or breached.

The types of impacts to lakes and ponds would be the same for Alternatives D1 and D2 as discussed for other action alternatives. However, there would be considerably more water usage over the life of the project due to the annual ice roads required for Alternatives D1 and D2. Alternative D2 water usage would be more than twice as much during drilling and more than ten times greater during operation than Alternative A. Alternative D1 water usage during construction and drilling is about the same as Alternative A, but water usage during operation in Alternative D1 is about nine times greater than Alternative A. However, as described for Alternative A, adequate monitoring and adherence to pumping regulations would limit impacts on lake water levels to minor and of short-term duration. However, these impacts would occur on an annual basis for the life of the project unlike under Alternative A. In addition, Alternatives D1 and D2 require about 25 percent more gravel mining than Alternative A.

Potential water quality impacts under Alternatives D1 and D2 could result from construction and operation of the project in a similar manner as the other action alternatives. The primary difference is the elimination of the CD5-GMT1 road, which would reduce the opportunity for water quality impacts along the road. Although less gravel and its associated impacts would not be dispersed along the road corridor under Alternatives D1 and D2, there would be a comparable amount of gravel discharged onto the tundra surface for construction of an airstrip and additional pad space for living quarters and storage (occupied structure pad).

The additional facilities required for project development under Alternatives D1 and D2 would increase the required gravel pad space and the subsequent footprint of the proposed development. Moving gravel from its source to its final location creates a potential for gravel spillage in water bodies, and a decrease in water turbidity.

In comparison to the other action alternatives during the operation period, Alternatives D1 and D2 could result in higher spill risk due to increased activity with aircraft operations, year-round living accommodations and potential delayed spill response when air access is restricted during periods of adverse weather.

4.2.2.5 Mitigation

All roads would be designed and constructed to provide adequate cross flow to prevent raising the water level on the upstream side of roads by more than 6 inches compared to that for the downstream side for more than one week after peak discharge (BLM 2004, § 2.4.6.1, p. 103).

Potential impacts and associated mitigation measures for the proposed project are listed in Table 4.2-9. Culvert(s) would be placed at ephemeral streams, to maintain hydrologic flow. The Tiŋmiaqsiġvik (Ublutuoch) River bridge length would be 350 feet instead of the 120-foot length required minimum in BLM (2004a), reducing the total road by more than 200 feet at the bridge approach, reducing potential flow restriction and associated erosion and sediment accumulation.

Specific measures to protect water resources are provided in BLM (2013: A-1 through A-7, B-1, B-2, C-2, C-3, C-4, E-2, E-3, E-4, E-6, E-8, K-1, and K-2). In particular, Stipulation K-1 prohibits permanent facilities within 3 miles of Fish Creek and 0.5 mile of the Tiŋmiaqsiġvik (Ublutuoch) River, except for essential pipeline and road crossings of the main channel which must be approved on a case-by-case basis. In addition to BLM lease stipulations and BMPs, project activities that could impact water resources will be subject to federal, state, and local permit requirements.

Impacts to water resources will be mitigated by:

- BMP A-6 – Requires all cuttings and drilling mud to be disposed of by injection, allowing on-pad temporary storage of muds and cuttings, as approved by ADEC. Freshwater aquifers are protected by surface casing that is installed and cemented in place at varying depths. EPA establishes aquifer exemption depths for certain disposal well classes. BLM and AOGCC both authorize casing setting depths for protection of fresh water aquifers on federal leases.

- Lease Stipulation E-2 – Prohibits permanent oil and gas facilities being constructed within 500 feet from fish-bearing water bodies. Note: BLM authorized a deviation from this stipulation (BLM 2004a).
- BMP E-6 – Requires that stream and marsh crossings be designed and constructed to ensure free passage of fish, reduce erosion, maintain natural drainage, and minimize adverse impacts to natural stream flow
- Lease Stipulation K-1 – Establishes setbacks from major rivers, including Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River with exceptions for essential road and pipeline crossings. Setbacks in the project study area include: Fish Creek (3 miles), Tiŋmiaqsiġvik (Ublutuoch) River (0.5 mile). Note: BLM authorized a deviation from this stipulation (BLM 2004a).
- Lease Stipulation K-2 - Establishes a 0.25-mile development setback from deep water lakes, defined as those greater than 13 feet except essential road and pipeline crossings considered on a case-by-case basis.

With adherence to BMPs, permit requirements, and lease stipulations, impacts to water resources are possible but likely to be localized in extent and temporary in duration.

Baseline flow data collected within the Fish Creek basin during spring breakup since 2009 (MBJ 2013a) will be used to assess potential impacts to drainage resulting from road construction after the initial construction season.

Table 4.2-9. Summary of Potential Water Resources Impacts and Mitigation Measures [a]

Resource	Activities	Potential Impact	Mitigation
Groundwater and Shallow Lakes	Construction of the GMT1 gravel pad and access road	Compaction of surface soils or removal of gravels and changes in recharge potential	The GMT1 pad and access roads are designed to limit acreage of fill and to prevent changes in recharge.
Groundwater	Underground disposal of non-hazardous waste	Contamination of groundwater (Note: groundwater is not typically a potable water source on the North Slope). Change(s) of groundwater flow patterns.	Underground disposal will be performed in accordance with applicable permits to prevent impacts to groundwater resources.
Lakes and Ponds	Construction of gravel access road and ice roads [a]	Increased bank erosion and sedimentation.	Gravel roads and pads will have erosion control mechanisms such as jute mats.
Lakes and Ponds	Construction and use of road and pads	Dust fallout on ice and snow which melts in spring, or direct fallout on water bodies in summer, resulting in increasing turbidity	Dust control measures for roads and construction areas to avoid impacts of dust on nearby water bodies
Lakes	Ice road construction, camp use, and drilling activities	Water withdrawals from lakes; impacts to fish	Water will be withdrawn only from permitted lakes and only permitted amount of water will be withdrawn.
Streams	Construction of the gravel access road, pipeline, and bridges and culverts	Blockage of natural drainage (channels and sheet flow); increased stages and velocities of floodwater, channel scour, bank erosion, sedimentation, and potential for over-bank flooding	Road, pipeline, and water crossings will be designed to maintain existing hydrology, including during flood periods. Gravel roads, culverts, and bridges will be designed to have erosion control mechanisms and will follow the APF Erosion Control Plan.
Streams	Construction of ice roads	Blockage of natural drainage and increased floodwaters	Ice bridges across rivers will be removed, slotted, or scored prior to spring breakup

[a] No CD5-GMT1 gravel road in Alternatives D1 and D2

4.2.2.6 Conclusions

In general, all action alternatives have the potential for long-term impacts to local water resources resulting from the placement of new infrastructure. Most impacts are related to changes in the drainage pattern, and to a lesser degree stream flow. There also would be short-term, temporary impacts from ice infrastructure (e.g., roads and pads). These impacts tend to be proportional to the amount of area impacted by infrastructure and the configuration of gravel placement, with modifications due to specific activities and locations. However, for all action alternatives the intensity of impacts is characterized as minor and of localized extent.

Potential surface water quality impacts may be categorized as follows, and discussed in BLM (2004, § 4F.2.2.2, pp. 1092 and 1093):

- Accidental release of fuels and other substances
- Reductions in DO and changes in ion concentrations in lakes
- Increases in turbidity and suspended solids.

Impacts on hydrology from Alternative A would result primarily from construction of gravel infrastructure (e.g., roads and pads), which could modify drainage patterns and streamflow. These impacts would be long-term, localized, and of low intensity. Ice roads and ice pads could seasonally affect natural drainage patterns and streamflow during spring breakup. However, this impact would be limited to the construction phase, and thus temporary. Water withdrawal for ice roads, drilling, and camp use has the potential to temporarily lower lake levels. The overall hydrological impacts of ice roads and the associated water usage is negligible, while the impacts of roads and pads are characterized as minor due to the longer duration. Erosion and sedimentation associated with road and pad building could increase sedimentation into waterways. However, based on previous studies there will be no measurable effect on water quality, as reported in MJM Research (2007d), MBJ (2009b), and MBJ (2010).

Because gravel fill construction would take place over winter when most water bodies are frozen, it is expected that impacts on water quality would be limited. Discharges of treated wastewater could occur to tundra in accordance with APDES permit requirements. It is not anticipated that there would be an increase in fecal coliform counts over the naturally occurring concentrations. As stated in BLM (2004, § 4F.2.2.2, p. 1091), increased turbidity of water bodies in the project study area would result from dust fallout, flooding, erosion and sedimentation, or bank failure. It is not expected that alkalinity and pH of surface water bodies would be affected beyond the snowmelt period. Adherence to federal and state operational guidelines, safety practices, planning requirements, lease stipulations, and BMPs will all serve to reduce impacts from these activities. The overall degree of impact for Alternative A to the hydrology and water quality is considered minor.

Impacts on hydrology and water quality from Alternative B would be of similar type and intensity as described for Alternative A. Due to the slightly greater length of gravel roads, there may be slightly greater impacts to the drainage patterns, stream flow and the amount of sedimentation or erosion. However, the magnitude of the increase is negligible. The Fish Creek setback is avoided, thus reducing the risk of potential erosion and sedimentation and associated turbidity that could be caused in or around water bodies within the setback. Overall, impacts to hydrology and water quality under Alternative B are expected to be minor.

Impacts on hydrology from Alternative C would be of similar type and intensity as described for Alternative A. However, the Nuiqsut airstrip extension causes additional impacts to drainage patterns and stream flow. The impact to the drainage pattern is major in the localized area of the airstrip extension because it causes gravel fill to be placed in a pronounced drainage. Flow thorough this drainage would need to be rerouted around the airstrip. Construction and use of the Nuiqsut Airport road and pad infrastructure has the potential to result in greater erosion and sedimentation than Alternative A. Turbidity could be increased. Other water quality impacts would be similar as to that described in Alternatives A and B. Overall, hydrology and water quality impacts would be minor.

Impacts on hydrology from Alternatives D1 and D2 would be of similar type as described for Alternative A, but the intensity, duration, and geographic extent of impacts varies from the other action alternatives with the configuration of the gravel placement. In general, the impacts to the drainage pattern would be of a greater intensity but would be more localized. Impacts on water level in lakes would be of similar magnitude as Alternative A, but occur for more seasons due to the annual withdrawals to support ice road construction, extended years of drilling (Alternative D2) and operation. Alternatives D1 and D2 have a larger gravel footprint than Alternative A and require more gravel mining. Moving gravel from a source to its final location creates a potential for gravel spillage in water bodies, and an increase in water quality (e.g., turbidity). Greater use of lake water will increase the potential for DO depletion if not carefully monitored. Dust fallout, erosion, and sedimentation could potentially affect the turbidity of smaller water bodies in the vicinity of the airstrip and new infrastructure. Overall, Alternatives D1 and D2 would have minor impacts to hydrology and water quality and less impacts than the other alternatives.

Global climate change could have unpredictable impacts on winter temperatures, water balance, water availability, and timing and magnitude of spring floods (BLM 2012, § 4.2.4.4). These changes could alter the impacts discussed for each alternative. A longer and warmer growing season could result in increased potential evapotranspiration reducing available water in lakes. Premature melting of ice roads could occur with sudden spring melts, requiring emergency demobilization in order to protect the tundra, and potentially leave less time for proper abandonment of ice bridges. Increased snowfall combined with late summer rainfall could increase the magnitude of spring peak flows above the normal range of flows, causing increased erosion and sedimentation. All alternatives under consideration would be affected, although impacts under Alternatives D1 and D2 may be greater due to a greater reliance on ice roads for operation and extended years of seasonal drilling as in the case of Alternative D2.

4.2.3 Atmospheric Environment

4.2.3.1 Climate and Meteorology

Impacts to climate and meteorology are described in BLM (2004, § 4.2.3.1) and BLM (2012, § 4.5.1.2). Green House Gases (GHGs) have been identified as a possible contributor to the rise in global mean temperatures. Ongoing scientific research has identified the potential impacts of anthropogenic (from human activities) GHG emissions and changes in biologic carbon sequestration on the global climate. Through complex interactions on a regional and global scale, these changes are thought to cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat radiated by the earth back into space, much as glass traps heat over a greenhouse. Construction and operations activities would generate GHG emissions (See Section 4.6, *Cumulative Impacts*). Due to the quantity and duration of these emissions, project impacts to climate and meteorology are expected to be negligible.

4.2.3.2 Air Quality

To address compliance with the National Ambient Air Quality Standards (NAAQS) and air quality-related values (AQRVs; visibility and deposition), BLM convened a technical workgroup under the terms of the Memorandum of Understanding among the U.S. Department of Agriculture, U.S. Department of the Interior, and U.S. EPA (2011), Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process Understanding (Air Quality MOU), signed June 23, 2011. In conjunction with the BLM, USFWS, EPA, U.S. Bureau of Ocean Energy Management, National Parks Service, U.S. Forest Service, and the State of Alaska, air quality modeling was conducted to address potential near-field and far field air quality impacts.

The modeling was conducted by CPAI (via its contractor, AECOM) pursuant to the Air Quality MOU between these agencies regarding air quality analyses and mitigation in connection with oil and gas development on federal lands. The modeling effort involved the completion of an emissions inventory for Alternatives A and D1; near-field modeling for ambient air quality impacts; far field modeling for ambient air impacts, visibility and deposition; and an Air Quality Impacts Assessment. All of these documents were reviewed by members of the technical workgroup. Alternative A was initially selected for an emissions inventory because this alternative is the Applicant’s proposed project. Emissions inventories were subsequently completed for Alternatives D1 and D2, to understand how emissions would differ from those emissions determined for Alternative A and to assess air quality impacts. Alternatives B and C have emission sources of the same types as proposed under Alternative A, from which emissions related to the construction and operation of the longer access road could be estimated. Alternatives D1 and D2, the roadless alternatives, have different numbers of and schedules for operation of emission sources due to ice road use and the need to operate an airstrip and camp at the GMT1 pad. Alternative A dispersion modeling analyses are considered to be representative of Alternative B and C air quality impacts due to the similarity in sources. It is assumed the same groupings of construction equipment would operate, but the construction schedule would be extended for longer access road construction under Alternatives B and C.

In addition to completing AERMOD near-field modeling for ambient air quality, CPAI undertook an additional long-range modeling effort, using the CALPUFF model. Use of the CALPUFF model was intended to assist BLM in preparation of the air quality analysis in the Supplemental EIS by providing modeled results for potential future visibility impairment and deposition in Gates of the Arctic National Park and Preserve and the Arctic National Wildlife Refuge, which are designated as Class II Areas under the Clean Air Act. These areas were identified by USFWS as Sensitive Class II areas, as defined in the Air Quality MOU, for the GMT1 SEIS air quality analysis because the areas are within 185 miles (300 kilometers) of the GMT1 well pad. The methodology and results of these modeling efforts are more fully described in the Air Quality Impacts Analyses completed for the GMT1 project, which are available online at www.blm.gov/ak/gmt. There are no Class I areas within approximately 450 miles (750 kilometers) of the project site.

Table 4.2-10 summarizes the action alternatives for which near-field and far-field modeling were performed.

Table 4.2-10. Summary of Quantitative Modeling Analyses Performed

Alternative	Near-Field Modeling	Far-Field Modeling
A	Yes	Yes
B	No (Alternative A results are representative)	No (Alternative A results are representative)
C	No (Alternative A results are representative)	No (Alternative A results are representative)
D1	Yes	Yes
D2	Yes	No (Alternative D1 results are representative)

Emissions sources for construction and drilling, and production phases of the GMT1 Project consist of typical equipment that has been used at other recent drill sites on the Alaska North Slope. The following air pollutants would be produced during activities associated with this project under all alternatives: nitrogen oxides (NO_X), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter (PM, including both $PM_{2.5}$ and PM_{10}), volatile organic compounds (VOC), total reduced sulfides (TRS), hazardous air pollutants, and greenhouse gases such as carbon dioxide, methane, and nitrous oxide. Emissions of other regulated pollutants would be negligible. The types and amounts of air pollutants generated vary based on the phase of activity. Ten percent of the fugitive PM_{10} dust generated by driving on unpaved roads is assumed to be $PM_{2.5}$. The $PM_{2.5}$ fraction of PM_{10} for combustion particulate matter emissions is 89 to 100 percent (CPAI 2013a). Use of dust control measures will be required to limit impacts to air quality, and use of ULSD fuel will limit sulfur emissions.

Construction emissions, which are short-term and transient, would consist of fuel combustion emissions from on-road and non-road heavy equipment used in site preparation to excavate gravel, build the gravel pad and the access road, and construct the pipelines, VSMs, electrical lines, and communications lines from GMT1 to CD5. Additionally, small electric power generator engines, heaters, and other fuel-burning equipment as well as fugitive dust sources such as gravel excavation, storage, and placement would contribute to emissions during construction. Three construction seasons would be required. CPAI would be required to apply dust suppression measures to fugitive dust sources under a watering plan. Drilling emissions would also be released into the atmosphere concurrently with a portion of the construction phase of the project.

Operational emissions from GMT1 will be low because few permanent stationary source emission units are proposed for installation on the well pad after completion of construction. The ongoing and long-term emissions proposed at GMT1 include those from a heater, fugitive dust and tailpipe emissions from vehicle travel to transport workers and materials to the site, and minor fugitive emissions of field gas (containing VOCs and HAPs) from equipment and pipeline components. Production activities would also include periodic well interventions and, potentially, well infill drilling. These activities will require the use of fuel-fired heaters, boilers, engines, temporary storage tanks for flowback fluids, and additional mobile sources.

Emissions from project-related equipment, including stationary sources, mobile sources (including aircraft), non-road engines, and fugitive sources, are quantified and included in dispersion modeling for this SEIS air quality impacts assessment. Electric power from existing, off-site generation will be provided to the site during and after construction which will limit total project site emissions. Electricity will be provided by existing facilities which do not require any modifications as a result of the GMT1 Project development under Alternative A.

Flares are important safety and emission reduction devices used in the oil and natural gas industry. Flaring is generally preferable, in terms of both safety and air pollutant emission considerations, to venting of un-combusted hydrocarbon gas streams to the atmosphere. Relative to venting, flaring reduces emissions of methane, a more potent greenhouse gas than carbon dioxide, VOCs, and HAPs. Flaring results in emissions of NO_X and CO. Particulate matter emissions from flaring are low.

Flaring can be performed to relieve dangerous equipment overpressure conditions, to handle emergency releases of gas, to ensure safe plant shut-downs and start-ups, during testing or repairs, and to handle blowdown volumes associated with maintenance of large compressors or metering and pressure-regulating equipment at production and processing sites. Because flares used as safety and emission reduction devices are used primarily intermittently under certain conditions, emissions are generally lower than for flares used in an application during which gas is flared continuously.

No flaring is proposed to occur at the GMT1 pad as part of the proposed action. Currently flaring is performed at the APF which operates low pressure and high-pressure flares. The construction and operation of an additional well pad (GMT1), producing oil and gas to be sent to APF, may result in additional occurrences of flaring at the processing facility. Because flaring is typically a safety or operational response activity, quantifying any projected increase in flaring resulting from the GMT1 Project is difficult. The volume and duration of gas flaring performed at APF for the past five years is provided in Table 4.2-11 to indicate the magnitude of flared gas volumes. These volumes are typical for North Slope oil and gas production and processing facilities. Flaring was not included in the dispersion modeling performed for the analysis of GMT1 impacts because flaring is an intermittent activity performed at APF.

Table 4.2-11. Flared Gas Volumes at APF

Year	Duration of Flaring (Hours: Minutes)	Volume of Gas Flared (MMscf/year)
2013	36:10	86.5
2012	86:20	42.0
2011	21:02	13.9
2010	20:36	9.2
2009	39:05	44.1

Source: CPAI 2014c

Reduction of impacts to air quality from GMT1 Project development would be provided through design and operations features, mitigation described in Section 4.7, and the following protective measures of BLM (2013: A-9, A-10, E-1, and E-8).

Air pollutant emissions from the project will be subject to federal and state air quality regulations under the CAA. Air pollution impacts are limited by air quality regulations and standards, and state implementation plans, established under the federal CAA and the Clean Air Act Amendments (CAAA) of 1990. In Alaska, air pollution impacts are managed by ADEC under the Alaska Air Quality Control Regulations (18 AAC 50) and the EPA-approved state implementation plan. The proposed project is unlikely to have emissions that exceed the minor source thresholds. In Alaska portable oil and gas operations must be authorized under an

ADEC minor air quality permit. Based on total emissions and source types involved, the project will be required to obtain all applicable state air quality permits.

Alternative A

An emission inventory was prepared and an ambient air quality impact analysis was performed for Alternative A to compare model-predicted air quality impacts to applicable NAAQS and AAAQS in the near field and NAAQS/AAAQS and Air Quality Related Values (AQRVs) at locations within the Gates of the Arctic National Park and Preserve and the Arctic National Wildlife Refuge. Modeled concentrations were also compared to the Class II PSD increments for Infill Drilling, the operational activity with the highest potential emissions.

Emission Inventory

An emission inventory for Alternative A has been prepared for BLM as required under the Air Quality MOU regarding air quality analysis and mitigation required for agency decision-making (See Section 4.2.3.2). The emission inventory was developed using representative down hole produced fluids samples, manufacturer's emission data, AP-42 (USEPA 1995), the EPA MOVES model (version 2010b), the EPA National Mobile Inventory Model (NMIM, that uses current versions of MOVES and NONROAD models) for emissions from non-road engines, the FAA Emissions and Dispersion Modeling System (EDMS) for aircraft emissions, and Gas Research Institute emission factors/emission models and other accepted engineering models. The estimated emissions for Alternative A are shown in Table 4.2-12 for construction emissions and Table 4.2-13 for operational emissions. For each pollutant the highest rolling 12-month total emission in tons was selected for construction and for operations. These maximum 12-month emissions may not occur simultaneously but are presented to summarize the maximum possible emissions over the three-year construction period and future projected operations during any year.

Table 4.2-12. Maximum Potential 12-Month Construction Emissions for Alternative A

Pollutant	12-Month Time Period Ending	Tons Per Year
NO_X	Year 1, Month 10	125
CO	Year 1, Month 10	127
SO_2	Year 1, Month 10	1.9
PM_{10}	Year 2, Month 12	245
$PM_{2.5}$	Year 3, Month 2	33.2
VOC	Year 3, Month 5	25.6
HAPs	Year 3, Month 5	2.05
GHG (CO_2e)	Year 3, Month 3	30,980
TRS	Year 3, Month 5	12.9

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Air Quality Impact Analysis* (CPAI 2013a)

Table 4.2-13. Maximum Potential 12-Month Operational Emissions for Alternative A

Pollutant	Production Year Type	Point Source and Mobile Equipment Emissions	Fugitive Emissions	Total Tons Per Year
NO_X	Typical Production Year	93.4	NA	93.4
CO	Typical Production Year	43.1	NA	43.1
SO_2	Infill Drilling Year	0.82	NA	0.82
PM_{10}	Infill Drilling Year	6	239	244
$PM_{2.5}$	Infill Drilling Year	5.5	47.1	52.6
VOC	Infill Drilling Year	10.5	27.4	37.9
HAPs	Infill Drilling Year	1.9	1.0	2.9
GHG (CO_2e)	Infill Drilling Year	33,550	521	34,071
TRS	Infill Drilling Year	0	0.1	0.1

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Air Quality Impact Analysis* (CPAI 2013a)

Hazardous air pollutant (HAP) emissions, also known as air toxics, will result from combustion of fuels and from venting or fugitive emissions of field gas during well completions and production operations. HAPs are not routinely monitored on the North Slope. HAPs modeled for the GMT1 Project analysis include benzene, ethylbenzene, toluene, xylenes, formaldehyde, and n-hexane. The list of HAPS to examine has been developed over the years and agreed upon by the agency stakeholders involved with NEPA actions for oil and gas development projects. Combustion HAP emissions will result from the operation of mobile sources for Alternative A and from fuel combustion in stationary equipment. Mobile source HAP emissions are projected to decrease over time due to use of cleaner fuels and cleaner engines. Nationally, mobile source HAP emissions are projected to decrease by 72 percent from 1999 to 2050, even if vehicle activity increases by 145 percent (FHWA 2012).

Emissions of HAPs are also a concern from well venting during drilling and well completion activities which will occur during the developmental drilling phase of the project. A maximum emissions case was developed for several air toxics from this activity to model the short-term and long-term impacts from developmental drilling. The HAPs analyzed include benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde.

Near-Field Analysis

The ambient air quality impact analysis covered various activities related to the construction, and routine operation of a well site, access road, pipelines, and ancillary facilities to support the development of GMT1. For the near-field analysis impacts from criteria pollutant emissions of PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO, and emissions of air toxics (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) were evaluated.

Several factors were considered in selecting the modeled emission scenarios including the Alternative A construction and operation schedule, the location of the project-related emissions and their proximity to ambient air or sensitive receptors, and the relative magnitude and type of emissions for each activity. Five scenarios were selected for the near-field dispersion modeling analysis to cover the range of GMT1 Project-related worst case emissions for the various pollutants:

1. Access Road and Pad Construction
2. Gravel Mining
3. Infill Drilling
4. Operation of the Nuiqsut Man Camps
5. Well Intervention

The modeling analysis included tailpipe emissions from mobile sources. The EPA Guideline Model (USEPA 2005), AERMOD (Version 12345) was used. Alternative A impacts to ambient secondary $PM_{2.5}$ and ozone were not predicted using dispersion modeling. The AERMOD dispersion model does not have the capability to account for secondary particulate matter formation when predicting particulate matter impacts. Ozone was not modeled because there is no indication that ozone is currently a concern in this region of the country. There is no EPA-recommended modeling approach for conducting an ozone ambient air quality impact analysis on the North Slope. Development of an agency-approved ozone modeling protocol is not necessary because an ozone problem does not exist in the region. A qualitative analysis was performed. In arctic environments ambient concentrations of ozone are not sensitive to local VOC emissions; it can be concluded that the total VOC emissions of less than 50 tpy indicate that ozone formation will be minimized. Therefore, a qualitative assessment of the potential contribution to regional ozone and secondary $PM_{2.5}$ formation was conducted. Details of the analysis are provided in the Air Quality Impact Analysis report, which is included in CPAI (2013d). The background concentrations presented in Section 3.2.3.2 were added to the model-predicted GMT1 Project impacts to estimate total ambient air quality impacts.

The maximum ambient air quality impacts for all modeled scenarios under Alternative A are shown in Table 4.2-14.

Table 4.2-14. Alternative A Impacts Compared to Established Ambient Criteria

Pollutant	Averaging Period	Infill Drilling	Well Intervention	Access Road and Pad Construction	Gravel Mining	Operation of the Nuiqsut Man Camps	Maximum Total Concentration (μg/m^3)	NAAQS/ AAAQS (μg/m^3)	Percent of NAAQS/ AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	2,403	1,983	3,011	3,427	1,933	3,427	40,000	9	Gravel Mining
	8-hour	1,680	1,587	2,268	2,380	1,462	2,380	10,000	24	Gravel Mining
SO_2	1-hour	11	11	11	24	8.2	24	196	12	Gravel Mining
	3-hour	21	21	21	48	18	48	1,300	4	Gravel Mining
	24-hour	10	10	8.5	13	7.1	13	365	4	Gravel Mining
	Annual	0.80	0.76	0.43	0.45	0.41	0.80	80	1	Infill Drilling
NO_2	1-hour	138	164	155	168	146	168	188	89	Gravel Mining
	Annual	42	10	34.2	40	18	42	100	42	Infill Drilling
PM_{10}	24-hour	115	107	113	75	59	115	150	77	Infill Drilling
$PM_{2.5}$	24-hour	29	21	34.7	33	18	35	35	99	Access Road and Pad Construction
	Annual	8	4	7.42	5.9	4.4	8.0	12	67	Infill Drilling

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Air Quality Impact Analysis* (CPAI 2013a)

The highest 24-hour $PM_{2.5}$ impacts are predicted from the Access Road and Pad Construction scenario modeled. Modeled annual emissions for $PM_{2.5}$ and PM_{10} predict impacts that demonstrate compliance with the standards for Alternative A. Typically, 25 percent to 50 percent control efficiency for fugitive dust is modeled in drier and warmer climates throughout the lower 48 contiguous United States. The EI calculations estimating fugitive dust emissions were refined to correct certain conservative assumptions, such as the duration or locations of concurrently disturbed areas and the potential for windblown erosion from completed roads, and to more accurately reflect actual operations. By making these refinements to the calculations, project activities must only achieve an overall fugitive dust control efficiency of around 45 percent for emission levels to remain as previously estimated and modeled. The modeling assumed 75 percent control of dust for disturbed areas and 50 percent control of fugitive dust from roads through watering.

Given the geography and climate of the area, mitigation provided through a dust control plan, and the amount of water available on the North Slope, a higher control efficiency than that typically seen in drier and warmer climates can be expected. Watering at a frequency of about once per day can reasonably be expected to achieve around 50 to 75 percent fugitive dust control efficiency, given the conditions generally found on the Alaska North Slope during the summer months. BLM will use a performance-based approach to watering (i.e., in response to visible dust), require watering a minimum of twice per day, as well as additional watering in the event that visible fugitive dust emissions are observed by project personnel.

Under federal and state PSD regulations, increases in ambient air concentrations in Class I and Class II areas are limited by PSD increments. Emissions associated with a project may increase ambient concentrations above baseline levels only within the specific increments developed for SO_2, PM_{10}, $PM_{2.5}$, and NO_2. Modeling results for the Infill Drilling scenario are presented in Table 4.2-15. For this SEIS, modeled concentrations are compared to the Class II PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be interpreted as a regulatory increment consumption analysis. ADEC has established NO_2, PM_{10}, and $PM_{2.5}$ increment limits at 18 AAC 50.020, Table 3.

Table 4.2-15. Alternative A Impacts Compared to PSD Class II Increments for Infill Drilling Scenario

Pollutant	Averaging Period	Total Concentration (µg/m3)	PSD Class II Increment (µg/m3)
SO2	3-hour	3.4	512
	24-hour	2.84	91
	Annual	0.46	20
NO2	Annual	39.3	25
PM10	24-hour	71.2	30
	Annual	21.2	17
PM2.5	24-hour	33.3	9
	Annual	5.83	4

Ambient air quality impacts were also modeled for receptors in Nuiqsut to determine the effect of the project on the closest residences. The highest modeled concentrations for each pollutant are presented in Table 4.2-16.

Table 4.2-16. Alternative A Impacts Compared to Established Ambient Criteria at the Community of Nuiqsut

Pollutant	Averaging Period	Total Concentration ($\mu g/m^3$)	NAAQS/AAAQS ($\mu g/m^3$)	Percent of NAAQS/AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	163.8	40,000	4	Gravel Mining [a]
	8-hour	24.5	10,000	13	Gravel Mining [a]
SO_2	1-hour	1.4	196	5	Gravel Mining [a]
	3-hour	1.1	1,300	1	Gravel Mining [a]
	24-hour	0.2	365	2	Gravel Mining [a]
	Annual	0.001	80	0	Gravel Mining [a]
NO_2	1-hour	39.3	188	41	Gravel Mining [a]
	Annual	0.1	100	3	Gravel Mining [a]
PM_{10}	24-hour	1.6	150	33	Access Road and Pad Construction
$PM_{2.5}$	24-hour	0.6	35	22	Gravel Mining [a]
	Annual	0.005	12	18	Gravel Mining [a]

[a] Note the gravel extraction site modeled for the Draft SEIS was the Clover Material site. The project is now expected to use the ASRC Mine site for gravel extraction. The modeled concentrations shown in this table are for the Clover Material site. The Clover Material site is located northwest of Nuiqsut, and the ASRC Mine site is located east of and slightly closer to Nuiqsut. Impacts from the Clover Material site were modeled and were within the NAAQS/AAAQS for all pollutants.

Gravel extraction activity will occur during the months of February through April. A Nuiqsut wind rose developed from five years of data during the period of February to April, 2008 to 2012, shows bimodal wind direction with wind blowing from the east, east northeast, and northeast approximately 42 percent and from the west southwest, southwest, and south southwest approximately 30 percent of the time during this period (see Figure 4.2-1). The Clover Material site is located west northwest and the ASRC Mine site is closer and located to the east northeast of Nuiqsut.

The extraction rate at the ASRC Mine site during the 2014 gravel mining season was approximately 10 percent higher than that modeled for the Clover Material site. Gravel extraction at the ASRC Mine site for the CD5 project along with other projects removed a total of approximately 700.000 cubic yards of gravel February through April 2014. The gravel projected for the GMT1 Alternative A proposal is 628,050 cubic yards.

The ASRC Mine site used similar extraction methodology to the Clover Material site. Gravel at the ASRC Mine site is mined from subsurface deposits in strata nearly identical to that of the Clover Material site. Comparisons of the modeled Clover Material site and the ASRC Mine site find the volume of overburden removed per cubic yard of gravel will be nearly identical between the two sites, the number of lifts required to remove the gravel is the same, the number of blasts required per cubic yard of gravel will be approximately the same, and the extraction method will generally be the same. Given the small pool of equipment to draw from on the North Slope, the type (size/capacity) of equipment used to extract the gravel will be approximately the same.

Air quality criteria pollutants were measured in 2014 at Nuiqsut during a period of gravel extraction at the ARSC Mine site for CD5 construction. Blasting at the ASRC Mine site began February 7, 2014 and continued until April 28, 2014. Data plots indicate measured pollutant levels well below the NAAQS/AAAQS standards.

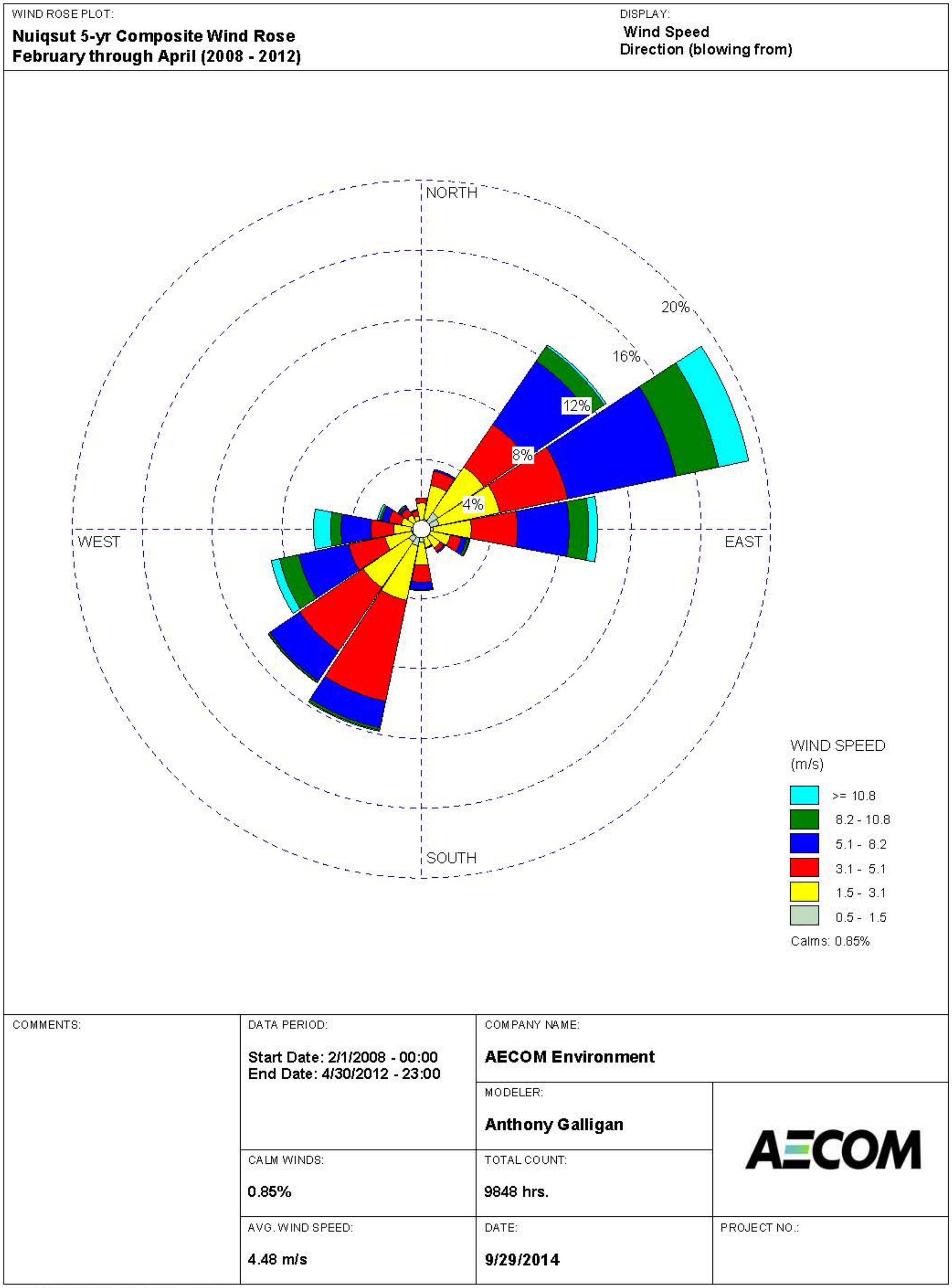

Figure 4.2-1. Nuiqsut 5-Year Composite Wind Rose, February through April (2008-2012)

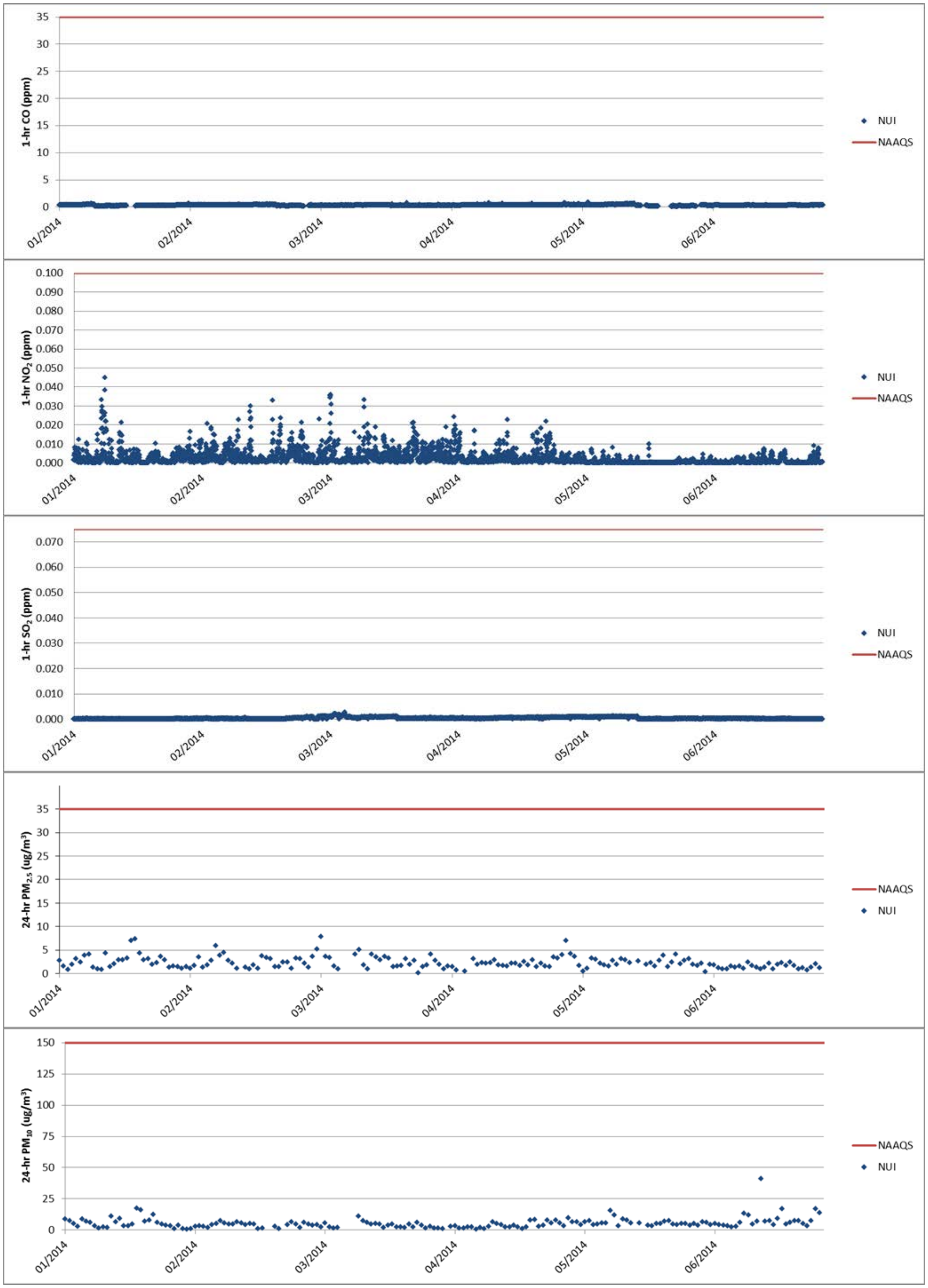

Figure 4.2-2. Measured Pollutant Levels at the ASRC Mine Site, January 2014 – June 2014

Air Toxics Impact Analysis

Results of the air toxics ambient analysis in the vicinity of the project activities are presented in Table 4.2-17, and results of the air toxics ambient analysis in the community of Nuiqsut are presented in Tables 4.2-18 and 4.2-19.

Tables 4.2-17 and 4.2-19 show maximum modeled 1-hour concentrations are below the criteria levels for each of the air toxics evaluated and that annual modeled concentrations are below the Reference Concentrations for Chronic Inhalation (RfCs) for each of the air toxics evaluated. Table 4.2-19 shows that the total excess cancer risk for both the most likely exposure (MLE) and maximally exposed individual (MEI) scenarios are less than 1.0E-06 in the community of Nuiqsut which represents a less than one-in-one million cancer risk.

The air quality analysis dispersion modeling was used to assess short-term acute exposure as well as long-term risk from air toxics. Short-term (1-hour) air toxics concentrations were compared to acute Reference Exposure Levels (RELs), as shown in Table 4.2-17 (for the highest concentrations off-pad) and Table 4.2-18 (concentrations predicted in Nuiqsut). RELs are defined as concentrations at or below which no adverse health impacts are expected. Tables 4.2-17 and 4.2-18 also provide the non-carcinogenic long-term exposure assessment, where annual modeled concentrations for each of the air toxics were compared directly to the RfCs. An RfC is defined by EPA as the continuous inhalation exposure concentration at which no long-term adverse health impacts are expected. Modeled concentrations are far below the thresholds which would indicate risk of short-term or long-term exposure-related health impacts.

Long-term cancer risk was analyzed by applying EPA's unit risk factors and adjustment factors to the annual modeled concentrations for two exposure duration scenarios: an MLE scenario and one reflective of the MEI. The cancer risk for each air toxic pollutant was summed to provide an estimate of the total inhalation risk. Table 4.2-19 shows that the total cancer risk for both the MLE and MEI scenarios are less than 1.0E-06, which represents a one-in-one-million cancer risk for residents of Nuiqsut.

Table 4.2-17. Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment [a]

Pollutant	REL (1-hour) (μg/m^3)	Maximum Modeled 1-hour Concentration (μg/m^3)	Non-carcinogenic RfC^3 (Annual) (μg/m^3)	Maximum Modeled Annual Concentration (μg/m^3)
Benzene	1,300 [b]	3.3	30	0.060
Ethyl benzene	350,000 [c]	0.5	1,000	0.0017
Formaldehyde	55 [b]	1.8	9.8	0.050
n-Hexane	390,000 [c]	68.9	700	0.49
Toluene	37,000 [b]	2.6	5,000	0.031
Xylenes	22,000 [c]	1.1	100	0.016

[a] EPA Air Toxics Database, Table 1 (USEPA 2012)

[b] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[c] No REL available for these air toxics. Values shown are from (IDLH/10), USEPA Air Toxics Database, Table 2 (USEPA 2011a).

Table 4.2-18. Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment for Nuiqsut Community Receptor [a]

Pollutant	REL (1-hour) ($\mu g/m^3$)	Maximum Modeled 1-hour Concentration ($\mu g/m^3$)	Non-carcinogenic RfC3 (Annual) ($\mu g/m^3$)	Maximum Modeled Annual Concentration ($\mu g/m^3$)
Benzene	1,300 [b]	0.19	30	3.80E-05
Ethyl benzene	37,000 [b]	0.029	5,000	1.05E-06
Formaldehyde	350,000 [c]	0.10	1,000	3.15E-05
n-Hexane	22,000 [b]	3.89	100	3.11E-04
Toluene	390,000 [c]	0.15	700	1.98E-05
Xylenes	55 [b]	0.061	10	1.01E-05

[a] EPA Air Toxics Database, Table 1 (USEPA 2012)

[b] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[c] No REL available for these air toxics. Values shown are from (IDLH/10), EPA Air Toxics Database, Table 2 (USEPA 2011a).

Table 4.2-19. Air Toxics Long-term Cancer Risk Analysis for Nuiqsut Community Receptor

Exposure Scenario [a]	Pollutant	Maximum Modeled Annual Concentration ($\mu g/m^3$)	Carcinogenic Unit Risk Factor [b] ($1/\mu g/m^3$)	Exposure Adjustment Factor	Cancer Risk
MLE	Benzene	3.80E-05	7.8E-06	0.43	1.28E-10
MLE	Ethyl benzene	1.05E-06	2.5E-06	0.43	1.13E-12
MLE	Formaldehyde	3.15E-05	1.3E-05	0.43	1.76E-10
Total Inhalation Cancer Risk					**3.05E-10**
MEI	Benzene	3.80E-05	7.8E-06	0.43	1.28E-10
MEI	Ethyl benzene	1.05E-06	2.5E-06	0.43	1.13E-12
MEI	Formaldehyde	3.15E-05	1.3E-05	0.43	1.76E-10
Total Inhalation Cancer Risk					**3.05E-10**

[a] MLE = most likely exposure; MEI = maximally exposed individual. Duration = 30 years (life of project)

[b] EPA Air Toxics Database, Table 1 (USEPA 2012)

Ambient Ozone and Secondary $PM_{2.5}$ Analysis

A qualitative analysis for ambient ozone cumulative impacts was performed for Alternative A. The analysis, which consisted of a review of recent emission trends of ozone precursors, a review of existing monitoring data, and a review of recent literature that details polar ozone trends and chemistry, clearly indicated that regional ozone concentrations are low (well below the NAAQS/AAAQS) and are not correlated to levels of anthropogenic precursor emissions. The conclusion is the small increase in regional precursor emissions that occur as a result of the project will have negligible effect on existing background ozone concentrations. Regional ozone levels will remain well below the NAAQS/AAAQS. Refer to Section 5.1.3, of the *Greater Mooses Tooth 1 Air Quality Impact Analysis* (CPAI 2013d) for the detailed analysis of ambient ozone cumulative impacts (CPAI 2013a).

Evidence compiled by EPA Region 10 suggests that secondary $PM_{2.5}$ formed from precursor emissions on the Alaska North Slope is low even in light of large precursor emissions (USEPA 2011b). Therefore, precursor emissions from the relatively small GMT1 Project will not result in significant secondarily formed $PM_{2.5}$. Refer to CPAI (2013d), Section 5.1.4, for the detailed analysis of secondary $PM_{2.5}$ formation (CPAI 2013a).

Near-Field Analysis Conclusions for Alternative A

The dispersion modeling analysis of near-field project impacts indicates compliance with all criteria pollutant NAAQS/AAAQS for all averaging periods. The near-field ambient air quality impacts analysis demonstrates that high air quality impacts will not result from the construction or operation of Alternative A. If CPAI achieves approximately 45-50 percent control of fugitive dust, the project will meet all state and federal air quality standards. As described above, BLM will use a performance-based approach to road watering to achieve the needed control efficiency. The impacts were predicted using dispersion modeling of emissions as directed under the Air Quality MOU.

Far-Field Analysis

The purpose of the far-field analysis is to quantify potential far-field air quality impacts to both ambient air concentrations and AQRVs from air pollutant emissions of NO_X, SO_2, PM_{10}, and $PM_{2.5}$. Air quality-related values include atmospheric deposition and visibility.

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and is reported as the mass of material deposited on an area in a given amount of time (kg/ha-yr, kilogram per hectare per year). Atmospheric deposition occurs as both wet and dry deposition. Wet deposition refers to air pollutants deposited by precipitation, such as rain and snow. One expression of wet deposition is precipitation pH, a measure of the acidity or alkalinity of the precipitation. Dry deposition refers to gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation.

Visibility can be defined as the ability to see color, texture, and contrast at a distance and can be reported as visual range, in units of distance such as miles. Visibility can be addressed by scene monitoring (producing images with a camera) or more fully by optical and chemical analyses (such as the Integrated Monitoring of Protected Visual Environments (IMPROVE) network).

The far-field analyses were performed using the EPA-approved version of the CALPUFF modeling system (Version 5.8) that was subsequently modified by the USFWS to account for Polar Stereographic coordinate system (BLM 2012). Impacts were analyzed for the Sensitive Class II areas located within 185 miles (300 kilometers) of the GMT 1 Project shown in Table 4.2-20. The scenario modeled in CALPUFF was the Infill Drilling scenario, selected to represent the maximum emissions for fuel combustion sources with the most potential to cause far field air quality and AQRV impacts.

Table 4.2-20. Sensitive Class II Areas

Area of Concern	Managing Agency	PSD Classification
Gates of the Arctic National Park	National Park Service	II
Arctic National Wildlife Refuge	Fish and Wildlife Service	II

The CALPUFF-predicted concentration impacts were compared with ambient air quality standards and post-processed to compute: 1) AQRV impacts due to light extinction change for comparison to visibility impact thresholds in Sensitive Class II areas; and 2) AQRV impacts due to deposition rates for comparison to sulfur (S) and nitrogen (N) deposition thresholds.

The analysis of air quality impacts from NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at the Arctic National Wildlife Refuge and Gates of the Arctic National Park indicated that total maximum ambient concentrations will be below the NAAQS/AAAQS for all pollutants examined for Alternative A.

Table 4.2-21. GMT1 Project-Only Air Quality Impacts at Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Ambient Background (µg/m^3)	Total Impact (µg/m^3)	NAAQS/AAAQS (µg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	2.42E-02	38	38	188	20
	Period [a, b]	2.04E-04	2.9	2.9	100	3
SO_2	1-hour [a]	3.72E-04	7.7	7.7	196	4
	3-hour [a]	2.46E-04	18	18	1,300	1
	24-hour [a]	1.09E-04	6.8	6.8	365	2
	Period [a, b]	4.29E-06	0.34	0.34	80	0.4
PM_{10}	24-hour [a]	1.38E-02	48	48	150	32
$PM_{2.5}$	24-hour [a]	1.38E-02	7.1	7.1	35	20
	Period [a, b]	6.84E-04	2.2	2.2	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore, the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Table 4.2-22. GMT1 Project-Only Air Quality Impacts at Gates of the Arctic National Park

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Ambient Background (µg/m^3)	Total Impact (µg/m^3)	NAAQS/AAAQS (µg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	1.23E-02	38	38	188	20
	Period [a, b]	2.54E-05	2.9	2.9	100	3
SO_2	1-hour [a]	2.54E-04	7.7	7.7	196	4
	3-hour [a]	2.34E-04	18	18	1,300	1
	24-hour [a]	9.04E-05	6.8	6.8	365	2
	Period [a, b]	1.62E-06	0.34	0.34	80	0.4
PM_{10}	24-hour [a]	1.32E-02	48	48	150	32
$PM_{2.5}$	24-hour [a]	1.32E-02	7.1	7.1	35	20
	Period [a, b]	3.39E-04	2.2	2.2	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore, the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in the Federal Land Managers' (FLM) Air Quality Related Values Workgroup (FLAG) guidance Document (FLAG 2010), with the results reported in percent change in light extinction and change in deciview (dv). The FLAG guidance thresholds are not regulatory requirements. A 5 percent change in light extinction (approximately equal to a 0.5 change in dv) is the threshold recommended in FLAG (2010) and is considered to contribute to regional haze visibility impairment. A 10 percent change in light extinction (approximately equal to 1.0 dv) is considered to represent a noticeable change in visibility when compared to background conditions. The BLM considers a 1.0 dv change as a potentially adverse impact. However, no applicable local, state, tribal, or federal regulatory visibility standards exist. The jurisdictional federal land manager or tribal government responsible for that land is responsible for

determining if adverse impacts are or are not significant. These determinations may differ from BLM levels for significant adverse impacts.
Visibility conditions calculated for the direct Alternative A project impacts using the FLAG method were evaluated at each distant Class II area of concern to determine if the 98th percentile change in light extinction exceeds both 5 and 10 percent change in light extinction thresholds (equivalent to 0.5 deciview (dv) and 1.0 dv).

All Alternative A visibility impacts are predicted to be well below both the visibility impact assessment thresholds of 0.5 and 1.0 delta-deciview (ddv) for both Sensitive Class II areas.

Table 4.2-23. GMT1 Number of Days Greater Than 0.5 ddv

	Number of Days Greater Than 0.5 ddv		
Area	2007	2008	2009
Arctic National Wildlife Refuge	0	0	0
Gates of the Arctic National Park	0	0	0

Table 4.2-24. GMT1 Number of Days Greater Than 1.0 ddv

	Number of Days Greater Than 1.0 ddv		
Area	2007	2008	2009
Arctic National Wildlife Refuge	0	0	0
Gates of the Arctic National Park	0	0	0

Table 4.2-25. GMT1 Project Maximum ddv Impact

	Maximum ddv		
Area	2007	2008	2009
Arctic National Wildlife Refuge	0.061	0.075	0.080
Gates of the Arctic National Park	0.042	0.054	0.079

Table 4.2-26. GMT1 Project 98th Percentile ddv Impact

	98th Percentile ddv		
Area	2007	2008	2009
Arctic National Wildlife Refuge	0.032	0.031	0.045
Gates of the Arctic National Park	0.020	0.022	0.023

FLAG (2010) recommends that applicable sources assess impacts of nitrogen and sulfur deposition at Class I areas. This guidance recommends the use of deposition analysis thresholds (DATs) developed by the National Park Service and the USFWS. The DATs represent screening level values for nitrogen and sulfur deposition from project-alone emission sources below which estimated impacts are considered negligible. The DAT established for both nitrogen and sulfur in western Class I areas is 0.005 kg/ha/yr. The DAT is also used to assess impacts to Class II areas. For the deposition impacts analysis for GMT1, results for the project-alone sources were compared to these thresholds.

Alternative A deposition impacts are well below the DAT at both Sensitive Class II areas (Table 4.2-27).

Table 4.2-27. GMT1 Project Deposition Impacts

Area	Pollutant	Averaging Period	Maximum Impact (kg/ha/yr)	DAT (kg/ha/yr)	Percent of DAT
Arctic National Wildlife Refuge	Nitrogen	Annual [a]	6.18E-05	0.005	1
Gates of the Arctic National Park	Nitrogen	Annual [a]	3.32E-05	0.005	1
Arctic National Wildlife Refuge	Sulfur	Annual [a]	2.13E-06	0.005	0.04
Gates of the Arctic National Park	Sulfur	Annual [a]	1.33E-06	0.005	0.03

[a] All maximum GMT deposition impacts occur in year 2008, thus represent a true annual impact.

Alternative B

A detailed ambient air quality impact analysis was not performed for Alternative B to assess near-field or far-field impacts. The detailed analysis performed for Alternative A is considered representative of the potential ambient air quality impacts which could result from Alternative B because the scenarios selected for modeling of Alternative A would be similar occurrences under Alternatives B, using the same equipment performing the same activities. While the specific locations and durations of construction activities may change, emissions are not expected to be dramatically different. Alternative B has a slightly longer access road.

The far-field emissions and AQRV analyses conducted for Alternative A are considered representative of Alternative B because the same types and numbers of emission sources and activities are proposed for the Infill Drilling scenario analyzed.

Emission Inventory

The construction, drilling, and operations emissions for Alternative B, which would avoid the Fish Creek setback, would be similar to those described in Alternative A. A detailed emission inventory was not prepared for Alternative B, but emissions will be very similar to those in Alternative A. The access road under Alternative B is projected to be approximately 1 mile longer, so construction emissions from land work and road construction could be expected to be slightly higher than those activities under Alternative A. In addition, ongoing operational fugitive dust emissions from traffic using the access road could be expected to be slightly higher due to the longer access road. As stated for Alternative A, 50 to 75 percent control of fugitive dust is assumed for Alternative B. Alternative B would require an estimated 57,000 cubic yards of additional fill material. The maximum potential emissions for each pollutant under Alternative B were extrapolated from the Alternative A emission estimates using a ratio of access road lengths for road-related construction and operational emissions. Increased emissions from pad construction or fill material blasting were not extrapolated and are considered to be minor. The differences in emissions resulting from Alternative B in comparison to Alternative A are considered negligible. Operational emissions from stationary emission units at GMT1 (which require permitting) are expected to be the same as those shown under Alternative A.

Table 4.2-28. Maximum Potential 12-Month Construction Emissions for Alternative B

Pollutant	12-Month Time Period Ending	Tons Per Year[a]
NO_X	Year 1, Month 10	132
CO	Year 1, Month 10	132
SO_2	Year 1, Month 10	1.9
PM_{10}	Year 3, Month 2	270
$PM_{2.5}$	Year 3, Month 2	36.0
VOC	Year 3, Month 5	25.6
HAPs	Year 3, Month 5	2.0
GHG (CO_2e)	Year 3, Month 3	30,980
TRS	Year 3, Month 5	12.9

[a] Alternative A emissions related to road construction were scaled from 7.8 miles to 8.6 miles to calculate representative Alternative B emissions.

Table 4.2-29. Maximum Potential 12-Month Operational Emissions for Alternative B

Pollutant	Production Year Type	Point Source and Mobile Equipment Emissions	Fugitive Emissions	Total Tons Per Year [a]
NO_X	Typical Production Year	93.4	NA	93.4
CO	Typical Production Year	43.1	NA	43.1
SO_2	Infill Drilling Year	0.82	NA	0.82
PM_{10}	Infill Drilling Year	6	243.6	249.6
$PM_{2.5}$	Infill Drilling Year	5.5	49.8	55.3
VOC	Infill Drilling Year	10.5	27.4	37.9
HAPs	Infill Drilling Year	1.9	1.0	2.9
GHG (CO_2e)	Infill Drilling Year	33,555	521	34,076
TRS	Infill Drilling Year	0	0.1	0.1

[a] Alternative A emissions related to access road use were scaled from 7.8 miles to 8.6 miles to calculate representative Alternative B emissions.

Impacts Analysis

The detailed analysis performed for Alternative A is considered representative of the potential ambient air quality impacts which could result from Alternative B because the scenarios selected for modeling of Alternative A would also occur under Alternative B.

Alternative C

A detailed ambient air quality impact analysis was not performed for Alternative C to assess near-field or far-field impacts. The detailed analysis performed for Alternative A is considered representative of the potential ambient air quality impacts which could result from the Alternative C because the scenarios selected for modeling of Alternative A would be similar occurrences under Alternative C, using the same equipment performing the same activities. While the specific locations and durations of construction activities may change, emissions are not expected to be dramatically different. Alternative C is the alternative with the longest permanent access road.

The far-field emissions and AQRV analyses conducted for Alternative A are considered representative of Alternative C because the same types and numbers of emission sources and activities are proposed for the Infill Drilling scenario analyzed.

Emission Inventory

The types of construction, drilling, and operations emission sources for Alternative C, Alternative Access via Nuiqsut, would be similar to those described in Alternative A, but the locations and magnitudes of emissions for the different source types would change under the Alternative C plan. Alternative C, with a Nuiqsut hub, would require improvements to infrastructure in Nuiqsut, which would result in construction emissions and higher ongoing mobile source emissions in Nuiqsut from use as the logistics center for the GMT1 pad. Personnel and certain supplies would be brought to Nuiqsut rather than APF, then transported to GMT1 by road vehicles. The diversion of air traffic from APF to Nuiqsut would potentially reduce aircraft emissions locally in APF and increase local aircraft operation emissions in Nuiqsut. Under Alternative C, the Nuiqsut Spur Road and Nuiqsut Dump Road would be upgraded. A new 1.2-mile airport access road would be constructed in addition to a new logistics pad at the airport and a 500-foot runway extension. Because the access road is longer than the access road proposed under Alternative A, both construction and operational emissions will be higher for this proposed roadway alignment. Construction emissions would also result in Nuiqsut from the construction of improvements including the upgrade of the Nuiqsut Spur Road, the Nuiqsut Dump Road, the new 1.2-mile airport access road, the new logistics pad connecting to the airstrip, and the 500-foot airport runway extension. The higher Alternative C construction emissions would include combustion emissions from use of fuels in construction equipment and fugitive dust (particulate matter) emissions from earth work and material handling. As with Alternative A, 50 to 75 percent control of fugitive dust has been assumed in the analysis; and BLM will use a performance-based approach to road watering to ensure dust control efficiencies are maintained. Traffic on the new airport access road could also be expected to increase fugitive dust over the levels projected in Alternative A. The entire route length for vehicles under Alternative C would be 17.4 miles.

A detailed emission inventory was not prepared for Alternative C, but estimated emissions have been extrapolated from Alternative A emissions. Operational emissions from sources located at GMT1 are expected to be the same as those shown under Alternative A because the pad design and equipment would not change under Alternative C. The Nuiqsut Spur Road, which will be constructed under a separate project during 2013-2014, would require widening from 24 feet to 32 feet. A simplified assumption was applied to assume construction emissions for the 9.6 miles of (future) existing roadway would increase by one-third expansion. Operational roadway-related emissions were scaled from the 7.6 mile access road proposed under Alternative A to a total length of 17.4 miles for vehicles accessing GMT1 from Nuiqsut.

Table 4.2-30. Maximum Potential 12-Month Construction Emissions for Alternative C

Pollutant	12-Month Time Period Ending	Tons Per Year [a]
NO_X	Year 1, Month 10	154
CO	Year 1, Month 10	147
SO_2	Year 1, Month 10	2.0
PM_{10}	Year 3, Month 2	343
$PM_{2.5}$	Year 3, Month 2	44.1
VOC	Year 3, Month 5	25.6
HAPs	Year 3, Month 5	2.0
GHG (CO_2e)	Year 1, Month 10 [b]	34,086
TRS	Year 3, Month 5	12.9

[a] Alternative A emissions related to improvements to the Nuiqsut Spur Road connecting with the GMT1 access road use were assumed to require a one third expansion (equivalent to constructing 3.2 miles of new access road in material volume and duration) to calculate representative Alternative C emissions.

[b] During this period emissions associated with construction were scaled to account for construction of a road length of 11 miles rather than 8.6 miles. This resulted in the maximum rolling yearly total for GHG.

Table 4.2-31. Maximum Potential 12-Month Operational Emissions for Alternative C [a]

Pollutant	Production Year Type	Point Source and Mobile Equipment Emissions	Fugitive Emissions	Total Tons Per Year [b]
NO_X	Typical Production Year	93.4	NA	93.4
CO	Typical Production Year	43.1	NA	43.1
SO_2	Infill Drilling Year	0.82	NA	0.82
PM_{10}	Infill Drilling Year	5.7	293.6	299.3
$PM_{2.5}$	Infill Drilling Year	5.5	79.6	85.1
VOC	Infill Drilling Year	10.5	27.4	37.9
HAPs	Infill Drilling Year	1.9	1.0	2.9
GHG (CO_2e)	Infill Drilling Year	33,609	521	34,130
TRS	Infill Drilling Year	0	0.1	0.1

[a] Emissions may shift from APF related to aircraft, cargo, and camp activities. These emissions have not been quantified for Alternative C; net emission increases related to GMT1 development will be equal to those calculated under Alternative A.

[b] Alternative A emissions related to access road use were scaled from 7.8 miles to 17.4 miles to calculate representative Alternative C emissions.

Impacts Analysis

The detailed analysis performed for Alternative A is considered representative of the potential ambient air quality impacts which could result from Alternative C because the scenarios selected for modeling of Alternative A would also occur under Alternative C.

Alternatives D1 and D2

Air Emissions

The construction, drilling, and operations emissions for Alternatives D1 and D2 would differ from those described in Alternative A for transportation sources because no permanent access road would be constructed (i.e., no CD5-GMT1 road). Access would be by aircraft year-round, and by land-based vehicles using ice roads during winter. Stationary source emissions from ongoing GMT1 operations would include a waste incinerator and two backup generators in addition to those operational sources proposed under Alternative A. Alternatives D1 and D2 would also include emission sources associated with the airstrip operations such as seasonal use of a portable heater. Construction emissions and transportation-related emissions would be higher at the GMT1 site because an airstrip facility, supporting storage, and a camp would be constructed, requiring a bigger site footprint (87.4 acres for Alternative D1 and 85.8 acres for Alternative D2). Due to additional power generation needs for a scenario with roadless GMT1 and GMT2 pads, a new gas-fired turbine would be installed at APF.

Alternative D1

A detailed emission inventory has been prepared for Alternative D1. The estimated emissions for Alternative D1 are shown in Table 4.2-32 for construction emissions and Table 4.2-33 for operational emissions. For each pollutant the highest rolling 12-month total emission in tons was selected for construction and for operations. These maximum 12-month emissions may not occur simultaneously but are presented to summarize the maximum possible emissions over the three-year construction period and future projected operations during any year.

Table 4.2-32. Maximum Potential 12-Month Construction Emissions for Alternative D1

Pollutant	12-Month Time Period Ending	Tons Per Year
NO_X	Year 3, Month 7	155
CO	Year 1, Month 10	149
SO_2	Year 1, Month 10	2.3
PM_{10}	Year 3, Month 6	107
$PM_{2.5}$	Year 3, Month 7	24.5
VOC	Year 3, Month 5	38.4
HAPs	Year 3, Month 11	5.1
GHG (CO_2e)	Year 3, Month 7	45,246
TRS	Year 3, Month 5	12.9

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D (Roadless) Air Quality Impact Analysis* (CPAI 2013b)

Table 4.2-33. Maximum Potential 12-Month Operational Emissions for Alternative D1

Pollutant	Production Year Type	Tons Per Year
NO_X	Typical Production Year	178.9
CO	Infill Drilling	116
SO_2	Infill Drilling	1.8
PM_{10}	Infill Drilling	107
$PM_{2.5}$	Infill Drilling	28.7
VOC	Infill Drilling	50.9
HAPs	Infill Drilling	6
GHG (CO_2e)	Infill Drilling	51,338
TRS	Infill Drilling	0.1

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D (Roadless) Air Quality Impact Analysis* (CPAI 2013b)

Alternative D1 Near-field Results

The ambient air quality impact analysis covered various activities related to the construction, and routine operation of a well site, airstrip, pipelines, and ancillary facilities to support the development of GMT1 for Alternative D1. For the near-field analysis impacts from criteria pollutant emissions of PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO, and emissions of air toxics (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) were evaluated.

Several factors were considered in selecting the modeled emission scenarios including the Alternative D1 construction and operation schedule, the location of the project-related emissions and their proximity to ambient air or sensitive receptors, and the relative magnitude and type of emissions for each activity. Four scenarios were selected for the near-field dispersion modeling analysis to cover the range of GMT1 Project-related worst-case emissions for the various pollutants:

1. Access Road and Pad Construction
2. Gravel Mining
3. Infill Drilling
4. Well Intervention

The maximum ambient air quality impacts for all scenarios modeled for Alternative D1 are shown in Table 4.2-34.

Table 4.2-34. Alternative D1 Impacts Compared to Established Ambient Criteria

Pollutant	Averaging Period	Infill Drilling	Well Intervention	Access Road and Pad Construction	Gravel Mining	Maximum Total Concentration (μg/m^3)	NAAQS/ AAAQS (μg/m^3)	Percent of NAAQS/ AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	2,349	1,983	3,308	3,373	3,373	40,000	8	Gravel Mining
	8-hour	1,680	1,587	2,465	2,487	2,487	10,000	25	Gravel Mining
SO$_2$	1-hour	12	12	12	24	24	196	12	Gravel Mining
	3-hour	21	21	22	46	46	1,300	4	Gravel Mining
	24-hour	10	10	8.9	13	13	365	4	Gravel Mining
	Annual	0.81	0.76	0.45	0.46	0.81	80	1	Infill Drilling
NO$_2$	1-hour	155	165	166	183	183	188	97	Gravel Mining
	Annual	42	13	31	41	42	100	42	Infill Drilling
PM$_{10}$	24-hour	**152**	**152**	**152**	101	**152**	150	**101**	Infill Drilling, Well Intervention, or Access Road and Pad Construction
PM$_{2.5}$	24-hour	**35**	**35**	**44**	**35**	**44**	35	**126**	Access Road and Pad Construction
	Annual	9.1	7.0	8.3	6.2	9.1	12	76	Infill Drilling

Concentrations shown in bold and underlined exceed the NAAQS/AAAQS.

High 24-hour PM_{10} and $PM_{2.5}$ impacts are predicted from road and pad construction activities, well intervention, and infill drilling. High 24-hour $PM_{2.5}$ emissions are also predicted for gravel mining. The modeling assumed 50 to 75 percent control of fugitive dust based on watering.

Modeling results for the Infill Drilling scenario are presented in Table 4.2-35 for Alternative D1, compared to the Class II PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be interpreted as a regulatory increment consumption analysis. ADEC has established NO_2, PM_{10}, and $PM_{2.5}$ increment limits at 18 AAC 50.020, Table 3.

Table 4.2-35. Alternative D1 Impacts Compared to PSD Class II Increments for Infill Drilling Scenario

Pollutant	Averaging Period	Total Concentration ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	3-hour	3.8	512
	24-hour	3.2	91
	Annual	0.47	20
NO_2	Annual	40	25
PM_{10}	24-hour	112	30
	Annual	101	17
$PM_{2.5}$	24-hour	73	9
	Annual	11	4

Ambient air quality impacts were also modeled for receptors in Nuiqsut to determine the effect of Alternative D1 on the closest residences. The highest modeled concentrations for each pollutant are presented in Table 4.2-36.

Table 4.2-36. Alternative D1 Impacts Compared to Established Ambient Criteria at the Community of Nuiqsut

Pollutant	Averaging Period	Total Concentration ($\mu g/m^3$)	NAAQS/AAAQS ($\mu g/m^3$)	Percent of NAAQS/AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	1,664	40,000	4	Well Intervention
	8-hour	1,286	10,000	13	Well Intervention
SO_2	1-hour	9.1	196	5	Well Intervention
	3-hour	19	1,300	1	Well Intervention
	24-hour	7.0	365	2	Well Intervention
	Annual	0.34	80	0	Well Intervention
NO_2	1-hour	80.2	188	43	Gravel Mining [a]
	Annual	3.0	100	3	Well Intervention
PM_{10}	24-hour	49	150	33	Well Intervention
$PM_{2.5}$	24-hour	7.8	35	22	Well Intervention
	Annual	2.2	12	19	Access Road and Pad Construction

[a] Note the gravel extraction site modeled for the Draft SEIS was the Clover Material site. The project is now expected to use the ASRC Mine site for gravel extraction. The modeled concentrations shown in this table are for the Clover Material site. The Clover Material site is located northwest of Nuiqsut, and the ASRC Mine site is located east of and slightly closer to Nuiqsut. Impacts from the Clover Material site were modeled and were within the NAAQS/AAAQS for all pollutants.

Alternative D1 results predict criteria pollutants will be in compliance in the community of Nuiqsut.

Air Toxics Impact Analysis

Results of the air toxics ambient analysis for Alternative D1 in the vicinity of the project activities are presented in Table 4.2-37, and results of the air toxics ambient analysis in the community of Nuiqsut are presented in Tables 4.2-38 and 4.2-39.

Tables 4.2-37 and 4.2-38 show maximum modeled 1-hour concentrations are below the criteria levels for each of the air toxics evaluated and that annual modeled concentrations are below the RfCs for each of the air toxics evaluated. Table 4.2-39 shows that the total excess cancer risk for both the MLE and MEI scenarios are less than 1.0E-06 in the community of Nuiqsut which represents a less than one-in-one million cancer risk.

Table 4.2-37. Alternative D1 Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment

Pollutant	REL (1-hour) (μg/m^3)	Maximum Modeled 1-hour Concentration (μg/m^3)	Non-carcinogenic RfC [c] (Annual) (μg/m^3)	Maximum Modeled Annual Concentration (μg/m^3)
Benzene	1,300 [a]	3.3	30	0.10
Ethyl benzene	350,000 [b]	0.52	1,000	0.013
Formaldehyde	55 [a]	8.1	9.8	0.43
n-Hexane	390,000 [b]	69	700	0.49
Toluene	37,000 [a]	2.6	5,000	0.040
Xylenes	22,000 [b]	1.1	100	0.034

[a] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[b] No REL available for these air toxics. Values shown are from (IDLH/10), EPA Air Toxics Database, Table 2 (USEPA 2011a).

[c] EPA Air Toxics Database, Table 1 (USEPA 2012)

Table 4.2-38. Alternative D1 Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment for Nuiqsut Community Receptor

Pollutant	REL (1-hour) (μg/m^3)	Maximum Modeled 1-hour Concentration (μg/m^3)	Non-carcinogenic RfC [c] (Annual) (μg/m^3)	Maximum Modeled Annual Concentration (μg/m^3)
Benzene	1,300 [a]	0.19	30	1.10E-04
Ethyl benzene	350,000 [b]	0.03	1,000	1.00E-05
Formaldehyde	55 [a]	0.40	9.8	3.2E-04
n-Hexane	390,000 [b]	3.89	700	3.40E-04
Toluene	37,000 [a]	0.15	5,000	5.00E-05
Xylenes	22,000 [a]	0.06	100	4.00E-05

[a] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[b] No REL available for these air toxics. Values shown are from (IDLH/10), EPA Air Toxics Database, Table 2 (USEPA 2011a).

[c] EPA Air Toxics Database, Table 1 (USEPA 2012)

Table 4.2-39. Alternative D1 Air Toxics Long-term Cancer Risk Analysis for Nuiqsut Community Receptor

Exposure Scenario [a]	Pollutant	Maximum Modeled Annual Concentration (μg/m^3)	Carcinogenic Unit Risk Factor [b] (1/μg/m^3)	Exposure Adjustment Factor	Cancer Risk
MLE	Benzene	1.1E-04	7.8E-06	0.43	3.7E-10
MLE	Ethyl benzene	1.0E-05	2.5E-06	0.43	1.1E-11
MLE	Formaldehyde	3.2E-04	1.3E-05	0.43	1.8E-09
Total Inhalation Cancer Risk					**2.2E-09**
MEI	Benzene	1.1E-04	7.8E-06	0.43	3.7E-10
MEI	Ethyl benzene	1.0E-05	2.5E-06	0.43	1.1E-11
MEI	Formaldehyde	3.2E-04	1.3E-05	0.43	1.8E-09
Total Inhalation Cancer Risk					**2.2E-09**

[a] MLE = most likely exposure; MEI = maximally exposed individual. Duration = 30 years (life of project)

[b] EPA Air Toxics Database, Table 1 (USEPA 2012)

Near-Field Analysis Conclusions for Alternative D1

The dispersion modeling analysis of near-field project impacts indicates compliance with all criteria pollutant NAAQS/AAAQS for all averaging periods with the following exceptions:

- Predicted PM_{10} 24-hour and $PM_{2.5}$ 24-hour and annual impacts exceed the NAAQS/AAAQS for one or more of the scenarios (Infill drilling, Well Intervention, Access Road and Pad Construction, and/or Gravel Mining).

For the cases identified above, the near-field ambient air quality impacts analysis demonstrates that high air quality impacts will result from the construction and operation of Alternative D1 for particulate matter. The project must meet all state and federal air quality standards and restricted access to project areas where high air quality impacts are predicted (where project emissions will exceed the NAAQS/AAAQS) would be required under Alternative D1. The impacts were predicted using dispersion modeling of ambient air quality impacts as directed under the Air Quality MOU.

Results of the near-field analysis indicate that air quality impacts are predicted to be higher than those predicted under Alternative A for 8-hour CO, 1-hour NO_2, 24-hour PM_{10}, 24-hour $PM_{2.5}$ and annual $PM_{2.5}$. Impacts from 1-hour CO and 3-hour SO_2 are predicted to be lower under Alternative D1 than Alternative A. Impacts are predicted to be the same for 1-hour SO_2, 24-hour SO_2, annual SO_2, and annual NO_2. Differences in predicted concentrations for these two alternatives result from the different equipment that will be used and different operational schedules. A culpability analysis was not prepared for either alternative to determine exactly which emission sources caused higher predicted concentrations for the D1 alternative compared to Alternative A.

Alternative D1 Far-field Results

The analysis of air quality impacts from NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at the Arctic National Wildlife Refuge and Gates of the Arctic National Park indicated that total maximum ambient concentrations will be below the NAAQS/AAAQS for all pollutants examined for Alternative D1.

Table 4.2-40. GMT1 Alternative D1 Air Quality Impacts at Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Ambient Background (µg/m^3)	Total Impact (µg/m^3)	NAAQS/AAAQS (µg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	5.6E-02	38	38.1	188	20
	Period [a, b]	5.9E-04	2.9	2.90	100	3
SO_2	1-hour [a]	4.5E-04	7.7	7.70	196	4
	3-hour [a]	3.2E-04	18	18.0	1,300	1
	24-hour [a]	1.4E-04	6.8	6.80	365	2
	Period [a, b]	5.6E-06	0.3	0.30	80	0
PM_{10}	24-hour [a]	5.2E-02	48	48.1	150	32
$PM_{2.5}$	24-hour [a]	5.2E-02	7.1	7.15	35	20
	Period [a, b]	2.6E-03	2.2	2.20	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to the two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Table 4.2-41. GMT1 Alternative D1 Air Quality Impacts at Gates of the Arctic

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Ambient Background (µg/m^3)	Total Impact (µg/m^3)	NAAQS/AAAQS (µg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	2.7E-02	38	38.0	188	20
	Period [a, b]	7.8E-05	2.9	2.90	100	3
SO_2	1-hour [a]	3.3E-04	7.7	7.70	196	4
	3-hour [a]	3.0E-04	18	18.0	1,300	1
	24-hour [a]	1.2E-04	6.8	6.80	365	2
	Period [a, b]	2.1E-06	0.3	0.30	80	0
PM_{10}	24-hour [a]	7.0E-02	48	48.1	150	32
$PM_{2.5}$	24-hour [a]	7.0E-02	7.1	7.17	35	20
	Period [a, b]	1.3E-03	2.2	2.20	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to the two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

All Alternative D1 visibility impacts are predicted to be well below both the visibility impact assessment thresholds of 0.5 and 1.0 ddv for both Sensitive Class II areas.

Table 4.2-42. GMT1 Alternative D1 Number of Days Greater than 0.5 ddv

Area	Number of Days Greater Than 0.5 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	0	0	0
Gates of the Arctic	0	0	0

Table 4.2-43. GMT1 Alternative D1 Number of Days Greater than 1.0 ddv

Area	Number of Days Greater Than 1.0 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	0	0	0
Gates of the Arctic	0	0	0

Table 4.2-44. GMT1 Alternative D1 Maximum ddv Impact

Area	Maximum ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	0.238	0.288	0.315
Gates of the Arctic	0.154	0.220	0.431

Table 4.2-45. GMT1 Alternative D1 98th Percentile ddv Impact

Area	98th Percentile ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	0.127	0.114	0.170
Gates of the Arctic	0.079	0.085	0.087

Alternative D1 deposition impacts are well below the DAT at both Sensitive Class II areas.

Table 4.2-46. GMT1 Alternative D1 Deposition Impacts

Area	Pollutant	Averaging Period	Maximum Impact (kg/ha/yr)	DAT (kg/ha/yr)	Percent of DAT
Arctic National Wildlife Refuge	Nitrogen	Annual [a]	1.92E-04	0.005	4
Gates of the Arctic	Nitrogen	Annual [a]	1.03E-04	0.005	2
Arctic National Wildlife Refuge	Sulfur	Annual [a]	2.79E-06	0.005	0.1
Gates of the Arctic	Sulfur	Annual [a]	1.72E-06	0.005	0.03

[a] All maximum GMT deposition impacts occur in year 2008, thus represent a true annual impact.

Alternative D1 far-field modeling demonstrates that Alternative D1 would have a slightly higher contribution to ambient concentrations, visibility impacts, and deposition impacts than Alternative A. Overall, the project contribution to these issues is negligible when the project is considered by itself.

Alternative D2

Air Emissions

GMT1 Alternative D2 defines development in which there is no road access between GMT1 and the existing APF except via an annual ice road (as in Alternative D1) and allows only seasonal drilling when the ice road is in place. Alternative D2 air emissions are very similar to Alternative D1 emissions, with the exception that drilling is assumed to be limited to an 80-day period each year instead of being performed throughout the year. Therefore, the emissions inventory developed for Alternative D1 was revisited and revised where necessary to account for the seasonality and develop the emission inventory for Alternative D2.

A detailed emission inventory has been prepared for Alternative D2. The estimated emissions for Alternative D2 are shown in Table 4.2-47 for construction emissions and Table 4.2-48 for operational emissions. For each pollutant the highest rolling 12-month total emission in tons was selected for construction and for operations. These maximum 12-month emissions may not occur simultaneously but are presented to summarize the maximum possible emissions over the three-year construction period and future projected operations during any year.

Table 4.2-47. Maximum Potential 12-Month Construction Emissions for Alternative D2

Pollutant	12-Month Time Period Ending	Tons Per Year
NO_X	Year 1, Month 10	129
CO	Year 1, Month 10	139
SO_2	Year 1, Month 10	2.12
PM_{10}	Year 3, Month 6	93.4
$PM_{2.5}$	Year 3, Month 11	21.1
VOC	Year 3, Month 11	26.1
HAPs	Year 3, Month 12	4.2
GHG (CO_2e)	Year 3, Month 11	34,927
TRS	Year 3, Month 5	12.9

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D2 (Roadless) Air Quality Impact Analysis* (CPAI 2014b)

Table 4.2-48. Maximum Potential 12-Month Operational Emissions for Alternative D2

Pollutant	Production Year Type	Tons Per Year
NO_X	Typical Production Year	178.6
CO	Typical Production Year	92.8
SO_2	Infill Drilling	1.17
PM_{10}	Infill Drilling	94
$PM_{2.5}$	Infill Drilling	22.8
VOC	Infill Drilling	40.6
HAPs	Infill Drilling	5
GHG (CO_2e)	Typical Production Year	36,308
TRS	Infill Drilling	0.1

Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D2 (Roadless) Air Quality Impact Analysis* (CPAI 2014b)

Alternative D2 Near-field Results

The same four activities selected for Alternative D1 dispersion modeling were considered to represent the worst-case impacts for Alternative D2. For the near-field analysis impacts from criteria pollutant emissions of PM_{10}, $PM_{2.5}$, NO_2, SO_2, and CO, and emissions of air toxics (benzene, toluene, ethyl benzene, xylenes, n-hexane, and formaldehyde) were evaluated for four scenarios:

1. Access Road and Pad Construction
2. Gravel Mining
3. Infill Drilling
4. Well Intervention

The amount of drilling activity did not factor into the modeled criteria pollutant emission calculations for the gravel mine site or pad construction modeling scenarios because these scenarios do not include emission sources specifically associated with drilling. Therefore, the Alternative D1 modeled emissions inventory for those scenarios is considered equal to Alternative D2.

Only the well intervention and infilling drilling modeling scenarios include emission sources specifically associated with drilling. Therefore, criteria pollutant emissions for only these scenarios were updated. Alternative D2 emission calculation updates include fewer cargo aircraft flights because the ice road will be used to transport all drilling supplies, reduced fugitive dust and tailpipe emissions due to reduced numbers of vehicles on the roads because supplies will not need to be stockpiled at the pad for drilling during the portion of the year without ice road access, reduced operation of the drill rig, and reduced operation of the non-mobile drilling support equipment. The permanent routine operation sources are the same for Alternatives D1 and D2.

The maximum ambient air quality impacts for all scenarios modeled for Alternative D2 are shown in Table 4.2-49.

Table 4.2-49. Alternative D2 Impacts Compared to Established Ambient Criteria

Pollutant	Averaging Period	Infill Drilling	Well Intervention	Access Road and Pad Construction	Gravel Mining	Maximum Total Concentration ($\mu g/m^3$)	NAAQS/ AAAQS ($\mu g/m^3$)	Percent of NAAQS/ AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	2,349	1,983	3,308	3,373	3,373	40,000	8	Gravel Mining
	8-hour	1,680	1,587	2,465	2,487	2,487	10,000	25	Gravel Mining
SO_2	1-hour	11.5	12	12	24	24	196	12	Gravel Mining
	3-hour	21	21	22	46	46	1,300	4	Gravel Mining
	24-hour	10	10	8.9	13	13	365	4	Gravel Mining
	Annual	0.77	0.76	0.45	0.46	0.77	80	1	Infill Drilling
NO_2	1-hour	<u>**211**</u>	164	166	183	<u>**211**</u>	188	**112**	Infill Drilling
	Annual	21	13	31	41	41	100	41	Gravel Mining
PM_{10}	24-hour	<u>**152**</u>	<u>**152**</u>	<u>**152**</u>	101	<u>**152**</u>	150	**102**	Infill Drilling, Well Intervention, Access Road and Pad Construction
$PM_{2.5}$	24-hour	<u>**35**</u>	<u>**35**</u>	<u>**44**</u>	<u>**35**</u>	<u>**44**</u>	35	**125**	Infill Drilling, Well Intervention, Access Road and Pad Construction, and Gravel Extraction
	Annual	7.1	7.0	8.3	6.2	8.3	12	69	Access Road and Pad Construction

Concentrations shown in bold and underlined exceed the NAAQS/AAAQS.

High 1-hour NO_2 impacts are predicted from infill drilling. High 24-hour PM_{10} impacts are predicted from infill drilling and well intervention. High 24-hour $PM_{2.5}$ impacts are predicted from infill drilling, well intervention, road and pad construction, and gravel mining. The modeling assumed 50 to 75 percent control of fugitive dust based on watering.

Modeling results for the Infill Drilling scenario are presented in Table 4.2-50 for Alternative D2, compared to the Class II PSD increments. These comparisons are made for informational purposes only, and the analyses described herein are not intended to be, nor should they be interpreted as a regulatory increment consumption analysis. ADEC has established NO2, PM10, and PM2.5 increment limits at 18 AAC 50.020, Table 3.

Table 4.2-50. Alternative D2 Impacts Compared to PSD Class II Increments for Infill Drilling Scenario

Pollutant	Averaging Period	Total Concentration ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
SO_2	3-hour	3.8	512
	24-hour	3.2	91
	Annual	0.43	20
NO_2	Annual	18	25
PM_{10}	24-hour	112	30
	Annual	36	17
$PM_{2.5}$	24-hour	73	9
	Annual	5.4	4

Ambient air quality impacts were also modeled for receptors in Nuiqsut to determine the effect of Alternative D2 on the closest residences. The highest modeled concentrations for each pollutant are presented in Table 4.2-51.

Table 4.2-51. Alternative D2 Impacts Compared to Established Ambient Criteria at the Community of Nuiqsut

Pollutant	Averaging Period	Total Concentration ($\mu g/m^3$)	NAAQS/AAAQS ($\mu g/m^3$)	Percent of NAAQS/AAAQS	Scenario Resulting in Highest Concentration
CO	1-hour	1,664	40,000	4	Gravel Mining [a]
	8-hour	1,286	10,000	13	Gravel Mining [a]
SO_2	1-hour	9.1	196	5	Gravel Mining [a]
	3-hour	19	1,300	1	Gravel Mining [a]
	24-hour	7.0	365	2	Gravel Mining [a]
	Annual	0.34	80	0	Gravel Mining [a]
NO_2	1-hour	80	188	43	Gravel Mining [a]
	Annual	3.0	100	3	Gravel Mining [a]
PM_{10}	24-hour	49	150	33	Gravel Mining [a]
$PM_{2.5}$	24-hour	7.8	35	22	Gravel Mining [a]
	Annual	2.2	12	18	Access Road and Pad Construction

[a] Note the gravel extraction site modeled for the Draft SEIS was the Clover Material site. The project is now expected to use the ASRC Mine site for gravel extraction. The modeled concentrations shown in this table are for the Clover Material site. The Clover Material site is located northwest of Nuiqsut, and the ASRC Mine site is located east of and slightly closer to Nuiqsut. Impacts from the Clover Material site were modeled and were within the NAAQS/AAAQS for all pollutants.

Alternative D2 results predict criteria pollutants will be in compliance in the community of Nuiqsut.

Air Toxics Impact Analysis

Results of the air toxics ambient analysis for Alternative D2 in the vicinity of the project activities are presented in Table 4.2-52, and results of the air toxics ambient analysis in the community of Nuiqsut are presented in Tables 4.2-53 and 4.2-54.

Tables 4.2-52 and 4.2-53 show maximum modeled 1-hour concentrations are below the criteria levels for each of the air toxics evaluated and that annual modeled concentrations are below the RfCs for each of the air toxics evaluated. Table 4.2-54 shows that the total excess cancer risk for both the MLE and MEI scenarios are less than 1.0E-06 in the community of Nuiqsut which represents a less than one-in-one million cancer risk.

Table 4.2-52. Alternative D2 Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment

Pollutant	REL (1-hour) (µg/m^3)	Maximum Modeled 1-hour Concentration (µg/m^3)	Non-carcinogenic RfC [c] (Annual) (µg/m^3)	Maximum Modeled Annual Concentration (µg/m^3)
Benzene	1,300 [a]	3.3	30	0.094
Ethyl benzene	350,000 [b]	0.52	1,000	0.013
Formaldehyde	55 [a]	7.9	9.8	0.38
n-Hexane	390,000 [b]	69	700	0.27
Toluene	37,000 [a]	2.6	5,000	0.031
Xylenes	22,000 [a]	1.1	100	0.032

[a] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[b] No REL available for these air toxics. Values shown are from (IDLH/10), EPA Air Toxics Database, Table 2 (USEPA 2011a).

[c] EPA Air Toxics Database, Table 1 (USEPA 2012)

Table 4.2-53. Alternative D2 Air Toxics Acute Exposure Assessment and Long-term Non-carcinogenic Exposure Assessment for Nuiqsut Community Receptor

Pollutant	REL (1-hour) (µg/m^3)	Maximum Modeled 1-hour Concentration (µg/m^3)	Non-carcinogenic RfC [c] (Annual) (µg/m^3)	Maximum Modeled Annual Concentration (µg/m^3)
Benzene	1,300 [a]	0.19	30	7.00E-05
Ethyl benzene	350,000 [b]	0.03	1,000	1.00E-05
Formaldehyde	55 [a]	0.39	9.8	2.50E-04
n-Hexane	390,000 [b]	3.89	700	2.00E-04
Toluene	37,000 [a]	0.15	5,000	3.00E-05
Xylenes	22,000 [a]	0.06	100	2.00E-05

[a] EPA Air Toxics Database, Table 2 (USEPA 2011a)

[b] No REL available for these air toxics. Values shown are from (IDLH/10), EPA Air Toxics Database, Table 2 (USEPA 2011a).

[c] EPA Air Toxics Database, Table 1 (USEPA 2012)

Table 4.2-54. Alternative D2 Air Toxics Long-term Cancer Risk Analysis for Nuiqsut Community Receptor

Exposure Scenario [a]	Pollutant	Maximum Modeled Annual Concentration ($\mu g/m^3$)	Carcinogenic Unit Risk Factor [b] ($1/\mu g/m^3$)	Exposure Adjustment Factor	Cancer Risk
MLE	Benzene	7.0E-05	7.8E-06	0.43	2.3E-10
MLE	Ethyl benzene	1.0E-05	2.5E-06	0.43	1.1E-11
MLE	Formaldehyde	2.5E-04	1.3E-05	0.43	1.4E-09
Total Inhalation Cancer Risk					**1.6E-09**
MEI	Benzene	7.0E-05	7.8E-06	0.43	2.3E-10
MEI	Ethyl benzene	1.0E-05	2.5E-06	0.43	1.1E-11
MEI	Formaldehyde	2.5E-04	1.3E-05	0.43	1.4E-09
Total Inhalation Cancer Risk					**1.6E-09**

[a] MLE = most likely exposure; MEI = maximally exposed individual. Duration = 30 years (life of project)

[b] EPA Air Toxics Database, Table 1 (USEPA 2012)

Near-Field Analysis Conclusions for Alternative D2

The dispersion modeling analysis of near-field project impacts indicates compliance with all criteria pollutant NAAQS/AAAQS for all averaging periods with the following exceptions:

- Predicted NO_2 1-hour impacts exceed the NAAQS/AAAQS for the Infill Drilling scenario.
- Predicted PM_{10} 24-hour and $PM_{2.5}$ 24-hour and annual impacts exceed the NAAQS/AAAQS for one or more of the scenarios (Infill Drilling, Well Intervention, Access Road and Pad Construction, and/or Gravel Mining).

For the cases identified above, the near-field ambient air quality impacts analysis demonstrates that high air quality impacts will result from the construction and operation of Alternative D2 for particulate matter and NO_2. The project must meet all state and federal air quality standards and restricted access to project areas where high air quality impacts are predicted (where project emissions will exceed the NAAQS/AAAQS) would be required under Alternative D2. The impacts were predicted using dispersion modeling of ambient air quality impacts as directed under the Air Quality MOU.

Results of the near-field analysis indicate that air quality impacts from Alternative D2 are predicted to be higher than Alternative A for 8-hour CO, 1-hour NO_2, 24-hour PM_{10}, 24-hour $PM_{2.5}$ and annual $PM_{2.5}$. Impacts from 1-hour CO, 3-hour SO_2, and annual NO_2 are predicted to be lower under Alternative D2 than Alternative A. Impacts are predicted to be the same for 1-hour SO_2, and 24-hour SO_2. Annual $PM_{2.5}$ impacts are predicted to be lower for Alternative D2 than the impacts of Alternative D1. Differences in predicted concentrations for these two alternatives result from the different equipment that will be used and different operational schedules. A culpability analysis was not prepared for either alternative to determine exactly which emission sources caused higher predicted concentrations for the D2 alternative compared to Alternative A.

One-hour NO_2 impacts for Alternative D2 are larger than those for Alternatives A or D1 and exceed the NAAQS/ AAAQS. This is explained as follows:

- The drill rig stationary sources are most culpable for the impacts.
- While there are no differences in short-term emissions for drill rig sources between Alternatives D1 and D2, the 1-hour NO_2 modeling included a refinement that incorporated the actual drilling profile (i.e., activity over time), which is different for

each alternative. Alternative D1 assumed the drill rig sources operated continuously for 14 months to drill the first nine wells, and then did not operate for the remaining 46 months for the modeled five-year period. Alternative D2 assumed the drill rig sources operated for the three months of the Active Drilling Season, and then did not operate for the remaining nine months for each of the five years modeled. The key point to highlight is that for Alternative D1, continuous drilling occurred over a shorter portion of the total five-year modeling period leaving three modeled years with no drilling activity occurring.

- One-hour NO_2 NAAQS compliance is based on the five-year average 98th percentile of the annual distribution of 1-hour daily maximum modeled concentrations. Developing a five-year average value factors in more years with zero concentration from the drill rig sources for Alternative D1 (three years of zero impacts from drilling) than for Alternative D2 (no years with zero impacts from drilling). For Alternative D1, after the first two years, impacts decrease since drilling is complete in the first 14 months (1.17 years). The same is not the case for Alternative D2 which has drilling occurring in all five years to complete the same number of wells.

Alternative D2 Far-field Results

Given far-field Alternative A and D1 project-only impacts for air quality and Air Quality Related Values (AQRVs) were negligible at all Class II areas analyzed, and modeled emissions for Alternative D2 were equal to or less than those modeled for Alternative D1, Alternative D2 project-only far-field impacts will be equally negligible. Far-field modeling was not performed for Alternative D2. The project-only impacts predicted for Alternative A and D2 are between 1 and 4 orders of magnitude smaller than the background concentration used for the air quality cumulative impact analysis. Therefore, the Alternative A and D1 ambient air quality impact analyses demonstrate that the cumulative impact analysis is not sensitive to project emissions. The same results would be expected for Alternative D2.

Project-only visibility and sulfur and nitrogen deposition at each of the Class II areas analyzed were well below applicability thresholds (i.e., between 0 and 7 percent of applicable standards) and considered negligible for both Alternatives A and D1. Similar to the far-field air quality impact analysis, a comparison of cumulative impacts (i.e., project plus Reasonably Foreseeable Development [RFD] sources) to AQRVs clearly indicates that RFD, and not project, sources dominate the cumulative impact analysis. Because of the lack of sensitivity impacts to AQRVs from project-only emissions, and the small changes in modeled emissions between Alternatives D2 and D1, Alternative D1 conclusions are equally representative for Alternative D2.

Alternative E

Under Alternative E, the No Action Alternative, no air pollutant emissions would occur from the proposed project. Emissions in the area from the existing Alpine field would continue.

Summary of Air Quality Analysis Results

Estimated total project emissions for each GMT1 Project alternative under consideration are summarized for construction in Table 4.2-55. Operational emissions are summarized in Table 4.2-56.

Table 4.2-55. Maximum Potential 12-Month Construction Emissions for Each Alternative Under Consideration (Tons per Year)

Pollutant	Alternative A [a]	Alternative B	Alternative C	Alternative D1[b]	Alternative D2[c]	Alternative E
NO_X	125	132	154	152	129	0
CO	127	132	147	163	139	0
SO_2	1.9	1.9	2.0	2.25	2.12	0
PM_{10}	245	269	343	107	93.4	0
$PM_{2.5}$	33.2	36.0	44.1	24.4	21.1	0
VOC	25.6	25.6	25.6	34.9	26.1	0
HAPs	2.0	2.0	2.0	5.3	4.2	0
GHG (CO_2e)	30,980	30,980	34,086	43,761	34,927	0
TRS	12.9	12.9	12.9	12.9	12.9	0

[a] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Air Quality Impact Analysis*, (CPAI 2013a)

[b] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D (Roadless) Air Quality Impact Analysis* (CPAI 2013b)

[c] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D2 (Roadless) Air Quality Impact Analysis* (CPAI 2014b)

Alternative E, the no action alternative, would not result in any air emissions. Alternative A construction emissions are lower than estimated emissions for construction of Alternatives B and C because Alternative A has the shortest access road length. Construction would take a shorter amount of time resulting in the lowest emissions from combustion of fuel in construction equipment and the lowest fugitive dust emissions from material blasting and handling for road construction. Alternatives D1 and D2 have much lower predicted particulate matter emissions because a permanent access roadway would not be constructed. Emissions of NO_X, CO, SO_2, VOC, HAPs, and GHG are predicted to be higher than the maximum 12-month emissions of those pollutants under Alternative A. Alternative D2 12-month construction emissions are lower than Alternative D1 because the duration of developmental drilling would be limited to three months during the three-year construction period instead of 14 consecutive months.

Table 4.2-56. Maximum Potential 12-Month Operational Emissions for Each Alternative Under Consideration (Tons per Year)

Pollutant	Alternative A [a]	Alternative B	Alternative C	Alternative D1[b]	Alternative D2[c]	Alternative E
NO_X	93.4	93.4	93.4	179.6	178.6	0
CO	43.1	43.1	43.1	159.3	92.8	0
SO_2	0.82	0.82	0.82	1.85	1.17	0
PM_{10}	244	249	299.3	108	94	0
$PM_{2.5}$	52.6	55.3	85.1	29.4	22.8	0
VOC	37.9	37.9	37.9	52.8	40.6	0
HAPs	2.9	2.9	2.9	6	5	0
GHG (CO_2e)	34,071	34,076	34,130	50,121	36,308	0
TRS	0.1	0.1	0.1	0.1	0.1	0

[a] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Air Quality Impact Analysis* (CPAI 2013a)

[b] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D (Roadless) Air Quality Impact Analysis* (CPAI 2013b)

[c] Source: *ConocoPhillips Alaska, Inc. Greater Mooses Tooth 1 Alternative D2 (Roadless) Air Quality Impact Analysis* (CPAI 2014b)

Operational emissions would not result from Alternative E, the no action alternative. Except for particulate matter, Alternative A emissions are predicted to be the lowest of all action alternatives for the maximum 12-month emissions for each pollutant. Operations at the GMT1 well pad would be identical under Alternatives A, B, and C; the only differences in operational emissions for these scenarios is the use of a longer access road. Alternatives D1 and D2 have greater emissions for all pollutants except PM_{10} and $PM_{2.5}$ because fugitive roadway dust emissions are avoided for the roadless alternative but increased combustion emissions will result from additional stationary source equipment required at the pad under the roadless alternative as well as aircraft accessing the site. Alternative D2 operational emissions are lower than Alternative D1 operational emissions because drilling is limited to a three-month period in any year when the ice road is in place.

The dispersion modeling analysis of near-field project impacts indicates compliance with all criteria pollutant NAAQS/AAAQS for all averaging periods with the following exceptions:

- 24-hour $PM_{2.5}$ concentrations are predicted to exceed the NAAQS/AAAQS for Alternatives D1 and D2 during infill Drilling, Well Intervention, Road and Pad Construction, and Gravel Mining.
- 24-hour PM_{10} concentrations are predicted to exceed the NAAQS/AAAQS for Alternatives D1 and D2 during Infill Drilling, Well Intervention, and Road and Pad Construction.
- 1-hour NO_2 concentrations are predicted to exceed the NAAQS/AAAQS for Alternative D2 during Infill Drilling.
- Alternatives D1 and D2 have predicted NAAQS/AAAQS exceedances in some scenarios; whereas, Alternative A is not predicted to result in concentrations that exceed the NAAQS/AAAQS.

The air toxics analysis indicates a less than a one-in-a-million cancer risk for all scenarios.

The dispersion modeling analysis of far-field project impacts indicates compliance with all criteria pollutant standards at the Sensitive Class II areas. The AQRVs analysis indicates the project-only impacts are below thresholds.

Impact Criteria

For this SEIS, the Air Quality impact criteria presented in Table 4.2-57 were developed to guide the evaluation of impacts from the proposed GMT1 development. The nature of an impact is generally defined by the intensity or magnitude of the impact, the duration, the potential for the impact to occur, and the geographic extent.

Table 4.2-57. Impact Criteria—Air Quality

Impact Category	Magnitude	Definition
Intensity	High	• Causing modeled pollutant concentrations of greater than or equal to the NAAQS/AAAQS; • Modeled project impacts exceed thresholds listed in NPS FLAG guidance, perceptible visibility impacts will occur and be visible from many areas of the park, occur many days over the course of a year, or be visible to a majority of park visitors on the days that they occur; and/or, • Nitrogen and sulfur deposition loading levels exceed screening thresholds listed in NPS DAT guidance, and available scientific information indicates that deposition may harm the integrity of resources in the park.
	Medium	• Causing modeled pollutant concentrations of >50% but <100% of the NAAQS/AAAQS; • Modeled project impacts exceed thresholds listed in NPS FLAG guidance, perceptible visibility impacts will occur and be visible from many areas of the park, occur between one and several days per year, or be visible to many park visitors on the days that they occur; and/or, • Nitrogen and sulfur deposition loading levels exceed screening thresholds listed in NPS DAT guidance, and available scientific information indicates that deposition will not, or is not, harming integrity of resources in the park.
	Low	• Causing modeled pollutant concentrations of <50% of the NAAQS/AAAQS; and/or, • Predicted visibility impacts and nitrogen and sulfur deposition loading levels are below thresholds listed in NPS FLAG and DAT guidance.
Duration	Long term	Irreversible impacts to air quality that extend beyond the life of the project
	Interim	Impacts last longer than 24 months through the life of the project
	Temporary	
Potential to Occur	Probable	Unavoidable
	Possible	Potential to occur (may be able to mitigate)
	Unlikely	May occur, but unlikely to occur
Geographic Extent	Statewide	Project area and beyond
	Local	Within GMT1 Project area footprint
	Limited	Within 100 yards of project pad ambient air boundaries

The air quality impact criteria of Table 4.2-57 were used to evaluate each proposed alternative. The assessment of impacts is presented in Tables 4.2-58 through 4.2-63. A column for "potential to occur" is included to note a relative likelihood of impact for specific activities associated with project development in each alternative.

Table 4.2-58. Alternative A—Impact Evaluation for Air Quality

Activity	Intensity	Duration	Potential	Extent
Construction	Medium	Temporary	Probable	Local
Drilling	Medium	Temporary	Probable	Limited
Operations	Low	Medium term	Probable	Local
Overall	Medium	Medium term	Probable	Local

Table 4.2-59. Alternative B—Impact Evaluation for Air Quality

Phase	Intensity	Duration	Potential	Extent
Construction	Medium	Temporary	Probable	Local
Drilling	Medium	Temporary	Probable	Limited
Operations	Low	Medium term	Probable	Local
Overall	Medium	Medium term	Probable	Local

Table 4.2-60. Alternative C—Impact Evaluation for Air Quality

Phase	Intensity	Duration	Potential	Extent
Construction	Medium	Temporary	Probable	Local
Drilling	Medium	Temporary	Probable	Limited
Operations	Low	Medium term	Probable	Local
Overall	Medium	Medium term	Probable	Local

Table 4.2-61. Alternative D1—Impact Evaluation for Air Quality

Phase	Intensity	Duration	Potential	Extent
Construction	High	Temporary	Probable	Local
Drilling	High	Temporary	Probable	Limited
Operations	Low	Medium term	Probable	Local
Overall	High	Medium term	Probable	Local

Table 4.2-62. Alternative D2—Impact Evaluation for Air Quality

Phase	Intensity	Duration	Potential	Extent
Construction	High	Temporary	Probable	Local
Drilling	High	Temporary	Probable	Limited
Operations	Low	Medium term	Probable	Local
Overall	High	Medium term	Probable	Local

Table 4.2-63. Alternative E—Impact Evaluation for Air Quality

Phase	Intensity	Duration	Potential	Extent
Construction	NA	NA	NA	NA
Drilling	NA	NA	NA	NA
Operations	NA	NA	NA	NA
Overall	NA	NA	NA	NA

Mitigation Measures

As required by the 2004 ASDP ROD, the permittee will implement a plan approved by the Authorized Officer for limiting fugitive dust. Methods of dust control could include road watering, vehicle washing, covering of stockpiled material, ceasing construction during wind events, the use of chemical stabilizers, and chip seal, and could vary for the frozen and non-frozen seasons. Stationary drill site equipment will be electrically powered or utilize natural gas. The western North Slope uses ultra-low sulfur diesel for all rolling stock[10], including portable heaters.

Potential New Mitigation Measure 1: Air Quality (new subparagraph to BMP A-10)

Objective: Prevent unnecessary or undue degradation of the lands and protect health.

Requirement/Standard: To the extent practicable, all oil and gas operations (vehicles and equipment) must be powered by natural gas or electric power rather than diesel fuel. To the extent natural gas and electric power are not available, the permittee will use gasoline rather than diesel to the extent practicable. Any vehicles and equipment that require diesel fuel must use ULSD as defined by the Alaska Department of Conservation, Division of Air Quality.

Potential Benefits and Residual/Unavoidable Impacts: Natural gas has fewer impurities, is less chemically complex, and generally results in less pollution when combusted than diesel fuel. In most applications, using natural gas produces less CO_2, SO_2, and particulate matter, than diesel fuel, resulting in reduced health risks from fuel combustion in equipment associated with oil and gas operations. Natural gas is an available fuel for stationary combustion sources on the North Slope; however, vehicle fueling with natural gas may not be currently feasible due to a lack of infrastructure and availability of appropriate vehicles. Where use of natural gas is not practicable, use of gasoline generally results in less pollution when combusted than diesel fuel. Use of natural gas-generated electric power to operate GMT1 sources, rather than diesel-fired electric power generation, is environmentally beneficial.

Potential New Mitigation Measure 2: Air Quality (new subparagraph to BMP A-10)

Objective: Provide BLM oversight and technical review of air quality monitoring near the GMT1 project; address concerns in the local community regarding oversight for air quality.

Requirement/Standard: Permittee will provide funding for monitoring to identify and address concerns related to air quality in the Nuiqsut area. Reports from the monitoring station in Nuiqsut will be provided to BLM, the State, NSB, and the local community and tribal government pursuant to BMP A-10 (h). The Permittee will provide funding for BLM technical review of these documents.

Potential Benefits and Residual/Unavoidable Impacts: Members of the public have expressed concern over air quality in the project vicinity. Additionally, CPAI owns the air quality monitoring station in Nuiqsut. Providing for a technical BLM review of the monitoring results provides certainty for BLM and the community that air quality is being carefully

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[10] Rolling stock associated with GMT1 would include but may not be limited to: Pick-Up trucks (crew cab with 8 ft box typical); 15-passenger vans; 20-35 passenger buses; 1 - 3 ton flatbed trucks; 2500 - 4000 gallon fuel trucks; 10,000-gallon tankers (tractor-trailer); 100 - 175 bbl water trucks; 200 - 325 bbl vac trucks (tractor-trailer); Lowboy tractor-trailers (35 - 50 ft trailers); Standard 40 ft tractor-trailers; Motor Graders; Snow Blowers; Loaders / Forklifts (CAT 966 / Volvo L180 and/or similar); Zoom-Booms (telescoping forklifts); End-Dumps (tractor-trailer and/or maxi-haul); Excavators (Cat 345 or similar); 25 - 60 ton cranes (rubber tired); Boom trucks (supporting well operations); Tucker snowcat (or similar); Slick Line Unit (well work operations); Wire Line Unit (well work operations).

considered and will help identify any potential project-related impacts that would cause exceedances of NAAQS, or fail to protect public health.

4.2.3.3 Noise

Potential impacts of noise generated by oil and gas industry activities in the NPR-A are discussed by BLM (2012, § 4.4.21.2) and for the project study area by BLM (2004, § 4F.2.3.3). The findings presented in these BLM documents regarding the potential impacts from noise are adopted in this analysis. In addition, a summary of the results of noise impact analysis presented in the Point Thomson Project Final EIS is presented in this section to provide background noise data for construction and operation activities that are similar to the GMT1 Project action alternatives (Corps 2012, Appendix O).

Impact analysis criteria used in this assessment for transportation systems are presented below in Table 4.2-64. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts.

Table 4.2-64. Impact Criteria — Noise

Impact Category	Magnitude	Definition
Intensity	High	Dominates the soundscape
	Medium	Occasionally punctuates the soundscape
	Low	Calculated noise levels are comparable to periods of quietest natural sound (i.e., when no wind occurs)
Duration	Long-term	Irreversible impact on soundscape
	Interim	Impact lasts through operational phase of project
	Temporary	Impact lasts only through project construction and/or drilling
Context	Unique	Impacts to residential communities, concentrated subsistence use areas, biological resources listed as threatened or endangered (or proposed for listing) under the ESA and/or depleted under the MMPA and the portion of the resource affected fills a unique ecosystem role within the locality or region.
	Important	Impacts to individual residences, dispersed subsistence use areas, or depleted biological resources within the locality or region or resources protected by legislation.
	Common	Impacts to oilfield workers and usual or ordinary resources in the project study area; resource is not depleted in the locality or protected by legislation.
Geographic Extent	Statewide	Extending beyond the project study area
	Regional	Within the project study area
	Local	Within or adjacent to project components

This section describes results of analyses of noise that would be generated by the action alternatives and potential impacts on receptors, which, for purposes of this SEIS, are defined as communities (human receptors), and wildlife (birds, mammals, and fish). Noise associated with construction, drilling, and operations have the potential to impact both people and wildlife in the project study area as described below.

Nuiqsut is the community nearest the proposed project (11.5 miles east south-east of the proposed GMT1 drill site). However, local residents travel widely over the project study area, pursuing subsistence activities. Additional information regarding the impacts of noise on subsistence users is presented in Section 4.4.5.

As described previously in Section 3.2.3.3, noise is defined as unwanted sound. Sound is made up of tiny fluctuations in air pressure. Sound, within the range of human hearing, can vary greatly in its intensity. A logarithmic scale, known as the decibel scale (dB), is used to quantify sound intensity and to compress the scale to a more manageable range. Sound is characterized by both its amplitude (how loud it is) and frequency (or pitch). The human ear does not hear all frequencies equally. The A-weighted scale (dBA) is used to reflect this selective sensitivity of human hearing. This scale puts more weight on the range of frequencies where the average human ear is most sensitive, and less weight on those frequencies we do not hear as well. The human range of hearing extends from approximately 3 dBA to around 140 dBA (Corps 2012, Appendix O, § 2.1, p. 3).

The ambient sound level of a region is defined by the total noise generated, including sounds from both natural and artificial sources. The magnitude and frequency of environmental noise can vary considerably in part because of changing weather conditions throughout a day or over the course of several days or weeks (BLM 2004, § 4F.2.3.3, p. 1103). The noise analysis conducted for this SEIS considers residents of Nuiqsut and areas where local residents travel for subsistence activities, and the wildlife that inhabit the same area.

Noise sources will include construction activities, drilling, and gravel mining; stationary sources such as generators and compressors; and mobile sources including heavy earth-moving equipment, large gravel-haul trucks, tractor-trailers, oil field service trucks, pickups, and other vehicles. Noise from aircraft overflights, landings, and takeoffs will be also be generated (BLM 2012, § 4.4.21.2, p. 349).

Noise and vibration measurements have been collected and analyzed in separate studies for the Northstar Production project and the Point Thomson project located on the North Slope. This information is used as introduction to the types of noise that could be expected from the GMT1 action alternatives.

The Northstar Production project is an artificial drilling island approximately 6 miles offshore of Prudhoe Bay. Field measurements were collected and analyzed of noise and vibrations created by heavy equipment and other sources from the final construction phases of the project. Noise sources from the construction included ice augers, water pumps for ice road construction, a bulldozer plowing snow, a trencher cutting ice, trucks hauling gravel over an ice road, a large excavator trenching the seafloor for a subsea pipeline, and driving sheet pile. In-air sounds generated by construction were reported to reach background levels within 2 miles of the activities (Greene et al. 2008).

The noise impact analysis for the Point Thomson Project, a large natural gas production project, included noise generated at central production facility (CPF), drill pads, roads, and an airstrip (Corps 2012, Appendix O, pp. 49-50). The Point Thomson Project is substantially larger, and includes more noise-generating equipment than the proposed GMT1 Project. Noise analyses for the Point Thomson Project, gathered in 2010, are summarized below to provide context for the currently proposed GMT1 Project:

- Ambient noise levels at a coastal plain monitoring site, located approximately 9 miles inland, were measured at 32 dBA in winter and 31 dBA in summer, and were dominated by the sound of weather events. During summer ambient noise is dominated by sounds of wind and animals including caribou, bears, and insects.
- Noise has the potential to dominate the ambient soundscape in the immediate vicinity (within 0.5 mile) of the noise sources;

- The drill rig is a large noise emission source during the construction and drilling phase and power turbines used during operations would be the greatest noise source during operations;
- Noise in the Point Thomson project area (a 2.5-mile buffer from facilities) would increase between 0 to 21 dBA depending on existing conditions and distance from the noise sources.
- Construction and drilling noise may be audible, estimated at 5 dBA over ambient levels, up to 8 miles away. Increases of less than 2 dBA are generally considered to be below the threshold of human perception (depending on the spectral distribution of the sound; low frequency sounds may be audible during periods of low or no wind).

Construction

Construction of the GMT1 Project will be typical of other ACP oilfield development projects in terms of schedule, equipment used, and other types of activities. Construction of the proposed facilities is expected to temporarily increase noise levels within the project study area. Noise levels would vary during the construction period, depending on the type of activity. There would be a temporary increase in noise levels in the immediate vicinity (within 0.5 mile) of the construction activities, occurring at a specific location for only part of a single winter season (BLM 2004, § 4F.2.3.3, p. 1104).

The ASRC Mine site is located 4.5 miles east of Nuiqsut. If this site is used, the blasting and earthmoving activity necessary to extract gravel would result in short-term, medium-intensity noise impacts to Nuiqsut, depending on the season and environmental conditions. Wind is a prevalent environmental condition. Noise from blasting at the ASRC Mine site would be audible at Nuiqsut. During CD5 construction, blasting at the ASRC could be heard in Nuiqsut, and took place at 6 p.m. each evening during gravel excavation.

The construction of the GMT1 Project gravel roads, pads, and pipelines would cause temporary increases in noise in the immediate vicinity of the construction sites. Dispersed subsistence activities could place individuals or small groups within a zone of noise levels above background for short periods.

Summer construction-related activities, during which birds and other wildlife are present and active, may occur. The level of disturbance that may be encountered will vary depending on species of bird, the nature of the disturbance, the location, and the distance of the bird from the disturbance. The range of bird responses to noise may include temporary or permanent displacement from preferred habitats and increased energy expenditures, which could have other impacts. Disturbances from noise would also have similar impacts on mammals. If noise results in displacement from preferred habitats, the animals may be required to expend energy responding to the noise disturbance. If unable to compensate for the expended energy, the animal's survival and reproduction could be effected depending on the timing of the noise disturbance. The potential disturbance of birds and mammals are discussed in Section 4.3.3 and 4.3.4, respectively.

Pile-driving work for bridge construction at the Tiŋmiaqsiġvik (Ublutuoch) River and Crea Creek will occur during winter at locations where the ice is grounded to the bottom of the channel and the transmission of vibratory sounds into or through water is avoided. Noise and vibration resulting from pile-driving work can extend thousands of feet away from the origin of the activity with vibration and noise disturbances occurring with each blow delivered to the pile. Pile driving is known as one of the noisiest construction operations with a 90 dBA level at

300 feet from the source for the noisiest hammer (Marr 2014). The intensity of both vibration and noise related to pile-driving work decreases with the long distance from the source. The primary complaint associated with pile-driving is the annoyance caused to people and potentially wildlife.

Pile driving during the winter months would reduce the impact as fish would be in overwintering areas and possibly away from pile-driving activities. Pile driving produces underwater noise audible to species in the area and is likely to be one of the noisiest on-site activities. In underwater environments, pile driving is known to produce strong noise levels. The level of underwater noise is dependent upon the depth of the water or ice into which piles are driven, the density/resistance of the substrate, bottom topography and composition, physical properties and dimensions of the pile, and type of pile-driver used (BLM 2012, § 5.11, p. 5-346). Noise from pile-driving can result in hearing loss, masking of biologically important sounds, increased stress levels, impacts to immune systems, and death to fish, larvae, and eggs. Larger fish can be startled while smaller fish can be injured or die (BLM 2012, § 5.12, p. 5-379).

In 2012 laboratory-based studies were conducted on the impacts of pile-driving sounds on non-auditory tissues of fish. The studies indicated that the severity of injury in different fish species was related to the sound exposure level of each strike and the total number of strikes. At the maximum level tested, mortal injuries were observed. Impulsive sounds travel great distances from their source and fish will likely hear these sounds out to a distance that is substantially greater than the distance over which fish may suffer barotrauma. Indeed, fish have a higher probability of hearing pile driving sounds before they are close enough to be injured. It is often theorized that fish would swim away from impulsive sounds when the signals are below those that cause damage. However, at this time there is no data to support those theories (Popper et al. 2013).

Special studies may be conducted during one or more phases of the proposed project. During these studies, helicopters may be utilized. The noise level from passing helicopters varies by aircraft type and conditions with a range of 68 to 78 DBA during flight (approximately 1,300 feet); however, this noise is only detectable for approximately 30 seconds (BLM 2004, § 4F.2.3.3, p. 1105).

Drilling and Operation

During drilling, the predominant sources of noise will include diesel engines used for power generation and the drill rig operation, with equipment dB ratings of 85 dBA and 110 dBA, respectively (BLM 2004, § 4F.2.3.3, p. 1105). Generally, the drilling equipment in the project study area will operate at about 70 dBA from less than 1,000 feet if properly mitigated by noise minimization measures such as mufflers on the exhaust systems of engines and turbines (BLM 2004, § 4F.2.3.3, p. 1105). During construction, fixed-wing aircraft would operate primarily into and out of APF or Nuiqsut, as there would not be an airstrip completed (airstrip only applies to Alternatives D1 and D2).

Noise from drilling activities at the GMT1 pad is unlikely to be heard at Nuiqsut located 11.4 miles away. Under typical weather conditions, background noise from the wind is expected to mask the noise generated at the drill site before reaching the community.

Comparison of Alternatives

The project action alternatives differ in the configuration of facilities and activities that produce noise and would result in different noise impacts to the community of Nuiqsut and to residents travelling in the project study area pursuing subsistence activities and wildlife.

The action alternatives include some common elements that would produce similar noise impacts, including the drill site location and the use of ice roads during construction. These noise impacts would be distributed along similar ice road access routes for construction of the GMT1 pad and other gravel infrastructure. Alternatives A, B, and C would involve construction of the CD5-GMT1 gravel road and vehicular traffic, whereas Alternatives D1 and D2 would involve construction of an airstrip and an occupied structure pad for housing and additional storage space, as well as the increase in noise caused by vehicular and air traffic in the project vicinity. Although the estimated volumes of gravel differ for these facilities, the transport of gravel over similar routes and durations to deliver this material would produce noise impacts to Nuiqsut at approximately the same intensity, but for a longer period of time for Alternative C, which requires the most gravel to construct. Because the ice road linking the ASRC Mine site to the project area would be within 3 miles of Nuiqsut (the nearest community), impacts from noise due to transporting gravel may be expected in Nuiqsut.

Alternative C, which involves placement of gravel along the entire Nuiqsut Spur Road and Dump Road, would result in the highest intensity of construction noise impact to Nuiqsut residents among the four action alternatives. Gravel trucks, loaders, graders, and other equipment would be working adjacent to the community to place gravel for the airport access road and upgrade of the Dump Road. This noise impact would be in addition to that of Alternative A, because the road construction west, from the junction of the Nuiqsut Spur Road, is common to both Alternatives A and C.

Alternative C, which would utilize the Nuiqsut Airport for access, would introduce additional aircraft noise into the soundscape and increase the overall duration of impact, though the intensity would be similar to the existing noise sources. The types of aircraft that would deliver workers under this scenario are expected to be similar to existing commercial flights from Deadhorse. In addition, vehicular traffic noise would increase because vehicles would be used to transport workers from the Nuiqsut Airport to the project site.

Alternatives A and B differ by the location of the access road, with the Alternative B road alignment shifted to the south. The two road routes differ by a small amount in the potential vehicular traffic noise exposure to the community of Nuiqsut: Alternative A will have approximately 2.1 miles of the access road within 7.5 miles of the nearest residence in Nuiqsut. This road would be used for construction, drill rig transport, drilling support, operations, and spill response/training activities. In comparison, Alternative B would have 2.7 miles within the same distance (7.5 miles) from the nearest residence in Nuiqsut, a difference of 0.6 mile. This minor difference is unlikely to add a measureable increase in noise impact to Nuiqsut with Alternative B.

Under Alternatives A, B, and C, helicopters are planned to be used only to support special studies.

Alternatives A, B and C introduce new vehicular noise along the CD5-GMT1 gravel road from construction throughout the project life of the alternatives. Vehicular noise impacts would peak during construction and levels off during operations and production.

Alternatives D1 and D2 utilize the ice road during the winter season. Vehicle traffic noise along this corridor would have impacts during the months of December through April. During the remaining months, vehicular access, and the resulting noise impacts, would be restricted to the 1.3 miles connecting road from the pad to support facilities.

Alternatives D1 and D2 would use aircraft to transport personnel and equipment to the GMT1 pad, which would pose an additional noise impact mechanism not present with Alternatives A, B, and C. When the ice road is not available, helicopters and small, twin-engine aircraft would be the primary transportation link to the APF. Noise impacts from aircraft are well documented with respect to wildlife in natural environments and human populations residing in proximity to busy airports. Noise impacts from aircraft on human populations residing in proximity to busy airports are well documented, but those impacts on wildlife in natural environments are not so well understood (Krausman 1999). Twin-engine propellers at 1,000 feet elevation emit a noise level of 69 to 81 dBA (BLM 2004, § 4F.2.3.3, p. 1105). In a rural and generally non-human dominated soundscape such as the project study area, aircraft have the potential to create noise levels above background levels over large areas of landscape. However, the ambient level of natural sound produced by the wind is expected to mask aircraft noise for much of the time in the project study area.

Under Alternatives D1 and D2, aircraft noise would be audible to drill site workers housed at GMT1 on a regular basis (seasonally for Alternative D2) because the living quarters would be on the occupied structure pad adjacent to the airstrip. Noise from aircraft flying between APF and GMT1 under Alternatives D1 and D2 may be audible at Nuiqsut. The direct route between these facilities, a distance of 12.1 miles, would pass within 5.5 miles of Nuiqsut at its nearest point. About half of this flight path, would pass within 7 miles of Nuiqsut. Environmental conditions favoring sound transmission such as cold temperatures and calm winds would provide the greatest likelihood of noise impacts to Nuiqsut. The frequency of these conditions corresponding to flight times is potentially lower during the winter ice road season when flights would be replaced by ice road traffic. Flight frequency for Alternative D2 would be less during the first five seasons of drilling (before year-round operation begins). Nuiqsut is adjacent to its airport and experiences moderate to high levels of aircraft noise for short periods of time.

Takeoffs and landings would produce the highest levels of aircraft noise; potential noise impacts at Nuiqsut may result from flights at APF, located 8.1 miles from the nearest residence in the community. In comparison, takeoffs and landings at the GMT1 airstrip under Alternatives D1 and D2 are unlikely to be audible 9.6 miles away at the nearest residence in Nuiqsut, although the flight path may pass with audible range of the community.

Fixed-wing aircraft (e.g., Dash-8, CASA, DC-3) are used to transport cargo and/or personnel to and from APF from Deadhorse and/or Kuparuk. These aircraft do not transit over the Beaufort Sea and maintain a minimum altitude of 1,500 feet (weather permitting) when flying over the main channel of the Colville River. Fixed-wing aircraft operated by CPAI would not be flying near the GMT1 project study area under Alternatives A, B, and C. Helicopters managed by CPAI would be used during May through September to support compliance-related and other needs associated with GMT1. Helicopters would only fly inland at considerable distance away from Harrison Bay and, as such, would only have the very limited potential to impact marine mammals hauled out on land or ice along the flight route.

Mitigation

Reduction of potential noise impacts is provided through design and operations, mitigation described in Section 4.7, Protective Measure F-1 of the BLM (2013), and BMPs A-9, A-10, E-1, and E-8 from the 2013 NPRA-ROD. Workers in the project study area would be subject to Occupational Safety and Health Administration (OSHA) standards for hearing protection if, and as, necessary.

Conclusion

Noise generated by construction, drilling, and operation of the project action alternatives would have impacts to the community of Nuiqsut and subsistence resources including caribou, birds, and other wildlife. The impacts are expected to be temporary and within the range described in BLM (2004, § 4F.2.3.3).

Except for drilling, which may occur at any time of the year (except for Alternative D2), construction noise would be confined to two winter (ice road) seasons. Noise from the operation of production facilities at GMT1 would have an adverse impact to subsistence users, wildlife and non-subsistence users near these two sites. The relative impact to increased noise from facility operation would be of high intensity, long-term duration, and local in spatial extent. Likewise, the increase in noise generated by vehicle traffic on the CD5-GMT1 gravel road would have a low intensity, be localized to the road area and have traffic volumes and timing reflecting maintenance and monitoring schedules. Noise associated with gravel mining at the ASRC Mine site would be limited to the winter. Alternatives A and B would have similar noise generation activities. Alternative C is different in the long-term type and location of noise generation from a long-term, regular year-around increase in vehicle traffic between Nuiqsut and the APF. There would be an increase in aircraft traffic using the Nuiqsut Airport and a small decrease in the number of aircraft traffic to the APF. Alternatives D1 and D2 would eliminate vehicle summer traffic between CD5 and GMT1 and the conceptual GMT2; access to the two drill sites would be by aircraft to a new airport at each site. Winter access would include use of vehicles using a new ice road constructed each year.

Based on the BLM conclusion that wilderness characteristics of naturalness, outstanding opportunities for solitude or primitive unconfined recreation in NPR-A are essentially intact at a distance of 5 miles from communities (BLM 2012, § 4.8.7.18, p. 276), noise increases associated with the GMT1 Project would likely be within ambient conditions at a distance of 5 miles from a noise generator.

There are differences among the project alternatives with regard to potential noise impacts to the community of Nuiqsut. Alternatives D1 and D2, which would require the use of aircraft to transport personnel and supplies to the GMT1 pad site for most of the year (only seasonally for five drilling years for Alternative D2, pre-operation), would have the greatest potential noise impact to the community during drilling and operations. During construction, Alternative C, which involves gravel infrastructure development at the Nuiqsut Airport and around the community, would have the highest levels of noise impact as a result of gravel hauling and earthwork to construct pads, roads, and the airstrip extension. Incremental noise impacts from increased air traffic at the Nuiqsut Airport would be expected under Alternative C.

Based on data collected for the Point Thomson project (Corps 2012, Appendix O, pp. 49-50), noise levels are expected to be similar in summer and winter. Certain activities that take place, such as piling driving, will have a greater impact on the level of noise generated. Noise levels are expected to be highest during the construction phase of the project.

The noise impacts for Alternatives A, B, and C are all anticipated to be of medium intensity, temporary duration, local extent, and important context. The overall anticipated noise impact for these three alternatives is considered minor. For Alternatives D1 and D2, the noise impacts are anticipated to be high-intensity, temporary durations, regional in extent, and unique in context. The overall anticipated noise impact for Alternatives D1 and D2 is moderate.

Suggested Mitigation Measure which BLM will not Implement for GMT1

The standard BLM must follow regarding what new potential mitigation measures must be considered and evaluated in an EIS is found in the BLM NEPA Handbook Q&A, number 19(b). This standard provides that all relevant and reasonable mitigation measures that could improve the project should be identified if they are within jurisdiction of the agency. If BLM finds that a potential mitigation measure is not within BLM's jurisdiction to implement, or should not be implemented for some other reason, the potential mitigation measure would not be adopted in the ROD that is issued after the Final SEIS. The ROD will contain a section in its Appendix for Potential Mitigation Measures Not Adopted, which will document BLM's rationale for not adopting the potential mitigation measures.

The following mitigation measure is not considered to be reasonable, relevant, or effective to addressing impacts identified from the GMT1 permit to drill and right-of-way grant analyzed in this SEIS for the reasons stated below, and thus is not being carried forward for further consideration:

- Monitoring decibels of helicopter noise near Nuiqsut.

There would be difficulty in distinguishing between noise generated by helicopters and other sources. Also, any buffer zone that might be established by BLM would only apply to helicopter flights associated with activities permitted by BLM, limiting its effectiveness. Additionally, based on the analysis in this section, noise impacts under the proposed action are expected to be minor. For these reasons the measure is impracticable to implement and would provide only marginal benefits.

4.2.4 Project Effects on Climate Change

This section discusses the potential impacts of the project alternatives on climate change. The impacts of climate change on the environmental resources in the project study area are discussed elsewhere in this SEIS.

The proposed GMT1 Project would produce direct and indirect GHG emissions that contribute to climate change.

The BLM (2012, §§ 4.4 and 4.5; and Appendix B) provides updated analyses and conclusions about the impacts of oil and gas development in NPR-A, including the GMT1 project study area, from BLM (2004). These updated evaluations and conclusions are incorporated by reference and summarized below.

The BLM concluded that:

> *"Air quality impacts from oil development in the NPR-A would contribute some greenhouse gas emissions, including carbon dioxide, methane, and other gases. Although the cumulative effects of global greenhouse gas emissions are well understood, our current scientific understanding of climate change does not allow us to relate specific sources of GHG emissions to any specific climate-related regional or global impacts. Further, since the specific effects of the proposed action, which may or may not contribute to climate change, cannot be determined, it is equally impossible to determine whether any particular action will lead to significant climate-related environmental effects. While it is not possible to know*

> *with confidence the impact of increased greenhouse gas emissions due to proposed operations within the planning area on global climate change, the total GHG emissions would be minuscule in comparison with total global emissions and the contribution to climate change would be very small."*

Oil development in the NPR-A would also release particulate matter (PM). Fine particles ($PM_{2.5}$) can exist in the atmosphere for several weeks and have local short-term impacts on climate. Light-colored particles reflect and scatter incoming solar radiation, having a mild cooling effect, while dark-colored particles (often referred to as "soot" or "black carbon") absorb radiation and have a warming effect. The IPCC (2007) has recognized the potential for "black carbon" (light-absorbing carbon) to deposit on snow and ice, altering the albedo, and enhancing melting. However, there is considerable uncertainty regarding the net impact of atmospheric particles on climate. It is not currently possible to associate the impact of PM emissions from any particular activity on global climate change (BLM 2013c, Vol. 2, § 4.3.1.2).

Given BLM's conclusions regarding the project's effect on climate change, it is expected the impacts of the proposed GMT1 on climate change from the emission of GHGs are negligible.

4.3 Biological Environment

The following discussion of potential impacts to the biological environment is generally categorized and organized as it is in BLM (2004). Impacts to the following biological resources were analyzed.

- Vegetation and Wetlands
- Fish
- Birds
- Mammals
- Threatened and Endangered Species

4.3.1 Vegetation and Wetlands

The proposed project and the action alternatives would result in impacts to vegetation and wetlands during construction and operation. These impacts are described specifically for the 2004 proposed project by BLM (2004, § 4A.3.1), in general for the Northeast NPR-A (BLM 2008, §§ 4.4.5 – 4.4.6), and for the entire NPR-A (BLM 2012, § 4.5.5 – 4.5.6). The following discussion summarizes the impacts and is supplemented with information from the Point Thomson FEIS related to potential vegetation and wetland impacts (Corps 2012, § 5.8). In addition, results of analyses of impacts from Alternative D2 are incorporated into this SEIS.

The impact evaluation criteria used for analyses are defined in Table 4.3-1 and impact summary tables are provided for each alternative in Table 4.1-2. In circumstances where more than one level of intensity "magnitude" may apply to an impact category, the most severe intensity magnitude was used for determining impact levels. An analysis of effects on aquatic resources between alternatives, which may employ more detailed or precise measures, will be conducted during the CWA Section 404 permit review process that will be performed by the Corps, for purposes of determining the least environmentally damaging practicable alternative.

Table 4.3-1. Impact Criteria—Vegetation and Wetlands

Impact Category	Magnitude	Definition
Intensity	High	Impacting >25% of a vegetation or wetland type within the project study area.
	Medium	Impacting 5 to 25% of a vegetation or wetland type within the project study area.
	Low	Impacting < 5% of any vegetation or wetland type within the project study area.
Duration	Long term	Impact would be permanent, rehabilitation [a] or restoration[1] not possible.
	Interim	Impact would last for the life of the project, rehabilitation possible, restoration not possible.
	Temporary	Impact would last through project construction or would be incidental in other project phases, rehabilitation likely, restoration possible.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Statewide	Extends beyond project study area.
	Regional	Extends beyond 300 feet from project components but within project study area.
	Local	Within the footprint and extending 300 feet from project components.

[a] Rehabilitation means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area. Restoration means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. (73 Federal Register 70 [April 10, 2008], p. 19672).

The impact on vegetation and wetlands may also impact related resources such as soils, hydrology, water quality, and wildlife habitat described in other parts of Chapter 4. This section focuses on the potential impacts on vegetation and wetland ecosystems that are not covered in other sections of this SEIS.

Potential impacts to vegetation and wetlands have been analyzed for direct and indirect impacts for each alternative using GIS to overlay the project infrastructure such as gravel roads, pads, and airstrip onto the integrated terrain unit mapping (ITU) available for most, but not all, of the project study area (approximately 5 percent is not covered by ITU mapping). The potential impacts within the footprints of project components were calculated by overlaying the project component footprints for each alternative onto the baseline vegetation and wetland mapping described in Section 3.3.1, *Vegetation and Wetlands*, and determining the areas of each vegetation and wetland type within the footprints.

The combined footprint of direct impact on the tundra for each of the action alternatives is listed in Table 4.3-2 by vegetation and wetland classes. Table 4.3-2 also provides the portion of impacted vegetation type under each action alternative as a percentage of the total acreage of the corresponding vegetation type found in the mapped portion of the project study area (this analysis assumes that the unmapped portion of the project study area contains similar proportions of each vegetation type as found in the mapped areas). Table 4.3-3 provides details of the vegetation and wetland impacts by common components of each alternative.

4.3.1.1 Construction

Gravel placed on the tundra surface for the construction of roads, pads, and airstrip would smother the vegetation and permanently alter the natural soil horizon by compression. Gravel must be a minimum of 5 feet thick to maintain the integrity of the underlying permafrost, producing a large amount of weight (e.g., gravel weighs about 2,750 pounds per cubic yard, a 5-feet-thick layer would weigh 4,565 pounds per square yard). Roads would be a minimum of

5-feet thick, although the depth of gravel will vary at certain segments of the road, depending on the hydrology and topography of the area.

The VSMs installed to elevate pipelines would displace approximately a 24-inch diameter footprint each on the tundra surface. Pipelines would alter snow accumulation patterns and shade vegetation. Buried pipelines are not included in the project designs, thus avoiding impacts of thermokarst and subsidence that can be associated with such installations. However, pipelines would cross under the CD5-GMT1 road at one or two locations depending on alternative. In Alternatives A, B, and C the CD5 pipeline would cross under the CD5-GMT1 road just south of the CD5 pad (Appendix A, Sheet 11). In Alternatives A and C, the GMT1 pipeline would cross under the CD5-GMT1 road about a mile east of the GMT1 pad (Appendix A, Sheet 7).

To ensure that the existing thermal regime (i.e., permafrost) is maintained at these crossings, the pipelines would be installed as shown in Appendix A, Sheet 22 (CD5-GMT1 road at CD5 pipeline crossing) and Sheet 23 (CD5-GMT1 road at GMT1 pipeline crossing), with in impermeable membrane and rigid insulation installed under the pipelines, between the pipelines and existing ground surface. Section 2.5.2, *Infrastructure Development*, describes the installation of the pipeline.

Surface vegetation and overburden would be removed during excavation of gravel (ASRC Mine site). Overburden from the mine would be temporarily stockpiled on an adjacent ice pad. This ice pad would be built once and the gravel mined from the site would be hauled directly to the construction sites.

Expansion of the ASRC Mine site would result in loss of the existing vegetation and wetlands within the mine footprint. The only vegetation type within the expected footprint of excavation is Wet Sedge Meadow Tundra. Between 26.0 and 35.7 acres are expected to be impacted (26.0 acres, 28.3 acres, 35.7 acres, 35.1, and 34.5 acres, respectively), representing between 0.09 percent to 0.12 percent of the total 29,252 acres of this vegetation type within the mapped project study area. Mined gravel would be transported from the ASRC Mine site to the project area over ice roads during Year 1 (January–April 2016 and June–August 2016). Approximately 14,000 trips would be required to transport the gravel. Average trip length would be 17.1 miles for Alternatives A, B, and C and 17.4 miles for Alternatives D1 and D2.

The gravel mine would fill slightly with water over the course of the summer and would require dewatering. Water discharged to the tundra surface or into a natural drainage for this duration during the late growing season would temporarily alter the hydrologic regime and may affect vegetation or wetlands. If discharge rates were not controlled, or the flows not appropriately dissipated, vegetation could be destroyed and surface soil erosion could occur (BLM 2004, § 4F.3.1, p. 5-137). After cessation of gravel mining, the site would be closed and rehabilitated. Rehabilitation would include replacement of overburden, contouring, and creating stable sidewalls. Over the course of time, natural sheet flow would fill the mine site with water and create open water habitat. A Reclamation Plan is in place for the ASRC Mine site to reclaim the areas mined under Phase 1 and Phase 2. A Long-Term Adaptive Management Plan was developed to ensure that the project will be managed to ensure long-term sustainability of the reclamation and the enhanced waterfowl habitat resource values that are created (ASRC 2012). It is expected that similar plans to ensure the reclamation and management of future mined areas will be permit requirements.

Construction activities would require seasonal ice roads and seasonal ice pads, which would be built over consecutive years depending on the alternative. A summary of ice road construction parameters is provided in Table 2.3-2. When compared to gravel roads and pads, seasonal ice infrastructure has less of an impact to tundra vegetation communities; however, seasonal ice infrastructure may still cause disturbance such as delayed plant development, plant stress, freezing of plant tissues, and physical damage resulting in visible traces on the tundra surface (Corps 2012, p. 5-148). Plant communities dominated by shrubs and other woody species are the most susceptible to physical damage and stress caused by construction. Flooded and wet tundra types generally exhibit little or no impact from ice road construction (Corps 2012, § 5.8.3.1, p. 5-148). New ice road construction methods, such as using aggregate chips shaved from frozen lakes, substantially decrease both water demands and construction time (BLM 2012, § 4.2.1.2, p.18). The impacts to wetlands and vegetation from seasonal ice pads would be similar to those of ice roads. Generally, changes in the thermal regime or compaction of soil have not been found to result from ice road construction. The impacts of seasonal ice roads that are constructed within the same footprint each year may have additive effects, although there is limited documentation of this occurring (Corps 2012, p. 5-149).

Standard ice road construction practices have improved over time and include preconstruction routing surveys and design of roads to avoid tussock tundra areas, steep stream banks, and deep water holes. As-built data from previous year’s ice roads would be considered in design and construction crews would deviate alignments in the field if unexpected environmental conditions are encountered. Impoundment of snowmelt runoff upgradient of ice roads is expected to be of such short duration each year that its impacts would be negligible (Corps 2012, p. 5-149).

Water removal from freshwater sources would occur throughout the life of the project for use in building ice infrastructure. Water removal from freshwater sources is a permitted activity and would be regulated by permit stipulations intended to ensure recharge during spring snowmelt. Future water withdrawals would not be permitted until lakes have fully recharged. If complete recharge did not occur, the decreased water levels of ponds and lakes could result in exposure of bare substrate and potential decreased vigor of associated aquatic and shoreline vegetation until the pond refilled the following season (Corps 2012, p. 5-149).

4.3.1.2 Drilling and Operation

Drilling activities would not have specific impacts to wetlands and vegetation different than those discussed for construction. Discussion of potential impacts to wetlands and vegetation from hydrocarbon spills or leaks that could occur during drilling is presented in Section 4.5.

During operations, there would be indirect impacts to vegetation and wetlands adjacent to gravel roads, pads, and airstrip resulting from gravel spray and dust deposition, altered snow distribution, hydrologic impoundments, increased flooding, and thermokarst (Table 4.3-4). The effects of these impacts are likely to occur most often within 300 feet from the gravel feature, based on data presented in Auerbach et al. (1997). Gravel and dust could smother vegetation and cause early snowmelt, reduced soil nutrients, lower moisture, an altered soil organic horizon, higher bulk density, and greater depth of thaw. Other potential impacts identified by the Corps (2012, § 5.8.3.1) include: reduction in vegetation biomass, early green-up of plants, increases in graminoid composition, decreases in sphagnum and other mosses and lichens, shallower organic horizon, and changes to soil pH. A 300-foot zone of indirect impact to vegetation and wetlands is considered a high estimate of impact magnitude, as it is double the 150 feet used previously to estimate indirect gravel impacts by BLM (2012, § 4.3.3.2, p. 109) and nearly double the 164 feet used recently for the Point Thomson EIS by the Corps (2012 § 5.8.3.1, p. 5-138). For this analysis, the area of indirect impact was determined by applying a 300-foot-wide buffer to the perimeter of gravel-filled areas and calculating the area of each vegetation and wetland type within the zone using GIS. Maintenance of gravel roads would include periodic watering to aid in dust suppression.

Impoundment of water has been identified as a potential impact where gravel roads are constructed across areas susceptible to sheet flow during the intense spring snowmelt and runoff period. After snowmelt, surface flow is expected to be limited to drainageways, and culverts would be placed in those locations to prevent or limit impoundment. Potential vegetation inundation caused by impoundment was evaluated by the Corps (2012) for Point Thomson on the North Slope, which generally predicted that within a 500-foot-wide zone downgradient of a gravel road, approximately half the area would experience greater surface water flow and half would experience less surface water flow during the short-lived snowmelt period (Corps 2012, p. 5-133). A site-specific analysis of potential inundation by road fill is presented in Section 4.2.2, *Water Resources*.

Off-road tundra travel during the snow-free season using tundra-safe vehicles (e.g., low-ground-pressure vehicles) may occur for regular and emergency maintenance of pipelines and other infrastructure. The frequency of tundra travel cannot be estimated at this time, but could occur under a variety of circumstances, such as to investigate or clean up a pipeline leak or if there was need to access an existing pad or other site with no gravel or ice road access. Impacts to vegetation may range from light impacts such as compression to more severe impacts such as displacement or removal. The degree of impacts generally depends on the vegetation type and the number of passes over the tundra (Corps 2012, p. 5-151). Several stipulations apply to summer off-road tundra travel to protect wetlands and vegetation.

Discharges of treated domestic wastewater could occur in the tundra in accordance with APDES requirements. This applies to all action alternatives.

The indirect impacts summarized in Table 4.3-4 do not include the potential impacts of annual melt water inundation that is expected to occur beyond the 300 feet indirect impact zone for brief periods of time during the spring snow melt. Culverts would be placed in low spots to control drainage and prevent damage to the roadway, spaced at approximately 500-foot intervals along roads, or more closely as needed and/or stipulated by permit, to minimize surface water impoundments. During spring snowmelt, after construction, the need for additional culverts to minimize impoundments would need to be evaluated. At 500-foot spacing, the altered moisture regimes would extend an estimated average of 500 feet on the downgradient side of a gravel road. Culverts can become clogged with snow and ice during the snow melt period, increasing flooding potential (Corps 2012, p. 5-147). Infield gravel roads would also cross small tundra streams with culverts planned for small tundra streams, and bridges would be used to cross two of the drainages along the GMT1 access road system (see hydrology impacts discussion in Section 4.2.2).

Table 4.3-2. Direct Impacts of Construction on Vegetation and Wetlands for Action Alternatives

Vegetation Type	Wetland Type (Cowardin Code)[a]	Mapped Project Study Area [b] (Acres)	Veg Type as % of Mapped Area[2]	Veg Type as % of Total Study Area	Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
					Acres	(%)	Acres	(%)	Acres	(%)	Acres	(%)	Acres	(%)
Barren	Us (upland)	4,756.1	4.3	4.1					2.0	--				
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1			--	--						
Fresh Grass Marsh	PEM1H	463.6	0.4	0.4	--	--			--	--	--	--	--	--
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	0.8	0.1			0.9	0.1	--	--	--	--
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--	--			--	--	--	--	--	--
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2										
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	19.1	0.1	24.6	0.1	29.2	0.2	24.7	0.1	23.4	0.1
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	5.8	0.1	4.5	0.1	6.3	0.1	2.0	--	2.0	--
Open Low Willow	PSS1B	3,573.6	3.2	3.1	0.1	--	0.1	--	0.1	--	--	--	--	--
Open Tall Willow	PSS1B	66.7	0.1	0.1	0.3	0.5	0.3	0.5	0.3	0.5	--	--	--	--
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--	--			--	--	--	--	--	--
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	0.2	0.1			0.3	0.1	--	--	--	--
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	41.1	0.2	39.6	0.2	58.3	0.3	50.0	0.3	50.0	0.3
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.1	--	0.1	--	0.1	--	0.8	--	0.8	--
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	5.2	--	10.9	--	7.2	--	9.6	--	9.5	--
Total of Impact for Alternative					**72.7**		**80.2**		**104.7**		**87.0**		**85.7**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the vegetation/wetland type is not present within area considered for impact analysis.

[a] Wetland types are from the Cowardin classification system used by the National Wetland Inventory (http://www.fws.gov/wetlands/; Cowardin et al. 1979).

[b] Percent of vegetation type within the mapped vegetation portion of the project study area. Note that the study area is 116,447.7 acres and that 5,842.4 acres (5 percent) of the project study area extends outside of the vegetation map coverage.

Table 4.3-3. Direct Impacts to Vegetation and Wetlands by Components of Alternatives (Acres) [a]

Vegetation Type	Wetland Type (Cowardin Code) [b]	Mapped Project Study Area [c] (Acres)	Veg Type as % of Mapped Area [c]	Veg Type as % of Total Study Area	Alternative A					
					Alt. A Total	**CD1 to CD4N Waterline VSM**	**GMT1 Pad**	**CD5-GMT1 Road**	**GMT1 to CD5 Pipeline VSM**	**Pipeline Valve Pads**
Barren	Us (upland)	4,756.1	4.3	4.1						
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1						
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4	--	--				
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	0.8			0.8	--	
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--	--				
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2						
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	18.3	--	--						
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	19.1	--	--	18.8	--	0.2
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	5.8			5.8	--	
Open Low Willow	PSS1B	3,573.6	3.2	3.1	0.1	--		0.1		
Open Tall Willow	PSS1B	66.7	0.1	0.1	0.3			0.3		
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--	--				
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	0.2			0.2	--	
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	41.1		11.8	28.8	--	0.5
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.1			0.1	--	
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	5.2	--		5.2	--	
Total Direct Impact for Alternative Component					**72.7**	**--**	**11.8**	**60.1**	**--**	**0.7**

Table 4.3-3. Direct Impacts to Vegetation and Wetlands by Components of Alternatives (Acres) [a] (Continued)

Vegetation Type	Wetland Type (Cowardin Code) [b]	Mapped Project Study Area [c] (Acres)	Veg Type as % of Mapped Area [c]	Veg Type as % of Total Study Area	Alternative B						
					Alt. B Total	CD4N to CD1 VSM	GMT1 Pad	CD5-GMT1 Road	GMT1 to CD5 Pipeline VSM	Pipeline Tie-in Pad	Pipeline Valve Pads
Barren	Us (upland)	4,756.1	4.3	4.1							
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1	--				--		
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4	--	--					
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	--				--		
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--	--					
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2							
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	18.3	--	--							
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	24.6	--	0.1	24.3	--	0.2	0.1
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	4.5			4.5	--		
Open Low Willow	PSS1B	3,573.6	3.2	3.1	0.1	--		0.1	--		
Open Tall Willow	PSS1B	66.7	0.1	0.1	0.3			0.3	--		
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--	--					
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3							
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	39.7		11.8	27.3	--		0.6
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.1			0.1	--		
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	10.9	--		10.4	--	0.5	
Total Direct Impact for Alternative Component					**80.2**	**--**	**11.8**	**67.0**	**--**	**0.7**	**0.7**

Table 4.3-3. Direct Impacts to Vegetation and Wetlands by Components of Alternatives (Acres) [a] (Continued)

Vegetation Type	Wetland Type (Cowardin Code) [b]	Mapped Project Study Area [c] (Acres)	Veg Type as % of Mapped Area [c]	Veg Type as % of Total Study Area	Alternative C								
					Alt. C Total	CD1 to CD4N Waterline VSM	GMT1 Pad	CD5-GMT1 Road	GMT1 to CD5 Pipeline VSM	Pipeline Valve Pads	Nuiqsut Airport Extension[3]	Nuiqsut Airport Access Road	Nuiqsut Spur Road Upgrade
Barren	Us (upland)	4,756.1	4.3	4.1	1.9						0.2	0.8	0.9
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1									
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4	--	--							
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	0.9			0.8	--				0.1
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--	--							
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2									
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM 1P, E2SS1P	18.3	--	--									
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	29.2	--	--	18.8	--	0.2	--	2.6	7.5
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	6.3			5.8	--				0.5
Open Low Willow	PSS1B	3,573.6	3.2	3.1	0.1	--		0.1					
Open Tall Willow	PSS1B	66.7	0.1	0.1	0.3			0.3					
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--	--							
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	0.3			0.2	--				0.1
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	58.3		11.8	28.8	--	0.5	6.1	5.8	5.4
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.1			0.1	--				
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	7.2	--		5.2	--		0.1	0.1	1.7
Acreage in Unmapped Area											1.0		
Total Direct Impact for Alternative Component					**104.7**	**--**	**11.8**	**60.1**	**--**	**0.7**	**7.4**	**9.3**	**16.3**

Table 4.3-3. Direct Impacts to Vegetation and Wetlands by Components of Alternatives (Acres) [a] (Continued)

Vegetation Type	Wetland Type (Cowardin Code) [b]	Mapped Project Study Area [c] (Acres)	Veg Type as % of Mapped Area [c]	Veg Type as % of Total Study Area	Alternative D1							
					Alt. D1 Total	GMT1 Pad	CD5 to CD1 VSM	GMT1 to CD5 Pipeline VSM	1.3-Mile Access Road	Pipeline Valve Pads	Airstrip/ Apron	Occupied Structure Pad
Barren	Us (upland)	4,756.1	4.3	4.1								
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1								
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4	--		--					
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	--			--				
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--		--					
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2								
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	18.3	--	--								
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	24.7	--	--	--	3.3	0.2	13.0	8.1
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	2.0			--			2.0	
Open Low Willow	PSS1B	3,573.6	3.2	3.1	--		--	--				
Open Tall Willow	PSS1B	66.7	0.1	0.1	--			--				
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--		--					
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	--			--				
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	50.0	15.7		--	6.4	0.5	27.5	
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.8			--			0.8	
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	9.6		--	--			2.9	6.6
Total Direct Impact for Alternative Component					**87.0**	**15.7**	**--**	**--**	**9.7**	**0.7**	**46.1**	**14.7**

Table 4.3-3. Direct Impacts to Vegetation and Wetlands by Components of Alternatives (Acres) [a] (Continued)

Vegetation Type	Wetland Type (Cowardin Code) [b]	Mapped Project Study Area [c] (Acres)	Veg Type as % of Mapped Area [c]	Veg Type as % of Total Study Area	Alternative D2							
					D2 Total	GMT1 Pad	CD5 to CD1 VSM	GMT1 to CD5 Pipeline VSM	1.3-Mile Access Road	Pipeline Valve Pads	Airstrip/ Apron	Occupied Structure Pad
Barren	Us (upland)	4,756.1	4.3	4.1								
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1								
Fresh Grass Marsh	PEM1H, R2AB3H	463.6	0.4	0.4	--		--					
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	--			--				
Halophytic Grass Wet Meadow, brackish	PEM1R	350.4	0.3	0.3	--		--					
Halophytic Sedge Wet Meadow, brackish	PEM1R	254.0	0.2	0.2								
Halophytic Willow-Graminoid Dwarf Shrub Tundra	E2SS1/EM1P, E2SS1P	18.3	--	--								
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	23.4	--	--	--	3.3	0.2	13.0	6.8
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	2.0			--			2.0	
Open Low Willow	PSS1B	3,573.6	3.2	3.1	--		--	--				
Open Tall Willow	PSS1B	66.7	0.1	0.1	--			--				
Partially Vegetated	PUSR	1,230.7	1.1	1.1	--		--					
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	--			--				
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	50.0	15.7		--	6.4	0.5	27.5	
Water	PUBH, R2UBH	23,757.0	21.5	20.4	0.8			--			0.8	
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	9.5		--	--			2.9	6.6
Total Direct Impact for Alternative Component					**85.7**	**15.7**	**--**	**--**	**9.7**	**0.7**	**46.1**	**13.4**

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the vegetation/wetland type is not present within area considered for impact analysis.

[a] Includes runway extension, corridor, and pad.

[b] Wetland types are from the Cowardin classification system used by the National Wetland Inventory (http://www.fws.gov/wetlands/; Cowardin et al. 1979).

[c] Percent of vegetation type within the mapped vegetation portion of the project study area. Note that the study area is 116,447.7 acres and that 5,842.4 acres (5 percent) of the project study area extends outside of the vegetation map coverage.

Table 4.3-4. Indirect Impacts of Construction on Vegetation and Wetlands Based on a 300-Foot Zone of Impact

Vegetation Type	Wetland Type (Cowardin Code)[a]	Mapped Project Study Area [b] (Acres)	Veg Type as % of Mapped Area [b]	Veg Type as % of Total Study Area	Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
					Acres	(%)	Acres	(%)	Acres	(%)	Acres	(%)	Acres	(%)
Barren	Us (upland)	4,756.1	4.3	4.1					20.1	0.4				
Cassiope Dwarf Shrub Tundra	PSS3B	90.3	0.1	0.1	5.2	5.7	1.3	1.5	5.2	5.7	0.5	0.6	0.5	0.6
Fresh Grass Marsh	PEM1H	463.6	0.4	0.4	1.4	0.3			1.4	0.3				
Fresh Sedge Marsh	PEM1H	1,055.1	1.0	0.9	16.5	1.6	6.1	0.6	17.1	1.6				
Moist Sedge-Shrub Tundra	PEM/SS1B	16,791.9	15.2	14.4	184.1	1.1	217.0	1.3	461.1	2.7	75.1	0.4	75.3	0.4
Old Basin Wetland Complex	PEM1F, PUBH, PEM1B	6,713.4	6.1	5.8	60.2	0.9	76.7	1.1	81.0	1.2	30.0	0.4	30.0	0.4
Open Low Willow	PSS1B	3,573.6	3.2	3.1	1.5	--	0.9	--	1.5	--				
Open Tall Willow	PSS1B	66.7	0.1	0.1	2.1	3.1	2.1	3.1	2.1	3.1				
Riverine Complex	R2UBH, R2AB3H	299.4	0.3	0.3	2.8	0.9			5.9	2.0				
Tussock Tundra	PEM/SS1B	18,766.1	17.0	16.1	250.1	1.3	248.6	1.3	461.3	2.5	155.4	0.8	155.4	0.8
Water	PUBH, R2UBH	23,757.0	21.5	20.4	7.7	--	12.5	0.1	8.6	--	3.5	--	3.4	--
Wet Sedge Meadow Tundra	PEM1F, PEM1E	29,251.5	26.4	25.1	55.9	0.2	94.0	0.3	130.6	0.4	11.5	--	11.4	--
Total of Impact for Alternative					**587.3**		**659.2**		**1,195.7**		**275.9**		**275.9**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the vegetation/wetland type is not present within area considered for impact analysis.

[a] Wetland types are from the Cowardin classification system used by the National Wetland Inventory (http://www.fws.gov/wetlands/; Cowardin et al. 1979).

[b] Percent of vegetation type within the mapped vegetation portion of the project study area. Note that the study area is 116,447.7 acres and that 5,842.4 acres (5 percent) of the project study area extends outside of the vegetation map coverage.

Equipment used to haul and place gravel fill could harbor nonnative plant seeds, and the placement of fill would create barren areas that pose the greatest risks for establishment of invasive nonnative species, which could become established and spread in the NPR-A. Such establishment and spread would be at the expense of other, naturally occurring plant species that would be displaced, as well as to the wildlife species that use those plants (BLM 2012, § 4.3.5.5, p.136). Although non-native, invasive plant species have become a concern in the nation and Alaska, there are questions that remain about measurement and quantification of the environmental impact these species may cause (Barney et al. 2013).

Some of the impacts begun during construction would continue during operations, including ice road construction. Additionally, operations may require off-road tundra travel (as permitted) for regular and emergency maintenance along pipelines.

4.3.1.3 Comparison of Alternatives

Table 4.3-3 lists direct impacts (area in acres) on vegetation and wetlands by project component for all the action alternatives. As discussed in Section 4.2.1.3 (*Comparison of Alternatives, Terrestrial Environment*), a major difference in access between Alternatives A, B, and C, as compared to Alternatives D1 and D2, is the inclusion (or not) of the CD5-GMT1 gravel road. With the CD5-GMT1 road (Alternatives A, B and C) direct impacts would occur across a wider variety of vegetation and wetlands types and the area of impact would extend across the tundra (as compared to Alternatives D1 and D2 which do not include the road, and impacts would be more focused around GMT1 pad and airstrip). Under Alternatives A and C, the CD5-GMT1 road would cross nine vegetation/wetland types. Under Alternative B, the CD5-GMT1 road would cross seven vegetation/wetlands types. Map 3.3-1 depicts the CD5-GMT1 road route and vegetation types that would be crossed. In Alternatives D1 and D2, five vegetation/wetlands types would be impacted (mainly by the airstrip and apron). Although fewer vegetation/wetland types would be impacted in Alternatives D1 and D2 no vegetation/wetlands would be impacted because the CD5-GMT1 road is not part of these alternatives; however, five vegetation/wetlands types would be directly impacted by the airstrip and two types would be impacted by the occupied structure pad. Alternatives D1 and D2 have a larger footprint than Alternative A (because of the need for the airstrip/apron, occupied structure pad, and 1.3-mile access road between pads) and thus would impact more area of vegetation overall.

Other components associated with a CD5-GMT1 road include installation of culverts (See Section 4.2.2.4, *Comparison of Alternatives, Water Resources*). Impacts to surface water bodies caused by culverts in the road could cause impacts to vegetation (e.g., inundation). These impacts could occur farther across the tundra and affect more types of vegetation and wetlands.

In Alternatives A, B, and C, year-round vehicle traffic (described in Chapter 2, including specific trip frequency, vehicle type, location of travel, and purpose) along the CD5-GMT1 road would cause indirect impacts resulting from gravel spray/dust deposition onto the vegetation. There would be some gravel spray/dust deposition associated with Alternatives D1 and D2, but it would be less because the areas available for vehicle traffic are less and traffic would travel slower than along the major CD5-GMT1 road.

In addition, although Alternatives D1 and D2 do not include a permanent CD5-GMT1 road, these alternatives would require more years of ice roads (especially Alternative D2 with seasonal drilling), thus compressing the vegetation year after year. The impacts on vegetation of seasonal ice roads that are constructed within the same footprint each year may be additive, although there is limited documentation of this occurring (Corps 2012, p. 5-149).

The ice roads could the alter drainage (See Section 4.2.2.4, *Comparison of Alternatives, Water Resources*) during spring breakup and thus affect vegetation, because the ice would melt more slowly than the surrounding tundra and streams. Blockage of streamflow and increased stream stage could occur and thus affect vegetation if ice roads are not adequately slotted or breached.

The remainder of this section addresses the specific areas and types of impacts for each alternative and describes the impact levels on vegetation and wetlands for each alternative.

Alternative A

Alternative A would have a direct impact to vegetation totaling 72.7 acres, with the largest amount consisting of tussock tundra vegetation (41.1 acres) followed by moist sedge-shrub tundra (19.1 acres). The GMT1 pad would occupy 11.8 acres entirely within tussock tundra. The CD5-GMT1 road would cross several vegetation types, including tussock tundra (28.8 acres), moist sedge-shrub tundra (18.8 acres), old basin wetland complex (5.8 acres), and wet sedge meadow tundra (5.2 acres); minor amounts (<1.0 acre) of other vegetation types would also be impacted directly by the road. The impact of VSMs and valve pads are estimated to incur less than 1.0 acre of total impact, with the highest amounts occurring within tussock tundra and moist sedge-shrub tundra (Table 4.3-3). The direct footprint of Alternative A would be approximately 0.1 percent of the 116,447.7-acre project study area. The direct impacts would affect minor amounts of each vegetation type within the project study area, with the greatest relative impact of 0.5 percent occurring to the open tall willow vegetation type.

The indirect impacts of Alternative A, which may occur as a result of gravel spray and dust deposition extending up to 300 feet from the edge of the gravel footprint, total 587.3 acres (Table 4.3-4). The vegetation types include tussock tundra (250.1 acres), moist sedge-shrub tundra (184.1 acres), wet sedge meadow tundra (55.9 acres), old basin wetland complex (60.2 acres), and smaller amounts of other vegetation types. An estimated 7.7 acres of water (e.g., ponds, lakes, and streams) could be within the 300-foot dust shadow under Alternative A. The indirect footprint of Alternative A would impact 0.5 percent of the total project study area. The indirect impacts would affect certain vegetation types within the project study area more than others, with 5.7 percent of the Cassiope dwarf shrub tundra vegetation type in the project study area impacted by Alternative A. This exceeds the 5 percent threshold for medium intensity under the vegetation impact criteria.

All areas of direct and indirect impacts of Alternative A are within potential wetland. The impacts of Alternative A to vegetation and wetlands are characterized as moderate intensity because more than 5 percent of a vegetation type in the project study area would be impacted; long-term duration; the resource is important in context as wetlands are protected by legislation; and, the geographic extent is considered local, since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative A is rated moderate for impacts to vegetation and wetlands.

Alternative B

The direct impacts of Alternative B on vegetation are estimated to total 80.2 acres, with the largest area on tussock tundra (39.6 acres), moist sedge-shrub tundra (24.6 acres), and wet sedge meadow tundra (10.9 acres). The GMT1 pad would be at the same location as Alternative A and impact 11.8 acres of tussock tundra. As listed in Table 4.3-3, the CD5-GMT1 road would cross several vegetation types, including tussock tundra (27.3 acres), moist sedge-shrub tundra (24.3 acres), wet sedge meadow tundra (10.4 acres), and old basin wetland complex (4.5 acres); minor amounts (<1.0 acre) of other vegetation types would also be impacted directly by the CD5-GMT1 road. The VSMs and valve pads are estimated to incur less than 1.0 acre of total impact, with the largest area of impact within tussock tundra and wet sedge meadow tundra. The direct impacts would affect minor amounts of specific vegetation types within the project study area, with the greatest relative impact of 0.5 percent to the open tall willow vegetation type.

The indirect impacts of Alternative B are estimated to total 659.2 acres, with tussock tundra predicted with the largest area of impact (248.6 acres), followed by moist sedge-shrub tundra (217.0 acres), old basin wetland complex (76.7 acres), and wet sedge meadow tundra (94.0 acres). The indirect impacts affect less than 5 percent of a specific vegetation type within the project study area.

All direct and indirect impacts of Alternative B would be within potential wetlands as indicated by the ITU mapping. The impacts of Alternative B to vegetation and wetlands are characterized as low in intensity because less than 5 percent of each vegetation type would be impacted; long-term duration; the resource is important in context as wetlands are protected by legislation; and the geographic extent is considered local, since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative B is rated minor for impacts to vegetation and wetlands.

Alternative C

Alternative C is estimated to cause a total of 104.7 acres of direct impact, with the most on tussock tundra (58.3 acres), moist sedge-shrub tundra (29.2 acres), and wet sedge meadow tundra (7.2 acres). The expanded facilities at the Nuiqsut Airport (runway extension, apron, and pad) would directly impact 7.4 acres of mostly tussock tundra. The new road extending from the pad around the village and connecting to the dump road (Nuiqsut Access Road) would affect 9.3 acres, with 5.8 acres in tussock tundra. Widening of the planned Nuiqsut Spur Road and dump road would impact 16.3 acres, mostly moist sedge-shrub tundra (7.5 acres) and tussock tundra (5.4 acres). A portion of wet sedge meadow tundra (1.7 acres) would be filled during Nuiqsut Spur Road widening. The direct impacts would affect minor amounts of specific vegetation types within the project study area, with the greatest direct impact of 0.5 percent to the open tall willow vegetation type.

The indirect impacts of gravel spray and dust under Alternative C could impact an estimated 1,195.7 acres, consisting mostly of tussock tundra (461.3 acres), moist sedge-shrub tundra (461.1 acres), wet sedge meadow tundra (130.6 acres), and old basin wetland complex (81.0 acres). An estimated 8.6 acres of water features including lakes, ponds, and streams could be indirectly impacted by indirect impacts of gravel spray and dust under Alternative C. The indirect impacts would affect certain vegetation types within the project study area more than others, with 5.7 percent of the cassiope dwarf shrub tundra vegetation type in the project study area impacted by Alternative C. This exceeds the 5 percent threshold for medium intensity under the vegetation impact criteria.

A total of 102.7 acres of the direct impact of Alternative C are within potential wetlands as indicated by the ITU mapping. The impacts of Alternative C to vegetation and wetlands are characterized as medium intensity because greater than 5 percent of a specific vegetation type would be impacted; long term in duration; the resource is important in context as wetlands are protected by legislation; and the geographic extent is considered local. Overall, Alternative C is rated minor for impacts to vegetation and wetlands.

Alternative D1

Alternative D1 would have direct impact to 87.0 acres, with the largest area involving tussock tundra (50.0 acres), moist sedge-shrub tundra (24.7 acres), and wet sedge meadow tundra (9.6 acres). Like the other alternatives, Alternative D1 would require GMT1 gravel pad to support drilling and operation. Alternative D1 would not include the CD5-GMT1 road but instead would include an airstrip with an apron, and occupied structure pad for the drill and operations camps, and a 1.3-mile access road connecting the two pads. The GMT1 pad would be 15.7 acres, all on tussock tundra. The airport/apron would have total gravel footprint of 46.1 acres. The airstrip facility would impact tussock tundra (27.5 acres), moist sedge-shrub tundra (13.0 acres), wet sedge meadow tundra (2.9 acres), and old basin wetland complex (2.0 acres). The occupied structure pad would directly impact 14.7 acres with moist sedge-shrub tundra (8.1 acres) and wet sedge meadow tundra (6.6 acres). The access road connecting the GMT1 pad to the airstrip would impact 9.7 acres in area, consisting of tussock tundra (6.4 acres) and moist sedge-shrub tundra (3.3 acres). The direct footprint of Alternative D1 would impact approximately 0.1 percent of the project study area. The direct impacts would affect minor amounts of specific vegetation types within the project study area, with the greatest relative impact of 0.3 percent to the tussock tundra vegetation type.

The indirect impacts caused by gravel spray and dust could affect 275.9 acres, including tussock tundra (155.4 acres), moist sedge-shrub tundra (75.1 acres), old basin wetland complex (30.0 acres), and wet sedge meadow tundra (11.5 acres). The indirect footprint of Alternative D1 would be approximately 0.2 percent of project study area. The indirect impacts would affect less than 5 percent of specific vegetation types within the project study area.

All direct and indirect impacts of Alternative D1 would be within potential wetlands as indicated by ITU mapping.

The airstrip under Alternative D1 would be oriented in an east-west alignment, which aligns with the prevailing wind directions, but this is perpendicular to the local north-south topographic gradient. The gravel fill could intercept movement of sheet flow, runoff, and possibly water moving through the active layer in the same way that a roadway may cause such impacts. Culverts could not be placed through the airstrip because of geotechnical constraints, thus impacts on vegetation and wetlands from interrupting natural drainage patterns may occur in the vicinity of the airstrip. Refer to Section 4.2.2, *Water Resources*, for additional information about potential inundation caused by gravel fill.

The impacts of Alternative D1 to vegetation and wetlands are characterized as low in intensity; long-term duration; the resource is important in context as wetlands are protected by legislation; and the geographic extent is considered local, since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative D1 is rated minor for impacts to vegetation and wetlands.

Alternative D2

Alternative D2 would be similar to Alternative D1 with GMT1 pad, an airport/apron, occupied structure pad, and an access road between pads. The airstrip would be oriented in an east-west alignment like Alternative D1. All gravel impacts would be the same as described in Alternative D1, except the occupied structure pad. The occupied structure pad would be 13.4 acres of which 6.8 acres is moist sedge-shrub tundra and 6.6 acres is wet sedge meadow tundra. Direct impacts from Alternative D2 would be 85.7 acres, with the greatest amounts involving tussock tundra (50.0 acres), moist sedge-shrub tundra (23.4 acres), and wet sedge meadow tundra (9.5 acres). The direct footprint of Alternative D2 would impact approximately 0.1 percent of the project study area. The direct impacts would affect minor amounts of specific vegetation types within the project study area, with the greatest relative impact of 0.3 percent to the tussock tundra vegetation type.

The indirect impacts caused by gravel spray and dust could affect 275.9 acres, including tussock tundra (155.4 acres), moist sedge-shrub tundra (75.3 acres), old basin wetland complex (30.0 acres), and wet sedge meadow tundra (11.4 acres) (Table 4.3-4). The indirect footprint of Alternative D2 would impact approximately 0.2 percent of project study area. The indirect impacts would affect less than 5 percent of specific vegetation types within the project study area.

All direct and indirect impacts of Alternative D2 would be within potential wetlands as indicated by the ITU mapping.

The impacts of Alternative D2 to vegetation and wetlands are characterized as low in intensity; long-term duration; the resource is important in context as wetlands are protected by legislation; and the geographic extent is considered local, since the indirect impacts are expected to be limited to within 300 feet of the project components. Overall, Alternative D2 is rated minor for impacts to vegetation and wetlands.

Gravel Mining

Gravel mining would be required to construct each of the action alternatives. The footprint of impact would vary according to the gravel demand for each alternative (see Section 2.4.4, *Gravel Supply Options*). In general, the differences in amount of vegetation impacted as a result of gravel mining are similar between alternatives. The only vegetation type expected to be impacted as part of gravel extraction for the GMT1 Project from the ASRC Mine site is wet sedge meadow tundra. Between 26.0 and 35.7 acres will be disturbed as part of gravel extraction (26.0 acres, 28.3 acres, 35.7 acres, 35.1 acres, and 34.5 acres for Alternatives A through D2, respectively), which is between 0.09 percent and 0.12 percent of total wet sedge meadow tundra in the mapped project area.

Other Potential Impacts

There are no known occurrences of BLM sensitive plant species near the proposed facilities of the action alternatives. The nearest documented occurrence is approximately 2.5 miles away as described in Section 3.3.1, *Vegetation and Wetlands*. Overall, potential impacts to sensitive plant species are expected to be negligible under all the alternatives.

All action alternatives have the potential for spills to vegetation and wetlands resulting from pipelines, storage tanks, production facilities/infrastructure, drill rigs, or vehicles. The potential for spills would be present under all of the action alternatives. Because the location and length of oil transit pipelines under the action alternatives are similar, the potential risk from a pipeline spill is also expected to be similar.

In comparison to the other action alternatives during the operation period, Alternatives D1 and D2 could result in higher spill risk due to potential delayed spill response, increased activity with aircraft operations, year-round living accommodations and when air access is restricted during periods of adverse weather. Air travel has been restricted at APF 13 to 22 percent each year over the past four years. Compared to Alternative A, additional limitations exist for reliability of spill and emergency response equipment under Alternatives D1 and D2, without a road connecting to APF and the suite of spill resources maintained there. Dedicated spill response equipment would be provided and stored at GMT1.

Potential impacts of oil spills are described in BLM (2012, § 4.3.4.2), and in Section 4.5 of this SEIS. The extent of environmental impacts of a spill would depend on the type and amount of material spilled, the location of the spill, and the effectiveness of the cleanup. It is anticipated, based on North Slope spill history, that the majority of spills would be contained on a gravel road or pad with little or no impacts to wetlands or vegetation.

Alternative E

Alternative E, No Action, would have no new impacts on vegetation and wetlands from the GMT1 Project.

4.3.1.4 Mitigation

Design features and activities intended to minimize impacts from the project will be included in all the action alternatives. Lease Stipulations, BMPs and permit requirements would provide additional protection measures.

Lease stipulations and BMPs described in Appendix E, if properly implemented, should effectively reduce the impacts of development on vegetation (BLM 2012, § 4.3.5.3, p. 124). Specific BMPs A-1 through A-7 on solid and liquid-waste disposal, fuel handling, and spill cleanup would be expected to reduce the potential impacts of intentional releases, spills, and solid waste on vegetation. BMPs A-9 and A-10 would reduce air pollution. BMP C-2 regarding overland moves (and seismic work) would also effectively minimize impacts to vegetation.

Lease stipulations on activities associated with oil and gas exploration (Lease Stipulations D1 and D-2) and BMPs affecting development (BMP E-4, E-5, E-6, and E-12), such as facility design and construction of pipelines, roads, pads, airstrips, and other facilities, are expected to effectively minimize the amount of habitat that would be altered by gravel pads and other surface disturbances. Lease Stipulation G-1 would facilitate the regrowth of native vegetation following facility abandonment. The setbacks outlined in Lease Stipulations (K-1, K-2, K-3, K-4, K-7, K-8, and K-11) associated with development near rivers, lakes, and other specified habitats would be effective at minimizing impacts in high-value wetlands, such as areas dominated by pendant grass and riparian and floodplain habitats. BMP L-1 would minimize the impacts to vegetation of summer tundra travel, if such an action is permitted. BLM has authorized a deviation from BLM Stipulations E-2 and K-1 (BLM 2004a), and CPAI has requested a deviation from BLM Stipulation E-7 (Appendix E).

Potential New Mitigation Measure 1: Oil Field Abandonment (new subparagraph to BMP G-1)

Objective: Ensure long-term reclamation of land to its previous condition and use.

Requirement/Standard: The abandonment and reclamation plan shall provide that as wells or facilities are permanently abandoned; interim surface reclamation requirements will be incorporated whenever feasible, in consultation with the local community, tribal government, and interested stakeholders.

Potential Benefits and Residual/Unavoidable Impacts: Reclamation on portions of a development site shall begin once the BLM determines that environmental conditions are favorable for the replacement and reestablishment of natural soils and vegetation and such reclamation is feasible. Reclamation on portions of a development site that are no longer being used for development will decrease the short-term impacts to surface resources directly caused by infrastructure. This would have benefits to vegetation and wetlands by replacing gravel fill and other disturbed areas with productive and functioning wetland habitats that contribute to ecological services, including support of subsistence resources. Abandonment and reclamation activities within the NPR-A are governed by 43 CFR Part 3160, subpart 3162, which requires lessees to reclaim the land in accordance with plans approved by the BLM (43 CFR 3162.3-4 and 3162.5-1).

Another potential mitigation measure identified by BLM (2012, 4.3.5.5, p. 136) to prevent the introduction or spread of non-native, invasive plant species into the NPR-A would require that all equipment and vehicles are weed-free prior to transporting them into the area. In addition, annual monitoring along roads would be required and if non-native, invasive species are located, effective weed control measures would be required (which by purpose are not defined, allowing the Applicant to design the measures). A plan for implementing these controls would be submitted to BLM for approval.

Additional design measures required by state and federal permit conditions would contribute toward the avoidance and minimization of impacts to vegetation and wetlands, including:

- Minimizing gravel fill to the extent practicable.
- Minimizing the size of the gravel pads through optimizing project design and equipment layout.
- Designing pads, roads, bridges, and culverts to maintain natural drainage patterns and stream flows to the extent possible.
- Routing the gravel access roads to minimize overall length and footprint, with consideration for hydrologic impacts and project needs.
- Utilizing ice roads and pads for project access, pipeline construction, and temporary storage of mine site overburden.
- Watering gravel roads and pads, as necessary, to control dust generation.
- Slotting ice roads at designated stream crossings to facilitate drainage during breakup.
- Requiring workers to stay on gravel surfaces unless their job duties require them to be on the tundra.
- Requiring strict guidelines for travel on ice roads to avoid tundra damage, including ice road training, establishing speed and weight limits, and installing delineators along both sides of the road.
- Reducing surface discharge of wastewaters through use of a disposal well, including zero discharge of produced water and drilling wastes.
- Implementing spill prevention and response programs.

4.3.1.5 Conclusions

The direct impacts of construction and operation of the project alternatives include destruction of vegetation and wetlands during construction of gravel pads, roads, and airstrip; from excavation of material sites and construction of VSMs; and the potential for colonization by non-native, invasive species. These impacts are characterized as long-term. The direct impacts would be similar among all the action Alternatives A, B, C, D1, and D2, with slightly greater areas of fill under Alternatives C, D1, and D2 compared to Alternatives A and B.

Plant communities and wetlands could also be altered by dust deposition, salinity of gravel fill used in construction, snowdrifts, and blockage of or change to natural drainage patterns. The indirect impacts would also be long-term and are expected to be greater under Alternatives A, B, and C, which include the CD5-GMT1 road with a relatively large area contained within the 300-foot-wide indirect impact zone, whereas Alternatives D1 and D2 would have less indirect impact.

Overall, Alternatives A and C are predicted to have moderate impacts to vegetation and wetlands. The impacts of Alternatives B, D1, and D2 are characterized as minor. The primary differentiator is the relative intensity of impact, with Alternatives A and C each impacting greater than 5 percent of the total acreage of a single vegetation type occurring within the project study area. The impacts of Alternatives B, D1, and D2 would be less than this 5 percent threshold for each vegetation type. Alternative E would have no impacts to vegetation and wetlands.

Studies of climate change in the Arctic under the current conditions have shown that warming temperatures affect the distributions and growth rates of plant species, resulting in a northward expansion of the range of shrubs; increased growth rates of shrubs and graminoids; and decreased cover of mosses and lichens. Warming may also increase the potential for thermokarst development resulting from disturbance of organic mats or creation of impoundments.

As the climate warms, spread of invasive plants northward would be possible, and project components would provide vectors and establishment sites for such plants (BLM 2012, § 4.3.6.4, p. 143; Corps 2012, § 5.8.8.1, p. 5-203). There would be interaction between project impacts and climate change effects, in particular, climate change could cause vegetation changes and wetland drying that could exacerbate the indirect impacts of gravel fill, including dust deposition and tundra drying that may occur on the downgradient sides of gravel fills. Other effects of climate change are discussed above in Section 3.2.4, *Climate Change*.

4.3.2 Fish

The potential impacts of oil and gas development on fish resources in the NPR-A, including the project study area, are discussed in BLM (2012, § 4.3.7, p. 143); possible impacts from the originally proposed Alpine Satellite Development project are addressed in BLM (2004, § 4F.3.2, p. 1119). Discussion here largely focuses on information available after 2004 and a comparison of the new alternatives.

Impact analysis criteria used in this assessment for fish and fish habitat are presented in Table 4.3-5. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts.

Table 4.3-5. Impact Criteria—Fish and Fish Habitat

Impact Category	Magnitude	Definition
Intensity	High	FISH: Would impact normal movements of fish populations, or survival or reproductive success, resulting in population-level impacts, or the distribution of fish populations. HABITAT: Would impact greater than 25% of a water body (stream length or lake area) in the project study area used as fish habitat (including spawning and overwintering).
	Medium	FISH: Impact would be measureable but would not affect normal fish/invertebrate movement, or would have the potential to impact individual fish survival or reproductive success, but population-level impacts not expected. HABITAT: Would impact a limited area of spawning or overwintering habitat, or spawning or overwintering habitat outside of spawning or overwintering activity periods, or 5 to 25% of a water body within the project study area used as fish habitat.
	Low	FISH: An impact that cannot be measured or detected. HABITAT: Would impact less than 5% of a water body in the project study area that provides fish habitat.
Duration	Long Term	FISH: Impact would last longer than two life cycles of an affected species. HABITAT: Impact would extend beyond the life of the project; restoration not possible.
	Interim	FISH: Impact would last longer than two years but less than two life cycles of affected species. HABITAT: Impact would last for life of project; restoration possible.
	Temporary	FISH: Impact would last two years (24 months) or less. HABITAT: Impact would last through project construction, restoration possible or not needed.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation.
Geographic Extent	Statewide	Extends beyond the project study area.
	Regional	Extends beyond project components but within project study area
	Local	Within footprint of project components

4.3.2.1 Construction

Ice Roads and Pads

The potential impacts of ice roads and pads on fish include impacts to water-source lakes and fish in those lakes, water quality impairment during runoff, and fish barriers at stream crossings during spring breakup (BLM 2012, § 4.3.7.2, p. 147). These impacts are mitigated by BMPs A-3, A-4, and A-5 (hazardous materials), B-1 and B-2 (water use), and C-3 and C-4 (stream crossings).

The amount of lake water use and water quality impairment risk associated with each action alternative is proportional to the miles of ice road that would be required during a given year. From this perspective, during the first year of the construction phase the potential impacts on fish would be greatest under Alternatives A, B, and C (45, 43, and 50 miles, respectively) and the least under Alternatives D1 and D2 (33 miles). As a comparison, a winter exploration program in the same region in 2013 required 44 miles of ice roads (BLM 2012a: DOI-BLM-AK01000-2012-0001-EA), with a monitoring study documenting full recharge of lakes in the spring (MBJ 2013b). During the second year of the construction phase, the potential impacts on fish would be the same for Alternatives A, B, D1, and D2 (36 miles) and slightly less under Alternative C (30 miles). The number and location of ice pads would be expected to be similar across all action alternatives during construction.

Ice road stream crossings during the construction phase of the project would be at two locations on the Tiŋmiaqsiġvik (Ublutuoch) River and also on Barely Creek and Crea Creek under Alternatives A, C, D1, and D2. Under Alternative B, stream crossings would only be necessary at the two locations on the Tiŋmiaqsiġvik (Ublutuoch) River, making Alternative B the least likely to affect fish or fish habitat during construction. In the past decade industry has utilized the shallow upper Tiŋmiaqsiġvik (Ublutuoch) River crossing several times. The lower crossing would be in the vicinity of the permanent bridge where water depths are much greater (MJM Research 2005a) and overwintering habitat exists for several species of fish (Map 3.3-1; Morris 2003). In-season monitoring would be necessary here to avoid impacts to fish habitat, similar to data collected annually at the Colville River ice bridge (e.g., MBJ 2013c). Portions of the ice road spanning the smaller streams would also require adequate breaching in the spring to ensure the passage of fish, especially Arctic grayling that begin to swim up Crea Creek during breakup (Heim 2014). Crea Creek and Barely Creek drainages also contain potential fish overwintering habitat (Map 3.3-1). However, while the lakes not freezing to the bottom in this area may be suitable in winter for a variety of fish species, it is likely only Alaska blackfish and/or ninespine stickleback could actually survive in beaded stream pools based on depleted winter dissolved oxygen concentrations (Lilly et al. 2010).

Gravel Mining

The potential impacts on streams from gravel mining include changes in geomorphology as well as increased turbidity and sedimentation (BLM 2012, § 4.3.7.2, p. 151). Mitigation would occur under BMP E-8 (gravel mine site design and reclamation), which allows for site-specific considerations in developing a mining plan.

The ASRC Mine site is the proposed source of gravel for the GMT1 Project, regardless of action alternative. Regardless, a comparable quantity of gravel would be necessary for Alternatives A (628,050 cubic yards) and B (684,550 cubic yards), which is notably less than the amount of gravel required for Alternatives C (862,250 cubic yards), D1 (845,600 cubic yards), and D2 (830,800 cubic yards). The greater the amount of gravel mined would be expected to present a greater risk to fish resources. However, despite the selected alternative, minimizing impacts on fish habitat will hinge on an appropriate and effective mine site design and reclamation plan.

The existing ASRC Mine site is adjacent to the Colville River, which is a valuable fishery resource for the region (Morris 2003, MJM Research 2007d, and Moulton et al. 2010). The existing permit for Phase 2 requires that a 500-ft buffer zone from material site construction area to the Colville River be maintained free of development, including stockpiling of overburden to reduce impacts to the Colville River (Corps 2013a). It is expected that this requirement will be included as part of permitting future cells at the ASRC Mine site.

The placement of gravel on the tundra for the construction of roads, pads, and airstrip would potentially cause an increase in turbidity and sedimentation in streams and lakes during the following spring breakup period. The longer-term potential impacts from gravel fill are discussed in Section 4.3.2.2, *Drilling and Operation*.

4.3.2.2 Drilling and Operation

Ice Roads and Pads

Alternatives D1 and D2 would require ice roads each year during drilling and operation (30 years for D1 and 35 years for D2), making fish resources the most susceptible to winter impacts under this alternative. Alternatives A and B would require an ice road every five years during the life of the project. Because Alternative C would not require ice roads during drilling and operation, it would have the least potential for winter impacts on fish.

Roads, Pads, and Airstrips

Possible impacts of pads, roads, and airstrips (i.e., gravel fill) on fish resources are related to runoff patterns, runoff content, and stream crossings (BLM 2012, § 4.3.7.2, p. 152). These potential impacts are mitigated by Lease Stipulations/BMPs A-2 (wastewater), A-3, A-4, and A-5 (hazardous materials), A-7 (produced water), Lease Stipulation E-2 (infrastructure setback from fish-bearing waters), E-5 (minimize footprint), E-6 and E-14 (stream and marsh crossings), and K-1 (Fish Creek and Tiŋmiaqsiġvik [Ublutuoch] River setbacks). The specific location of gravel infrastructure under each alternative will most strongly influence the potential impacts on surrounding waters.

The size and placement of ancillary pads and the GMT1 pad are similar across most alternatives. Under Alternatives A, B, C, D1, and D2, the ancillary valve pads are only 0.7 acre (0.35 acre each) and are not anticipated to have an impact on the nearby Tiŋmiaqsiġvik (Ublutuoch) River. Alternative C would have an additional 0.7-acre ancillary tie-in pad near CD5, which would also likely be inconsequential to fish resources. The GMT1 pad would be the same under Alternatives A, B, and C. However, the 33 percent (3.9 acres) larger GMT1 pad under Alternatives D1 and D2 could increase the likelihood of impacts to Lake M9925 due to the proximity. Under all action alternatives, the GMT1 pad would be within 500 feet of one fish-bearing lake (M9925).

In Alternative C, the extension of the Nuiqsut airstrip and associated access road and staging pad would increase the overall gravel footprint by 14 acres. However, this would only entail a relatively small improvement project to existing infrastructure at Nuiqsut, which would be unlikely to contribute to fish habitat degradation. In Alternative D1, the 1.3-mile access road associated with the airstrip and occupied structure pad would require 70.5 acres of gravel fill footprint (69.2 acres for Alternative D2 with a slightly smaller occupied structure pad). The placement of this infrastructure could exacerbate possible impacts on Lake M9925 from the already comparatively larger GMT1 pad in Alternatives D1 and D2.

Alternative C requires widening the access road extending northwest from Nuiqsut. This upgraded road would only be 8 feet wider than the current Nuiqsut Spur Road. It is assumed that the wider road would have the same number and position of culverts for cross-drainage, such that the extra width only represents a minimal increase in risk to fish habitat due to a larger runoff area. Regardless of road width, the design would need to address local hydrologic patterns of water flowing eastward into fish-bearing waters (e.g., Lake L9306 and Nigliq Channel).

Compared to the proposed CD5-GMT1 gravel road under Alternatives A and C, a somewhat different route is proposed under Alternative B (Section 2.6), and no road between these pads is part of Alternatives D1 or D2. In Alternatives A and C, the CD5-GMT1 gravel road includes a bridge across the Tiŋmiaqsiġvik (Ublutuoch) River, a culvert at Barely Creek, and a bridge across Crea Creek. All three of these systems provide fish habitat, with the Tiŋmiaqsiġvik

(Ublutuoch) River and Crea Creek as anadromous waters that also support a wide-range of species (Maps 3.3-3 and 3.3-4). A recent study documents Arctic grayling movements among stream and lake habitat in the Crea Creek drainage throughout the summer and fall (Heim 2014). This includes notable use of Lake CC3 during the summer feeding period, which is just upstream of the proposed road crossing. While Barely Creek is primarily utilized by ninespine stickleback (MJM Research 2009), another recent study identified that species as an important high-energy prey source for larger size classes of Arctic grayling in the area (McFarland 2013). This section of road under Alternatives A and C would also be within 500 feet of three fish-bearing lakes (L9824, L9819, and L9820).

The road route proposed under Alternative B includes a bridge across the Tiŋmiaqsiġvik (Ublutuoch) River, but does not cross Barely Creek or Crea Creek, reducing the potential to create barriers to fish movements or impact hydrologic regimes, stream geomorphology, and water quality. By being routed further to the south, the road placement in Alternative B has the additional benefit of remaining outside of the 3-mile Fish Creek setback. This section of road under Alternative B would be within 500 feet of only one fish-bearing lake (L9824).

Pipelines

The potential for pipelines to impact fish resources is related to stream crossings, fluid spills, and maintenance (BLM 2012, § 4.3.7.2, p. 153). This would be mitigated by BMP A-3 (spill prevention and response plan), Lease Stipulation E-2 (infrastructure setback from fish-bearing waters), BMP E-4 (pipeline design, construction, and operation), and BMP L-1 (summer tundra travel).

Under all action alternatives, an injection water pipeline would be necessary from CD1 to CD5. While a portion of this would be on new VSMs and a portion on existing VSMs, construction would occur during the winter such that no impacts to fish habitat would be expected.

Under Alternatives A, C, D1, and D2 the multi-purpose pipeline system from GMT1 to CD5 would occur along the same route. This pipeline system would cross the Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, and Crea Creek. While there is no road next to the pipeline under Alternatives D1 and D2, the necessary additional diesel line would increase the risk of impacting those creeks from a pipeline leak or spill (also addressed in Section 4.5). The pipeline system under Alternative B would pose the smallest risk to fish-bearing streams, as it would cross the Tiŋmiaqsiġvik (Ublutuoch) River, but not Barely Creek or Crea Creek. Under Alternatives A, C, D1, and D2, the pipeline crossing at Barely Creek and Crea Creek would be within 500 feet of one fish-bearing lake (L9824), while under Alternative B, the pipeline would be within 500 feet of two fish-bearing lakes (L9824 and L9819).

4.3.2.3 Comparison of Alternatives

In general, the potential impacts of each action alternative on fish and fish habitat are related to certain project components most relevant to fish resources, as listed in Table 4.3-6

Table 4.3-6. Comparison of Alternatives Project Components Most Relevant to Fish Resources

Project Component	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2
Years of ice roads	2	2	2	30	38
Estimated winter water needs (ice roads and pads)	100 MG - Year 1 67.8 MG - Year 2	97 MG - Year 1 67.8 MG - Year 2	107.5 MG - Year 1 58.8 MG - Year 2	72 MG - Year 1 66.5 MG - Year 2 20.0 MG - Years 3-30	72 MG - Year 1 66.5 MG - Year 2 20.0 MG - Years 3-38
Ice road stream crossings (Year 1)	4 - Tiŋmiaqsiġvik (Ublutuoch) River(2), Barely Creek, Crea Creek	2 - Tiŋmiaqsiġvik (Ublutuoch) River(2)	4 - Tiŋmiaqsiġvik (Ublutuoch) River(2), Barely Creek, Crea Creek	4 - Tiŋmiaqsiġvik (Ublutuoch) River(2), Barely Creek, Crea Creek	4 - Tiŋmiaqsiġvik (Ublutuoch) River(2), Barely Creek, Crea Creek
Ice road stream crossings (Year 2)	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	1 - Tiŋmiaqsiġvik (Ublutuoch) River	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek
Ice road stream crossings (through life of project)	none	none	none	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek
Required volume of gravel fill	628,050 cubic yards	684,550 cubic yards	862,250 cubic yards	845,600 cubic yards	830,800 cubic yards
CD5-GMT1 gravel road: stream crossings with bridge	2 - Tiŋmiaqsiġvik (Ublutuoch) River, Crea Creek	1 - Tiŋmiaqsiġvik (Ublutuoch) River	2 - Tiŋmiaqsiġvik (Ublutuoch) River, Crea Creek	none	none
CD5-GMT1 gravel road: stream crossings with culvert	1 - Barely Creek	none	1 - Barely Creek	none	none
CD5-GMT1 gravel road: fish-bearing lakes within 500 feet	3 - L9824, L9819, L9820	1 - L9824	3 - L9824, L9819, L9820	none	none
GMT1 pad	11.8 acres	11.8 acres	11.8 acres	15.7 acres	15.7 acres
GMT1 pad: fish-bearing lakes within 500 feet	1 - M9925	1 - M9925	1 - M9925	1 - M9925	1 - M9925
GMT1 airstrip/access road/occupied structure pad	none	none	none	70.9 acres	69 acres
GMT1 to CD5 pipeline: stream crossings	3 - Tiŋmiaqsiġvik (Ublutuoch River), Barely Creek, Crea Creek	1 - Tiŋmiaqsiġvik (Ublutuoch) River	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek	3 - Tiŋmiaqsiġvik (Ublutuoch) River, Barely Creek, Crea Creek
GMT1 to CD5 pipeline: fish-bearing lakes within 500 feet	1 - L9824	2 - L9824, L9819	1 - L9824	1 - L9824	1 - L9824
Additional pipeline components?	none	none	none	2 - diesel line, water line	2 - diesel line & water line

MG = million gallons

All Alternatives pose a similar extent of risk to fish and fish habitat during the first two years of the construction phase. After that, much less risk would occur during winter under Alternatives A, B, and C as compared to D1 and D2, which require annual ice roads. In considering year-round potential impacts, Alternatives A, B, and C would have similar types of possible affects from permanent roads and associated bridges and culverts between CD5 and GMT1, which would not occur under Alternatives D1 and D2. Among the alternatives that include a permanent road, Alternative B has the least potential to affect fish, primarily due to routing over only one stream and being within 500 feet of only one fish-bearing lake. In comparison, Alternatives A and C route over three streams and are within 500 feet of three fish-bearing lakes. Although Alternatives D1 and D2 would not have a road between CD5 and GMT1, those alternatives would have an increased spill risk of various fluids or pollutants due to increased aircraft operations and permanent living accommodations. There would also be much less reliable spill response without a permanent road, including when air access may be restricted during periods of adverse weather. For example, air travel has been restricted at APF 13 to 22 percent each year over the past four years.

4.3.2.4 Mitigation

The risk of impacts to fish and fish habitat related to project activities would be reduced by adherence to BMPs and Lease Stipulations. These BMPs and lease stipulations include requirements and guidelines for handling hazardous materials, water use, ice road stream crossings, culvert placement and design, and size and location of pads, roads, and pipelines. A list of BMPs and Lease Stipulations that will reduce the risk of impacts to fish and fish habitats include:

- BMP A-2 – Pumpable waste be injected and that mud and cuttings be stored only temporarily until they are used to facilitate injection or backhauled.
- BMPs A-3 and A-4 – Require impermeable containment, spill prevention, and response planning.
- BMP A-5 – Prohibits equipment refueling within 500 feet of the active floodplain of any water body and fuel storage exceeding 210 gallons must also be outside of this setback.
- BMP A-6 – Prohibits surface discharge of reserve-pit fluids.
- BMP B-1 – Prohibits winter water withdrawals from rivers and streams.
- BMP B-2 – Limits withdrawal based on maximum depth and fish species present; requires intake screens on water withdrawals and screen design must be approved by ADF&G, Division of Habitat; sets restrictions on withdrawals during ice-free periods; limits compaction or removal of snow from an area of grounded ice.
- BMP C-3 – Streambank protection; removal, breaching or slotting of snow and ice bridges before spring breakup.
- BMP C-4 – Location of winter transportation bridges.
- Lease Stipulation E-2 – Prohibits permanent oil and gas facilities being constructed within 500 feet from fish-bearing water bodies. Note: BLM authorized a deviation from this stipulation (BLM 2004a).
- BMP E-4 – Requires that pipelines be built and operated with the best available technology for detecting and preventing corrosion or mechanical defects.

- BMP E-5 – Minimization of impervious surfaces by encouraging a reduced development footprint.
- BMP E-6 – Mandates fish passage and emphasizes that bridges, rather than culverts, are the preferred method for channel crossings; addresses stream and marsh crossings, is to reduce the potential for altering natural drainage patterns. (Examples of fish-passage culvert design are provided as an attachment to Appendix A.)
- BLM E-7 – Requires above ground pipelines be elevated to 7 feet and that a minimum distance of 500 feet be maintained between roads and pipelines. Note: CPAI has requested a deviation from this stipulation (Appendix F).
- BMP E-8 – Requires approval of the gravel mine site design and reclamation in consultation with other appropriate federal, state, and NSB agencies and would be subject to additional protections under AS 16.05.871.
- BMP E-14 – Requires hydrology and fish studies to determine the appropriate structures at stream channel crossings to reduce impacts on fish.
- Lease Stipulation D1 – Restricts drilling in rivers, streams, and fish-bearing lakes.
- Lease Stipulation E-2 – Requires that permanent oil and gas facilities and infrastructure be more than 500 feet from lakes, with essential pipeline and road crossings evaluated on a case-by-case basis; limits pipelines within 500 feet of fish-bearing waters and crossing of lakes; restricts discharge of pollutants from vehicle and equipment use, personnel camps, and produced fluids.
- Lease Stipulation K-1 – Establishes setbacks from major rivers, including Fish Creek and Tiŋmiaqsiġvik (Ublutuoch) River; exceptions for essential road and pipeline crossings. Note: BLM authorized a deviation from this stipulation (BLM 2004a).
- Lease Stipulation K-2 – Establishes a 0.25-mile development setback from deep water lakes, defined as those greater than 13 feet except essential road and pipeline crossings considered on a case-by-case basis.

4.3.2.5 Conclusion

As described above, the potential impacts to fish include injury at water-use intakes, altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, increased turbidity and sedimentation, and barriers to fish movement. Collectively, these could contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality.

Due to the predicted shifts in physical and chemical characteristics of the environment that could occur with climate change, impacts on fish from oil and gas activities in NPR-A could be greater or less than expected (BLM 2012, § 4.3.7.4, p. 161). The magnitude of shifts in these habitat characteristics will ultimately determine how habitats may change and how different fish species respond. For example, if water temperatures increase excessively, metabolic stress for many fish species would be greater and could result in lower tolerance thresholds to land-use impacts. Conversely, a moderate increase in water temperature could contribute to a more productive feeding season and enable fish to better survive the winter and additional stress. Although the trajectory of hydrologic patterns is unclear (BLM 2012, § 4.3.7.4, p. 161), those patterns will strongly influence fish habitat conditions in the future. For example, a change in the timing and quantity of water flow could contribute to fish passage problems at stream channel or wetland road crossings that are designed based on past flow regimes.

Based on the impact criteria established in Table 4.3-5, the various project components most relevant to fish (Table 4.3-6), and the potential impacts associated with those, Alternatives B, D1, and D2 would have the least impact on fish and fish habitat (see Section 4.3.2.3, *Comparison of Alternatives*). Alternatives A and C would have the greatest potential impact on fish resources primarily due to the presence of a permanent road and pipeline that would cross two additional streams, including one culvert, that would exist for the life of the project. The context of all alternatives would be "important," with anadromous fish species and anadromous waters in the project area protected by legislation, along with the existence of seasonal habitats critical to the life history of many fish species. Similarly, the geographic extent of all alternatives would be "regional," due to the fact that many fish species make extensive seasonal movements and utilize a variety of habitats that can extend beyond the project area. However, potential impacts under Alternatives B, D1, and D2 would most likely be greatest during construction, as related to gravel placement, while impacts under Alternatives A and C would be more extensive due the proximity of the permanent road and pipeline to streams, and the crossing of those streams. It is the distance from the permanent road and pipeline to fish-bearing streams and lakes in Alternative B that makes the magnitude of potential impacts much less than A and C. Based on these aspects of the alternatives, the intensity of Alternatives B, D1, and D2 could be "low" and the duration could be "temporary," while under Alternatives A and C the intensity could be "medium" while the duration could be "interim" for fish habitat, and "long-term" for fish.

4.3.3 Birds

The potential direct and indirect impacts to birds from the activities and infrastructure associated with the proposed GMT1 Project and other action alternatives are addressed in this section.

The GMT1 Project has the potential to impact birds, bird behavior, and their nesting, brood-rearing, foraging, and molting habitats through habitat loss and alteration, disturbance from noise and visual activity, displacement from habitats, or attraction to habitats altered by thermokarst and early green-up adjacent to gravel infrastructure (BLM 2012, § 4.3.8.2, p. 170; Corps 2012, § 5.9, p. 5-209).

The impact evaluation criteria for birds are presented in Table 4.3-7 and are based on the general impact criteria described in Section 4.1.2, *Impact Criteria.*

Table 4.3-7. Impact Criteria—Birds

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting 25 percent or more of a single high-value bird habitat present within the project study area.
	Medium	Potentially affecting more than 5 percent but less than 25 percent of a single high-value bird habitat present within the project study area.
	Low	Potentially affecting 5 percent or less of a single high value bird habitat present within the project study area.
Duration	Long Term	Lasting longer than ten years.
	Interim	Lasting longer than two years, but less than ten years.
	Temporary	Lasting less than two years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region, and is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality or region and is not protected by legislation.
Geographic Extent	Statewide	Extends beyond the ACP.
	Regional	Extends beyond 300 feet from project components but within the ACP.
	Local	Within the footprint and extending 300 feet from project components.

As indicated by the impact criteria, this evaluation primarily utilizes habitat to make impact rating determinations. Potential high-value habitats for each focal bird species, shown in the first column of Table 4.3-8 and Table 4.3-9, are used in evaluation of direct and indirect impacts. Potential high value habitats were selected using statistical analysis which identified species preference for select habitat types within the ASDP and Colville River delta whenever available (Johnson et al. 2013). For some species groups (e.g., gulls, geese, shorebirds, and passerines), potential high-value habitats were selected by habitat use documented in Johnson et al. (2013) and BLM (2004 § 4F.3.3). The evaluation of birds is divided into the project phases: 1) construction, and 2) drilling and operation.

4.3.3.1 Construction

Birds and bird habitats could be impacted during construction by habitat loss and alteration, disturbance and displacement, and mortality.

Habitat Loss and Alteration

Long-term bird habitat loss and alteration would be initiated during gravel extraction and placement of fill. These activities would be completed during the winter, when most birds are absent from the ACP. No birds or nests would be lost as a direct result of gravel mining or fill. During construction of roads and pads, gravel mine sites and tundra covered by gravel would be lost to use by birds. This loss of habitat would continue through the duration of the construction and operation of the project, and would be permanent unless habitat restoration measures were successfully implemented after abandonment of the infrastructure (BLM 2012, § 4.3.8.2, p. 170).

In addition to permanent habitat loss, temporary loss of habitat associated with gravel placement could occur on tundra adjacent to gravel structures, where accumulated snow from snow-plowing activities or snowdrifts would become compacted and lead to a delayed snowmelt. Delayed snowmelt persisting into the nesting season could preclude tundra-nesting birds from nesting in those areas (BLM 2012, § 4.3.8.2, p. 171).

Gravel infrastructure such as roads and pads can result in gravel spray and dust deposition (e.g., from vehicle traffic or wind), which can affect bird habitat by causing early snowmelt, and thus, early green-up on tundra adjacent to roads, pads, and airstrips which could attract waterfowl and shorebirds early in the season when other areas are not yet snow-free. Dust deposition could also increase thermokarst and soil pH, and reduce the photosynthetic capabilities of plants in areas adjacent to roads (Auerbach et al. 1997). Ground and air traffic (including helicopters), and wind can influence the amount of dust that may be deposited adjacent to roads and pads (BLM 2012, § 4.3.5.2, p. 129). For this analysis, a distance of 300 feet from the edge of gravel roads and pads was used to estimate the zone of impact for dust deposition, as discussed in Section 4.3.1, *Vegetation and Wetlands*.

Tundra ice roads would cause temporary bird habitat loss and alteration. Ice roads remain in place until after most birds have initiated nesting, causing temporary nesting habitat loss. Ice roads also compress the vegetation, especially standing dead vegetation used for concealment by some nesting birds. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (Corps 2012, § 5.9.3.1, p. 5-221).

Relatively slow melting ice roads could act as temporary dams, causing impoundments of water. Impoundments created by ice roads or gravel structures could be ephemeral (drying up early during the summer) and could cause temporary or permanent flooding on adjacent tundra, or they could become permanent water bodies that would persist from year to year. Hydrological impacts along roads and pads, such as impoundments are discussed in Section 4.2.2, *Water Resources*, and depicted in Map 4.2-1. Tundra covered by impounded water could result in a loss of nesting and foraging habitat for some birds. However, impoundments could also create new feeding and brood-rearing habitat that would be beneficial to some bird species (BLM 2012, § 4.3.8.2, p. 172).

Water withdrawal from lakes during ice road construction has the potential to lower the level of lakes and affect waterfowl and shorebirds that use adjacent habitats, particularly small islands and shoreline areas that loons and waterfowl use for nesting. Changes in the surface levels of lakes due to water withdrawal would be dependent on the amount of water withdrawn, the volume of the lake, and the recharge rate. There is also potential for impacts to birds resulting from potential impacts to invertebrate and fish food resources from varying winter water levels if pumped lakes do not fully recharge (BLM 2012, § 4.3.8.2, p. 171).

Disturbance and Displacement

Gravel mining and placement of gravel fill would occur during winter when most birds are not present. Road work such as grading, compacting, and reshaping of roads and pads would occur during summer when birds are present. The noise and vehicle traffic during these activities would likely disturb and displace birds away from gravel roads and pads. Disturbance causes birds to expend energy in responding, although it may not necessarily reduce their survival or productivity (Corps 2012, § 5.9.3.1, p. 5-221). Noise would likely cause the greatest disturbance to birds between June 1 and July 15 when birds on nests would be unable to move away from the disturbance (Corps 2012, § 5.9.3.1, p. 5-222). Construction-related disturbances to birds are also discussed in BLM (2004, § 4F.3.3, pp. 1138-1140).

Some birds that may have nested at sites previously not covered by gravel could be displaced and move to adjacent areas to nest. Johnson et al. (2003a) reported that waterbirds nesting near the Alpine oil field that were displaced from nesting sites by gravel placement probably moved their nests to nearby adjacent habitats. In addition, there may be a functional loss of habitat in areas near roads and pads, if development-related disturbances preclude birds from utilizing these habitats. Impacts related to habitat loss may be more severe for species that have specific habitat requirements or exhibit site fidelity (BLM 2012, § 4.3.8.2, p. 170).

Noise and visual cues from air traffic would disturb birds. Bird responses to aircraft include alert and concealment postures, interrupted foraging behavior, flight, and a reduction in nest attendance (Corps 2012, § 5.9.3.1, p. 5-222). The impacts of routine aircraft flights could range from bird avoidance of certain areas to abandonment of nesting attempts or lowered survival of young. The potential impact to birds from aircraft noise would probably be greatest during the nesting period when the movements of incubating birds are restricted and the molting period when, in addition to being a period of restricted movements, birds may be energetically stressed and sensitive to disturbance (BLM 2012, § 4.3.8.2, p. 176).

Aircraft noise levels would be highest during take-offs and landings, and most aircraft-related disturbance would be concentrated around the airstrip for brief time periods. Disturbance may also increase as a function of flight frequency, and birds in areas that experience many flights may experience larger disturbance impacts than those in areas with few flights. The behavioral response of birds to aircraft disturbances near the existing and planned airstrips (see Chapter 2, *Proposed Project and Alternatives*) would not necessarily result in lowered nest success. Johnson et al. (2003a) reported that birds nesting in proximity to the Alpine oil field airstrip, including tundra swans and yellow-billed loons, were not negatively affected by aircraft operations at that time.

Although the potential exists for displacement of some nesting birds near routinely used airstrips, as a result of numerous over flights, landings, and takeoffs, some birds may habituate to routine air traffic. Within the project study area, the duration of flights would be short and occur in a specific area and although likely to cause disturbance to birds, depending on the species and time of year that disturbance may be minimal. However, temporary displacement from high-value habitats could affect energy budgets of some birds, and incubating birds could be temporarily displaced from nests, making the nests more vulnerable to predation (BLM 2012, § 4.3.8.2, p. 176). The mitigation measure of hazing birds at or near airstrips would likely result in temporary disturbance and possible displacement of birds.

Oil spill response training activities using watercraft could be conducted on rivers and lakes during the open-water season. Spill response training activities would have the potential to disturb foraging, nesting, or brood-rearing waterfowl and other birds.

Disturbance to birds could result in temporary or permanent displacement from high-value habitats, potentially resulting in decreased nesting and nest attendance, nest abandonment, nest predation, and increased energy expenditures that could affect an individual bird’s survival or reproduction. Disturbances could displace birds from feeding habitats and negatively impact energy budgets. Disturbances would impact birds during the entire time that the birds are using the project area, although the impacts may carry depending on the species involved, including the pre-nesting period when birds gather to feed in open areas near roads, during nesting if the disturbance causes the bird on the nest to leave the nest exposing the nest to an increased rate of predation, and during brood-rearing and fall staging when some geese exhibit higher rates of alertness in areas near roads than do birds in undisturbed areas. Some evidence suggests that pedestrian traffic may have a greater impact on some species of birds than vehicular traffic (BLM 2012, § 4.3.8.2, p. 173).

Mortality

Birds may collide with structures necessary for operation such as communication towers, flare towers, buildings, antenna guy-wires, and elevated pipelines. Descriptions of such structures associated with GMT1 can be found in (Section 2.4.2, *Drill Site Design and Facilities*). Satellite dishes, elevated radio antennae, radio repeater sites would also add potential collision hazards. Although bird collisions with oil field structures are expected to be infrequent, some collisions and resultant mortality are probable.

Bird collision events with infrastructure during poor weather conditions are rare and episodic, but would have the potential to occur for the life of the project (long term). Facilities would always be lighted, a situation which can attract birds (Corps 2012, § 5.9.3.1, p. 5-223). Poor visibility due to fog and low light conditions, which are common in the project study area (See Section 3.2.3.1, *Climate and Meteorology*) would contribute to the risk of collisions with infrastructure. The potential for impact is lessened by the mitigative measure of downward shielded lighting. Most infrastructure collisions would likely involve individual birds or several birds from small flocks, but under certain conditions could involve large numbers of individuals.

Vehicle traffic on infield gravel roads poses the greatest threat to birds during the summer, when the largest numbers of birds are present in the project study area, possibly resulting in bird collision mortality. Among other species that are at risk, geese attracted to roadsides by early vegetation sprouting, brood-rearing waterfowl, and ptarmigan using roadside grit are susceptible to collisions with vehicles. Although geese may gain access to nutritious forage near roads, their exposure to vehicle disturbances also increases. Overall, collision mortality is generally thought to be low within North Slope oil fields, although this is poorly documented (Corps 2012, § 5.9.3.1, p. 5-223).

Predation

Ravens, gulls, Arctic fox and red fox, bears and other predators may be attracted to areas of human activity where anthropogenic sources of food and shelter are present. Survival of these predators could increase due to the availability of anthropogenic food sources and infrastructure that may provide nesting or denning sites, particularly during the winter. Other food sources for predators can arise from roadkill on new roads creating opportunities for scavenging predators. BLM has included recommendations for a roadkill monitoring and reporting system in Section 4.7, *Mitigation Measures and Monitoring*. Increased levels of bird and egg predation due to elevated numbers of predators could, in turn, impact bird populations (BLM 2012, § 4.3.8.2, p. 177).

Oil field operators have installed predator-proof dumpsters at camps and implemented new refuse handling techniques in recent years to minimize the attraction of predators. In addition, oil field workers undergo training to make them aware of the problems associated with feeding wildlife. At the Alpine oil field, Johnson et al. (2003a) reported that ravens (a predatory species) were rarely observed in the area prior to development of infrastructure, but were commonly observed after development with nests confirmed in 2000 and 2001. Although ravens were commonly observed after the construction of the Alpine development, Johnson et al. (2003a) reported no post-development increase in predation rates of loon and waterfowl nests.

4.3.3.2 Drilling and Operation

Habitat Loss and Alteration

After initial placement of gravel to construct roads and pads in the project study area, some habitat alterations from the indirect impacts of snowdrifts, dust fallout, thermokarst, and ponding would continue during project operation as described above (Section 4.3.3.1, *Construction*). An oil spill could impact birds using terrestrial or aquatic habitats, and could have a particular effect on congregations of shorebirds and waterfowl. Potential impacts to birds would depend on the location and size of the spill and on the time of year.

Disturbance and Displacement

The types of disturbance and displacement impacts that occur during the construction phase of this project (Section 4.3.3.1, *Construction*) would continue through the drilling and operations phase of the project, including noise and visual cues from vehicles, aircraft, pedestrians, bird hazing (as a mitigation measure), and other disturbances. The potential displacement of birds caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase; the impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives except D2, which is winter-only, drilling in February through April when migratory birds are not present.

Mortality

The potential for mortality such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and large numbers of birds are present in the project area. Birds attracted to the roadside by altered habitat, described above, would be at risk of mortality by vehicle strikes (BLM 2012, § 4.3.8.2, p. 173). Mortality impacts that occur during the construction phase of this project, such as collisions with infrastructure (see Section 4.3.3.1, *Construction*) would continue through the drilling and operations phase of the project.

An oil discharge in molting or brood rearing habitat could impact large numbers of birds that congregate in these areas. Increased predation on nests from predators attracted to development is a concern for birds nesting in the GMT1 project study area. Predators such as fox, bear, and predatory birds are attracted to the increased scavenging opportunities associated with development and humans.

Abandonment and Reclamation

The abandonment and reclamation of project facilities may involve removing gravel pads and roads or alternatively leaving these in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Winter activities would cause little disturbance or displacement, because most birds would be absent from the area. Depending on the types of abandonment and reclamation that actually occurs, summer road and air traffic could cause disturbance, displacement, and mortality to birds that would be similar in type, but at potentially lower intensity levels and for shorter durations than caused by traffic during the construction and operations phases.

Gravel pads, roads, and airstrips that are not revegetated would have diminished value to most birds. Revegetation without gravel removal would not return the site to its current utility for most birds. If gravel was removed, habitat similar to that currently existing in the area could be created and used by birds, although the precise mix of habitat types would likely not be the same as what prevailed at the time of disturbance (BLM 2012, § 4.3.8.2, p. 179).

4.3.3.3 Comparison of Alternatives

A major difference in components within Alternatives A, B, and C, as compared to Alternatives D1 and D2, is with regard to the proposed access (i.e., with or without the CD5-GMT1 gravel road). Alternatives A, B, and C have the CD5-GMT1 road which is a narrow linear feature crossing greater variety of habitats; Alternatives D1 and D2 have a similar amount for gravel fill, but in a concentrated location. Impacts resulting from the footprint of Alternatives D1 and D2 would be focused in the immediate vicinity of GMT1. In addition to the impacts caused by gravel placement for the CD5-GMT1 road, impacts to birds from vehicle traffic and aircraft traffic would vary depending on the presence or absence of the cross-tundra road. The impacts associated with the presence or absence of the CD5-GMT1 road are noted throughout this section along with comparison of the alternatives as a whole.

Habitat loss and alteration would vary somewhat among the action alternatives. The direct impacts of habitat loss due to gravel placement on potential high-value habitats for a suite of bird species/groups that were analyzed for habitat preferences are listed in Table 4.3-8. Table 4.3-9 presents the predicted area of indirect impacts (acres) to potential high-value bird habitats (for the same suite of bird species/groups as in the direct impact analysis) within 300 feet of gravel infrastructure. Although the spatial extent of indirect impacts on bird habitats are greater than those for direct impacts, most direct impacts on birds (loss of habitat) are expected to be more significant than indirect impacts (potential change in vegetation).

Considered individually, each of the action alternatives would result in a direct impact (total gravel footprint) representing less than one percent of the potential high-value bird habitats available within the project study area. None of the action alternatives would directly impact more than the 5 percent low intensity threshold (Table 4.3-7) of any single habitat identified as a potential high-value bird habitat (less than 1.1 percent would be impacted for each potential high-value habitat types) (Table 4.3-8). With the largest footprint, Alternative C would have the largest direct impact to potential high-value bird habitat (Table 4.3-8). Impacts from direct gravel placement is expected to be of low intensity, long term in duration, local in extent, and important in context (due to federal legislation of migratory birds; Table 4.3-10).

Alternatives D1 and D2 do not include a gravel road across the tundra and instead involve seasonal traffic across the tundra on ice roads. Few birds are present in the area during ice road season. Although Alternatives D1 and D2 include a year-round 1.3-mile gravel access road between GMT1 pad and the occupied structure pad and airstrip, D1 and D2 would have the least impact to birds attributed to vehicle traffic relative to the other action alternatives.

Indirect impacts (based on a 300-foot zone extending out from gravel fill) to potential high-value bird habitat under Alternatives A, B, and C would each amount to less than the 5 percent low intensity threshold (Table 4.3-7) for all of the habitats analyzed, except for moist tall shrub. Alternatives A, B, and C have potential indirect impacts to 8.3 percent of moist tall shrub habitat (a potential high value passerine habitat) in the project study area.

Indirect impacts that could result from either D1 or D2 would be less than the 5 percent low intensity threshold for any single potential high-value bird habitat (Table 4.3-9).

Table 4.3-8. Direct Impacts to Potential High-Value Bird Habitats from Gravel and Pipeline Infrastructure within the Project Study Area

Habitat Type [a] (Focal Species [b])	Project Study Area Mapped [c] (acres)	Percent of Total Project Study Area [d]	Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
			Direct Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Direct Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Direct Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Direct Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Direct Impact (acres)	Percent of Habitat Type Impacted in Project Study Area
Barrens (GE)	5,629.4	4.8%	--	--			--	--	--	--	--	--
Grass Marsh (GU, KE, TS)	463.6	0.4%	--	--			--	--	--	--	--	--
Moist Low Shrub (PA)	6,027.9	5.2%	0.1	--	0.1	--	0.1	--	--	--	--	--
Moist Sedge-Shrub Meadow (GE, PA, SB, TS)	16,791.9	14.4%	19.1	0.1%	24.6	0.1%	29.2	0.2%	24.7	0.1%	23.4	0.1%
Moist Tall Shrub (PA)	25.1	--	0.3	1.2%	0.3	1.2%	0.3	1.2%	--	--	--	--
Moist Tussock Tundra (PA, SB)	18,766.1	16.1%	41.1	0.2%	39.6	0.2%	58.3	0.3%	50.0	0.3%	50.0	0.3%
Nonpatterned Wet Meadow (GE, GU, SB)	6,315.2	5.4%	--	--			0.2	--	--	--	--	--
Old Basin Wetland Complex (KE, SB)	6,713.4	5.8%	5.8	0.1%	4.5	0.1%	6.3	0.1%	2.0	--	2.0	--
Patterned Wet Meadow (GE, GU, SB, TS)	22,936.3	19.7%	5.2	--	10.9	--	7.0	--	9.6	--	9.5	--
River or Stream (GE, KE, PA, TS)	4,096.7	3.5%	0.1	--	0.1	--	0.1	--	--	--	--	--
Riverine Complex (PA)	299.4	0.3%	0.2	0.1%			0.3	0.1%	--	--	--	--
Salt Marsh (GE, KE, TS)	625.1	0.5%	--	--			--	--	--	--	--	--
Sedge Marsh (GU, KE, SB, TS)	1,055.1	0.9%	0.8	0.1%			0.9	0.1%	--	--	--	--
Shallow Open Water with Islands or Polygonized Margins (KE, GU, TS)	1,142.1	1.0%	--	--			--	--	0.8	0.1%	0.8	0.1%
Shallow Open Water without Islands (KE, TS)	873.6	0.8%	--	--	--	--	--	--	--	--	--	--
Total			**72.6**		**80.2**		**102.7**		**87.0**		**85.7**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the habitat is not present within area considered for impact analysis.

[a] Source information for habitat preferences of pre-nesting KE and nesting/brood-rearing TS based on Monte Carlo analysis in Tables 5, 8, 21, 23 of Johnson et al. 2013
Source information for habitat of brood-rearing/molting GE found in Table 26 of Johnson et al. 2013; not based on Monte Carlo analysis
Source information for habitat of nesting GU found in Table 30 and p. 73 of Johnson et al. 2013; not based on Monte Carlo analysis
Source information for habitat of nesting/brood-rearing SB and nesting/foraging PA: BLM 2004, Section 4F.3.3, pp. 1134-1153

[b] Bird species/groups analyzed for habitat preferences/use: Geese- inclusive of brant and snow geese (GE), Gulls, inclusive of glaucous and Sabine's gulls (GU), King Eider (KE), Passerines (PA), Shorebirds (SB), Raptors and Owls (RO), Tundra Swan (TS)

[c] Note that 5.842.4 acres (5 percent) of the project study area extends outside of the habitat map coverage. All the project facilities under all action alternatives are within areas of mapped vegetation (except for 500 square feet of the airstrip extension under Alternative C).

[d] Total acreage of the project study area, inclusive of mapped habitat portion and not mapped area, is 116,447.7 acres.

Table 4.3-9. Indirect Impacts to Potential High-Value Bird Habitats within the Project Study Area (300-Foot Zone of Influence)

Habitat Type [a] (Focal Species [b])	Project Study Area Mapped [c] (acres)	Percent of Total Project Study Area [d]	Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
			Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area
Deep Open with Islands or Polygonized Margins (GU, KE, TS)	3,478.5	3.0%	0.4	--	2.5	0.1%	0.4	--				
Deep Open Water without Islands (GE, GU, KE, TS)	9,414.1	8.1%	1.8	--	1.2	--	1.8	--	0.3	--	0.3	--
Grass Marsh (GU, KE, TS)	463.6	0.4%	1.4	0.3%			1.4	0.3%				
Moist Low Shrub (PA)	6,027.9	5.2%	1.5	--	0.9	--	1.5	--				
Moist Sedge-Shrub Meadow (GE, PA, SB, TS)	16,791.9	14.4%	184.1	1.1%	217.0	1.3%	461.1	2.7%	75.1	0.4%	75.3	0.4%
Moist Tall Shrub (PA)	25.1	--	2.1	8.3%	2.1	8.3%	2.1	8.3%				
Moist Tussock Tundra (PA, SB)	18,766.1	16.1%	250.1	1.3%	248.6	1.3%	461.3	2.5%	155.4	0.8%	155.4	0.8%
Nonpatterned Wet Meadow (GE, GU, SB)	6,315.2	5.4%	0.8	--	0.6	--	11.2	0.2%				
Old Basin Wetland Complex (KE, SB)	6,713.4	5.8%	60.2	0.9%	76.7	1.1%	81.0	1.2%	30.0	0.4%	30.0	0.4%
Patterned Wet Meadow (GE, GU, SB, TS)	22,936.3	19.7%	55.1	0.2%	93.4	0.4%	119.4	0.5%	11.5	0.1%	11.4	--
River or Stream (GE, KE, PA, TS)	4,096.7	3.5%	1.2	--	1.2	--	1.2	--				
Riverine Complex (PA)	299.4	0.3%	2.8	0.9%			5.9	2.0%				
Sedge Marsh (GU, KE, SB, TS)	1,055.1	0.9%	16.5	1.6%	6.1	0.6%	17.1	1.6%				
Shallow Open Water with Islands or Polygonized Margins (KE, GU, TS)	1,142.1	1.0%	2.5	0.2%	2.5	0.2%	2.5	0.2%	2.4	0.2%	2.4	0.2%
Shallow Open Water without Islands (KE, TS)	873.6	0.8%	1.8	0.2%	5.1	0.6%	1.9	0.2%	0.8	0.1%	0.7	0.1%
Total			**582.2**		**657.9**		**1,169.7**		**275.4**		**275.4**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the habitat is not present within area considered for impact analysis.

[a] Source information for habitat preferences of pre-nesting KE and nesting/brood-rearing TS based on Monte Carlo analysis in Tables 5, 8, 21, 23 of Johnson et al. 2013
Source information for habitat of brood-rearing/molting GE found in Table 26 of Johnson et al. 2013; not based on Monte Carlo analysis
Source information for habitat of nesting GU found in Table 30 and p. 73 of Johnson et al. 2013; not based on Monte Carlo analysis
Source information for habitat of nesting/brood-rearing SB and nesting/foraging PA: BLM 2004, Section 4F.3.3, pp. 1134-1153

[b] Bird species/groups analyzed for habitat preferences/use: Geese- inclusive of brant and snow geese (GE), Gulls, inclusive of glaucous and Sabine's gulls (GU), King Eider (KE), Passerines (PA), Shorebirds (SB), Raptors and Owls (RO), Tundra Swan (TS)

[c] Note that 5.842.4 acres (5 percent) of the project study area extends outside of the habitat map coverage. All the project facilities under all action alternatives are within areas of mapped vegetation (except for 500 square feet of the airstrip extension under Alternative C).

[d] Total acreage of the project study area, inclusive of mapped habitat portion and not mapped area, is 116,447.7 acres.

The ASRC Mine site is the preferred source of gravel for the GMT1 Project. The footprint of impact would vary according to the gravel demand for each alternative (see Section 2.4.4, *Gravel Supply Options*). The habitats that would be expected to be impacted as part of gravel extraction for the GMT1 project from the ASRC Mine site include non-patterned wet meadow and patterned wet meadow, both of which are potential high-value bird habitats, as shown in Table 4.3-10

Table 4.3-10. Area of Habitat Units Impacted at the ASRC Mine Site for All Action Alternatives

Habitat Unit (acres within mapped project study area)[a]	Project Study Area Mapped [b] (acres)	Direct Impact (acres)				
Alternative:		**A**	**B**	**C**	**D1**	**D2**
Nonpatterned Wet Meadow	6,315	16.0	17.4	21.9	21.6	21.2
Patterned Wet Meadow	22,936	10.0	10.9	13.8	13.5	13.3
Estimated Area Impacted		26.0	28.3	35.7	35.1	34.5

Values that are greater than zero but less than 0.1 are noted with a dash (--).

[a] It is assumed that the gravel resources in Phase 3 of the ASRC Mine site are similar to those in Phase 2 of the ASRC Mine site. Estimated area impacted by gravel extraction are based on the Phase 2 permit: 83 acres of surface disturbance for 2 million cubic yards of gravel (Corps 2013a).

[b] Project area based on mapped area of 110,605.3 acres.

A Reclamation Plan is in place for the ASRC Mine site to reclaim the areas mined under Phase 1 and Phase 2. A Long-Term Adaptive Management Plan was developed to ensure that the project will be managed to ensure long-term sustainability of the reclamation and the enhanced waterfowl habitat resource values that are created (ASRC 2012). It is expected that similar plans to ensure the reclamation and management of future mined areas will be permit requirements.

Vehicle traffic on gravel roads may disturb or displace birds. Under all action alternatives, traffic would be most intense during construction, then taper off during drilling, and decrease more with post-drilling operation. Alternatives A, B and C may lead to increased vehicle traffic in the area, as some industrial use, and some traffic from local residents including subsistence use could occur once the Nuiqsut Spur Road is constructed. Alternatives A and C, share a common road (CD5-GMT1) where disturbance and displacement impacts to birds from ground transportation would be similar for both alternatives. On the east side of the CD5-GMT1, Alternative C would route additional traffic along the 5.8-mile Nuiqsut Spur Road for access to an improved airstrip in Nuiqsut. Alternative B would have a different and longer route for the access road from CD5 to GMT1, and this road would impact greater amounts of one potential high-value bird habitat, moist sedge-shrub meadow type (see Table 4.3-8 and Table 4.3-9) as compared to the other action alternatives. Alternatives D1 and D2 do not include the CD5-GMT1 road and instead involve seasonal traffic across the tundra on ice roads. Few birds are present in the area during ice road season. Although Alternatives D1 and D2 include a year-round 1.3-mile gravel access road between GMT1 pad and the occupied structure pad and airstrip, relative to the other action alternatives, D1 and D2 would have the least impact to birds attributed to vehicle traffic.

Potential disturbance impacts to birds from aircraft traffic under all action alternatives would stem from new flights at the APF airstrip and special studies utilizing rotary aircraft.

Under Alternatives A, B, and C, new flights are the greatest during the construction period, then once construction is complete, there is no need for routine additional fixed wing flights. Post construction, aircraft traffic primarily consists of helicopter flights for special studies from

May through September when migratory birds are present in the area. For Alternative D1, flights are the most intensive during construction and drilling. Once drilling is complete, flights decrease to support essential transportation operations and helicopter special studies. For Alternative D2, when construction is complete and seasonal drilling begins, flight frequency decreases to only support seasonal drilling. In 2023, when year-round operations begin under Alternative D2, flights increase to support year-round operations. Additional information and detail on aircraft traffic is provided within this SEIS in Chapter 2, Sections 2.5 through 2.9.

The presence or absence of the CD5-GMT1 road would affect types and frequency of aircraft traffic through the life of the project. Under roaded Alternatives, A, B, and C, the need for access by aircraft is negated, along with the accompanying aircraft disturbance. However, summer studies (via helicopter) would remain as a source of aircraft disturbance under the roaded alternatives. Aircraft would be required to access GMT1 pad during the non-ice road season for Alternatives D1 and D2. During ice road season for Alternatives D1 and D2, aircraft is still utilized for support of equipment and personnel. Potential impacts to birds from aircraft under Alternatives D1 and D2 is greater than other action alternatives due to the requirement to use aircraft to access the GMT1 pad when ice roads are not present (roughly nine months of the year).

Alternative C would include airport improvements at Nuiqsut (incremental increase in the length of the airstrip) and could potentially extend the zone of noise impact from aircraft using the extended airstrip. However, the exact volume of aircraft traffic that could work out of Nuiqsut has not been determined and the applicant's projection of airstrip use under Alternative C is minimal (APF is still the CPAI's anticipated base for aircraft under Alternative C). Therefore, the associated noise impact to local birds around Nuiqsut has not been determined.

Alternative D2 would be similar to Alternative D1 in terms of access but would be restricted to seasonal-only (winter) activity during drilling, which would likely lead to less impact to migratory birds because they are not present during the winter drilling season; however, once operations begin in 2023, flights would occur year round. The project-related aircraft traffic under Alternatives D1 and D2 would be additional to the existing activity at APF and Nuiqsut, and the duration would be long term.

Aircraft traffic associated with Alternative D1 would differ from Alternatives A, B, and C during drilling and operation because of reliance on aircraft for all transportation during non-ice road periods for D1 and D2. For Alternative D1, air traffic would be less once drilling is completed (May 2021). In Alternative D2 (seasonal drilling), air traffic would increase with the inclusion of year-round operations in 2023. The air traffic route specific to Alternatives D1 and D2 would generally follow the route of the CD5-GMT1 road (as proposed in Alternatives A, B, or C). The impacts associated with aircraft traffic for Alternative D1 are expected to be of low intensity, long-term duration, and of local extent.

Annual ice roads for Alternatives D1 and D2 (and ice roads for resupply constructed every five years for Alternatives A and B) would require winter construction activities. Few birds are present in the area during ice road season; however, re-use of ice annual road routes and ice pad locations could damage tundra, resulting in potential long-term impact to potential high value bird habitats.

Overall, Alternatives A, B, and C are predicted to have habitat loss and alteration rated as being of low intensity, long-term duration, and local extent (Table 4.3-11). Overall, Alternatives

D1 and D2 are expected to result in impacts of low intensity disturbance and displacement to birds in the project study area, although the impacts could extend into adjacent areas beyond the project study area, depending on the flight paths for airstrip approach and altitudes, resulting in a limited, regional level extent of impact (Table 4.3-12). The affected resource, which in this case include migratory birds, are rated as important in context due to their protection under federal legislation and because migratory birds fill a distinctive ecosystem and ecological service role within the locality and region.

Overall, Alternatives A, B, C, D1, and D2 are expected to result in minor impacts to birds and their habitats (Table 4.1-2).

Alternative E, No Action, would result in no impacts to birds.

Table 4.3-11. Impact Criteria Summary for Birds – Alternatives A, B, and C

Alternatives A, B, C, and D2				
Impact Type and Affected Population	**Intensity**	**Duration**	**Context**	**Geographic Extent**
Habitat Loss and Alteration	Low	Long Term	Important	Local
Disturbance and Displacement	Low	Long Term	Important	Local
Mortality and Predation	Low	Long Term	Important	Local

Table 4.3-12. Impact Criteria Summary for Birds – Alternatives D1 and D2

Alternative D1				
Impact Type and Affected Population	**Intensity**	**Duration**	**Context**	**Geographic Extent**
Habitat Loss and Alteration	Low	Long Term	Important	Local
Disturbance and Displacement	Low	Long Term	Important	Regional
Mortality and Predation	Low	Long Term	Important	Local

4.3.3.4 Mitigation

Numerous stipulations and BMPs are in place to effectively protect birds and their habitats within the NPR-A. These include BMPs A-1 through A-7 and E-9, which ensure that solid, liquid, and hazardous wastes (including fuels) do not impact birds or their habitats, and to reduce the potential for garbage and shelters that attract predators. The protection of bird habitats and food sources are addressed by BMPs B-1, C-3, C-4, and Stipulations E-2 and L-1, among others. It should be noted that BLM authorized a deviation from Stipulation E-2 (BLM 2004a). In addition to the BLM Stipulations noted above, there are BMPs and stipulations that regulate the types of activities that can occur near water bodies, including rivers and streams, types of equipment that can be used in the planning area, will serve to protect birds and their habitats. A list of BMPs is provided in Section 4.7, *Mitigation Measures and Monitoring*.

A Wildlife Avoidance and Interaction Plan and a Predator Management Plan, incorporating federal, state, and local stipulations on wildlife interactions would be developed as part of the operational permitting process.

The following design measures are recommended as part of the project design to avoid or minimize impacts on birds (Corps 2012, § 5.9.7, p. 5-266):

- Implementing controls to minimize nesting opportunities for predatory/nuisance birds, including the following:

  - Blocking off nooks and crannies with fabric/netting or other bird-nest deterrent.
  - Using scare devices to deter birds when they land in places likely to be nesting sites.
  - Removing nests as the birds try to construct them (before they have a chance to lay eggs).
- Designing facilities to minimize potential for bird strikes, including the following measures:
  - Careful consideration will be given to facility lighting (e.g., light hoods to reduce outward radiating light) that reduces the potential for disorienting migrating birds and reduces bird strikes.
  - Buildings and stack heights will be the minimum needed to perform their functions, with consideration for associated footprint. The flares will be free standing (no guy wires).
  - Communications towers will avoid the use of guy wires and will be attached to camps or other, larger structures when possible.
  - Power lines and fiber-optic cables will either be buried or placed on the pipeline VSMs.
  - Aircraft will generally maintain a 1,500-foot altitude to avoid impacts on ground nesting and foraging birds, except as required for takeoff and landing, safety, weather, and operational needs, or as directed by air traffic control.
- Limiting removal of water from freshwater lakes during the summer to minimize reductions in amount or quality of nesting and brood-rearing habitat through diminished water levels.
- Monitoring water withdrawal volumes and water body recharge, as needed or directed, by ADNR and/or ADF&G in the future.
- Gravel placement on the tundra will primarily occur during the winter; however, if site preparation and/or construction activities are approved, under BMP L-1, to occur on the tundra during the summer, these activities would occur after July 31 (when most Arctic nesting birds have hatched). The only exception would be if an emergency situation, such as an oil spill, required gravel placement prior to July 31. Areas in the vicinity of such field activities would be searched for nesting birds by a qualified biologist prior to the start of work. If an active nest was found, the appropriate USFWS Field Office would be contacted for instructions on how to avoid or mitigate the potential loss of the active nest.

Potential New Mitigation Measure 1: Roadkill Monitoring System for Wildlife

Objective: Implement a reporting system to monitor roadkill of birds and other wildlife on transportation routes.

Requirement/Standard: The permittee shall provide an annual report to the Authorized Officer reporting roadkill of birds and mammals, to help BLM determine whether additional preventative measures on vehicle collisions should be made.

Potential Benefits and Residual/Unavoidable Impacts: Knowledge about bird and mammal mortality due to vehicle traffic will help managers to develop methods to reduce collision rates with vehicles.

4.3.3.5 Conclusion

Overall, Alternatives A, B, C, D1, and D2 are predicted to result in minor impacts to birds and bird habitats. Alternative E, No Action, would result in no impacts to birds or bird habitats.

Birds that could be affected by the action alternatives include loons, waterfowl, shorebirds, raptors, passerines, seabirds, and ptarmigan. Most species in these groups migrate to wintering areas located outside of the NPR-A, and would not be directly affected by winter construction activities, although their habitats could be affected. A few species, such as ptarmigan, gyrfalcon, and snowy owl, may remain in the project study area during the winter, and could be temporarily displaced from high-value feeding or resting habitats by winter construction, drilling, or operations activities.

Activities related to the action alternatives, such as vehicle, aircraft, boat traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill cleanup activities, could cause disturbances that would affect birds. Summer fixed-wing or helicopter aircraft activity in support of the GMT1 Project, including related research, could result in disturbance to birds, causing temporary or permanent displacement from high-value feeding, nesting, staging, or brood-rearing habitats in localized areas near areas of activity.

Placement of gravel on the tundra for roads and pads, and removal of gravel at mine sites, could result in permanent habitat loss, especially if habitat restoration expected to take place after infrastructure features are retired is not successful. Temporary habitat loss or alteration could also occur in areas adjacent to gravel roads due to snow and/or dust deposition, thermokarst, and the formation of impoundments. Some types of habitat alteration, such as the formation of impoundments, could be beneficial to some species, while having a negative impact on others. Withdrawal of water from source lakes during winter could impact birds if water levels or prey availability in source lakes were affected. Lake surveys conducted prior to water withdrawal, limits on the amount of water that may be withdrawn from lakes due to Lease Stipulations, and the ability of lakes to naturally recharge, would likely negate any potential negative impacts related to water withdrawal.

Bird mortality could result from collisions with ground or air vehicle or vessel traffic, or with towers, buildings, pipelines, bridges, or other facilities. It is expected that collisions would only be a minor source of bird mortality; however, over the course of the life of the GMT1 Project these mortalities may accumulate for some species. Predators attracted to areas of human activity could also impact tundra-nesting birds by causing depredation of eggs and young; however, Lease Stipulations designed to eliminate attraction of predators to camps or equipment maintenance sites would help mitigate potential increases in predators. Adherence to Lease Stipulations that require proper disposal of garbage to avoid human-caused changes in predator populations would likely minimize potential impacts to birds from increased predation pressure.

Although impacts to birds could occur as a result of the action alternatives, long-term studies of bird density and abundance in the Prudhoe Bay oilfield, located on the ACP, indicate that oil production, as practiced in Prudhoe Bay, does not necessarily lead to substantial declines in bird density or productivity in or near the developed area (Bart et al. 2013).

Impacts to birds from climate warming may include a suite of impacts, both positive and negative. A longer open-water season may increase productivity of some species and increase productivity in aquatic and semi-aquatic systems, which provide food for many species of birds. Warmer soil temperatures are likely to increase thermokarst and may inundate low-lying tundra areas, increasing aquatic and wet tundra vegetation types. The increasing thickness of the active layer of soil above Arctic permafrost is likely to cause changes in moisture regimes and the distribution of vegetation types over much of the Arctic in coming years. Drying of wetlands would result in negative impacts to those species that relay on shallow water and wet meadows, and shrub expansion may reduce the quality and availability of some types of habitats. Such impacts could accelerate or exacerbate changes in soil thermal regimes that occur with development, potentially leading to greater impacts to bird habitat (BLM 2012, § 4.3.8.4, p. 186).

4.3.4 Mammals

This section presents the potential impacts to terrestrial and marine mammals that would result from implementation of the proposed project and other action alternatives. When applicable, impacts to habitat were used to determine potential impacts to individual species.

4.3.4.1 Terrestrial Mammals

The proposed GMT1 Project has the potential to impact terrestrial mammals as described in BLM (2004, § 4F.3.4.1) in the project study area and in BLM (2012, § 4.5.8.2) for the entire NPR-A, both of which are incorporated by reference. The following discussion summarizes the impacts and is supplemented with information from the Point Thomson EIS related to terrestrial mammal impacts (Corps 2012, § 5.10). In addition, analysis of impacts was conducted for Alternative D2 and results included herein.

Methodology

Terrestrial mammals occurring in the project study area were evaluated for potential impacts in this analysis. Caribou are particularly important with respect to subsistence and are a focus of the impact analysis (see Section 4.4.5, *Subsistence*). Analysis is included for other terrestrial mammals and their habitats, including grizzly bear, muskoxen, fox, wolverine, and small mammals. The general mechanisms of impact are expected to be similar to that described in BLM (2004, § 4F.3.4.1; 2012, § 4.5.8.2), and for the Point Thomson Project by the Corps (2012, § 5.10), which are incorporated by reference in this evaluation.

The results of analysis discussed in this section address potential impacts to terrestrial mammals based on habitat use, seasonal distributions, and seasonal movement patterns. For quantification of potential impacts to terrestrial mammals, a project study area was established that includes all gravel components for all alternatives with a surrounding buffer of approximately 2.5 miles, totaling approximately 116,448 acres (182 square miles). Terrestrial mammal habitat loss was based on the analyses described in Section 4.3.1, *Vegetation and Wetlands*. Terrestrial mammal habitat alteration was evaluated by using a 300-foot indirect impact zone (based on Auerbach et al. 1997), from proposed gravel infrastructure in response to possible physical changes caused by gravel spray and (or) dust deposition, snow drifting and piling, thermokarst, and altered wetland hydrology, as discussed in Section 4.3.1, *Vegetation and Wetlands*. Loss, alteration, and disturbance of forage habitats were evaluated based on estimated acreages obtained from GIS analysis of Applicant-provided project facility dimensions.

Previous research conducted by the Applicant was evaluated for caribou distribution and movements throughout the project study area. Caribou research areas, shown in Section 3.3.4.1, Figure 3.3-1, delineate geographic locations of surveys in the Colville River delta and the northeastern part of the NPR-A.

Impact analysis criteria used in this assessment for terrestrial mammals are presented in Table 4.3-13. These impact criteria were developed based on the terrestrial mammal analysis presented in the Point Thomson EIS (Corps 2012, § 5.10, p. 5-273).

The direct and indirect impacts were evaluated by comparing the infrastructure footprints for the alternatives, including proposed routes for roads and the locations of pads, airstrip, and pipeline VSMs. The types of habitats that each of these facilities directly impact was evaluated and used to compare alternatives. Gravel fill is expected to alter terrestrial mammal habitat and use in areas adjacent to the actual footprints of roads and pads due to gravel spray and dust deposition, snow drifting and piling, thermokarst, altered wetland hydrology, and increased disturbance by human activity. In addition to impacts from gravel fill and road usage, disturbance from aircraft (fixed-wing and helicopter) is expected to occur within the project study area.

Alterations to habitats adjacent to gravel infrastructure footprint were estimated using a 300-foot indirect impact zone extending from the edge of gravel infrastructure such as roads, pads, and airstrip. Habitats used by caribou were identified from information provided in Wilson (2012, p. 7-8 *in* BLM 2012; Teshekpuk Herd [TH], calving, post calving, oestrid fly and mosquito seasons), and BLM (2004, § 4F, p. 1159) for herd unspecified, calving, post calving, oestrid fly and mosquito seasons, winter and spring use areas. Habitat classifications within the project study area are presented in this document as the area within which caribou behavior may be altered by the existence and utilization of infrastructure.

Table 4.3-13. Impact Criteria – Terrestrial Mammals

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting more than 25% of all terrestrial habitat or specific habitat in the project study area, or a population of animals.
	Medium	Potentially affecting more than 5% and less than 25% of all terrestrial habitat or specific habitat in the project study area, or a population of animals.
	Low	Potentially affecting 5% or less of all terrestrial habitat or a specific habitat in the project study area, or a population of animals.
Duration	Long Term	Lasting five or longer than five breeding seasons.
	Interim	Lasting two or longer than two breeding seasons, but less than 5 breeding seasons.
	Temporary	Lasting less than two breeding seasons.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region. Impacts will occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region. Impacts will not occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation. Impacts will not occur in times or areas of specific importance for affected species (e.g., foraging, calving areas, migratory corridor) or across a large portion of the range of a resident population.
Geographic Extent	Statewide	Arctic Coastal Plain.
	Regional	Habitat Loss and Alteration: Extending beyond the 300 feet indirect impact zone; Disturbance: Extending beyond project study area to include known ranges of major caribou herds using project study area.
	Local	Habitat Loss and Alteration: Within the gravel footprint and 300 feet indirect impact zone; Disturbance: Within project study area (2.5-mile buffer around project footprint).

A summary of potential impacts to terrestrial mammals, including caribou, moose, muskoxen, grizzly bear, wolf, wolverine, and foxes that may be locally affected by GMT1-related activities is presented in Table 4.3-14.

Table 4.3-14. Summary of the Types of Potential Impacts to Terrestrial Mammals

Project Activity	Facilities and Activities	Potential Impacts
Construction	Ice Roads and Pads	Physical habitat changes, including hydrologic alteration long-term vegetation loss, dust impacts Displacement from (or attraction to) altered habitats Disturbance from noise or activity Obstruction of Movements
	Gravel Placement for Roads, Pads, Airstrip	Physical habitat changes, including hydrologic alteration, long-term vegetation loss, dust impacts Displacement from (or attraction to) altered habitats Disturbance from noise or activity Obstruction of Movements
	Gravel Mining	Physical habitat changes, including hydrologic alteration and long-term vegetation loss Displacement from (or attraction to) altered habitats Disturbance from noise or activity
Drilling and Operation	Vehicle Traffic Aircraft Traffic Human Activity	Collisions (mortality) Disturbance and Obstruction of Movements from vehicles or air traffic Defense of Life and Property (mortality) Increased Hunting Premature Den Emergence (Grizzly Bear)
	Pipelines	Obstruction of Movements Spills or leaks causing exposure to toxic materials

Construction

Construction of project action alternatives would affect terrestrial mammals and their habitats through interim- and long-term habitat loss and alteration; interim- and long-term habitat fragmentation; interim-term construction, vehicle collision, and human safety mortality; and interim-term altered survival or productivity. Construction and use of ice roads, gravel roads, airstrip, pipelines, and other infrastructure would primarily occur during the winter; however some construction activities would occur in the summer months. Construction-related impacts to terrestrial mammals were evaluated for the project study area by BLM (2004, § 4A, 4F.3.4.1) and for oil and gas activities for the entire NPR-A in BLM (2012, § 4.5.9.2).

Habitat Loss and Alteration

Construction of the project action alternatives would result in long-term, direct, and indirect habitat loss due to gravel extraction and the placement of gravel for roads, pads, and airstrip (Table 4.3-15). The project may result in loss of forage habitat for caribou and other terrestrial mammals. Habitat lost to gravel fill may provide insect relief habitat for caribou and possibly also for muskoxen (Corps 2012, § 5.10.3.1, p. 5-277). Gravel mining would also impact terrestrial mammal habitat within the footprint of the mined area (see Section 4.2.1, *Terrestrial Environment*).

Development of the proposed project's action alternatives could potentially disturb and impact Arctic fox dens that occur within the area. Habitats suitable for Arctic fox dens have not been identified as limiting fox populations on the North Slope, and some foxes are likely to use culverts and other artificial habitat as den sites and for temporary shelter (Corps 2012, § 5.10.3.1, p. 5-283). Arctic ground squirrels and other small mammals would also lose minor amounts of foraging and burrow habitat due to gravel fill and mining. Grizzly bears would lose minor amounts of foraging habitat and could lose minor amounts of den habitat. Gravel fill and facility construction may create denning habitat for bears and fox.

Construction of ice roads across tundra habitats would cause temporary loss of winter forage for both small and large herbivores, and would also cause temporary subnivean habitat loss for small mammals. Clearing and piling of snow from the pads, roads, and airstrip during the winter could result in the collapse of subnivean tunnel systems used by small mammals. Ice roads and snow drifts would not melt before most birds begin nesting in late May to early June, altering the distribution and availability to mammalian predators of nests and prey under and near the ice roads and snow piles.

Ice road construction would crush standing dead vegetation, reducing concealment cover for small mammals and potentially increasing their risk of predation. Compaction of standing dead vegetation would be medium-term, requiring several growing seasons to reestablish. Damage to dwarf shrubs and tussock tundra from ice road construction could result in long-term impacts to vegetation cover (Corps 2012, § 5.10.3.1, p. 5-283). Tundra ice roads to support pipeline construction would be required for two winter construction periods, resulting in medium-term loss of winter forage and subnivean habitat. Snow pile habitat losses would be seasonal, but snow piling would likely occur annually in the same locations and would continue as long as the facilities were maintained, resulting in long-term habitat alteration. Winter construction of gravel and ice roads with associated vehicle traffic has the potential to disturb hibernating grizzly bears in dens (Corps 2012, § 5.10.3.1, p. 5-286).

Small and large terrestrial mammals could be affected by reduced forage and habitat loss in areas near gravel fill by deposition of snow piles and drifts, gravel spray and (or) dust deposition, altered hydrology, and thermokarst. In addition, snow would drift around buildings, roads, and pipelines. Deep drifts would likely reduce the availability of winter forage for caribou or muskoxen, but might provide additional protection for small animals using subnivean habitats. Dust deposition on snow caused by vehicle traffic on gravel roads would lead to early melt and green-up that may attract caribou or muskoxen, as well as small herbivores. Dust deposition may be increased during construction, when vehicle traffic would be expected to be highest; although disturbance from human presence and noise may reduce caribou or muskoxen use of these areas. Terrestrial mammals attracted by early vegetation sprouting along roadways may also increase the risk of predation and vehicle collision mortality (Corps 2012, § 5.10.3.1, p. 5-283).

Disturbance

Equipment noise during construction of ice roads and from traffic on ice roads has the potential to disturb and displace Arctic fox, caribou, and muskoxen, which may occur near ice roads during winter. Construction traffic on ice and gravel roads in winter and summer with associated human activity would likely be greater than other project phases and would potentially cause displacement of small mammals, caribou, and muskoxen, as well as attraction of Arctic foxes and grizzly bears. Project activities would disturb terrestrial mammals if they cause a change in behavior or stress in the animals. Some project activities would cause animals to avoid an area or be completely displaced from an area such that they would not return (Corps 2012, § 5.10.3.1, p. 5-285).

Caribou are disturbed by oil and gas infrastructure and associated human activity when they are sufficiently close to perceive the disturbance, but tend to move to a comfortable distance from the disturbance; they may be more likely to approach infrastructure during reduced traffic periods in late evening or overnight (Corps 2012, § 5.10.3.1, p. 5-285). Such disturbance would most likely affect maternal caribou and muskoxen and may result in some displacement from the area of the gravel roads, pads, or airstrip. Displacement would be most pronounced during construction when traffic levels would likely be heaviest; but would continue for the life of the project as long as traffic and human activity continued (Corps 2012, § 5.10.3.1, p. 5-285).

Hazing animals away from an airstrip is another potential source of disturbance to caribou, which are known to gather on these areas for insect relief. Hazing would be conducted if necessary for safe aircraft operations.

The most common disturbing stimulus associated with roads is traffic, and traffic volumes of 15 vehicles per hour or more may deflect caribou movements or delay successful road crossing for several hours (Corps 2012, § 5.10.3.1, p. 5-286). This effect may be most evident with the proposed CD5-GMT1 road in fall migration, and to a lesser extent spring migration, when the area is most heavily used by the TH. According to traffic estimates, described by Alternative in Chapter 2, average traffic volume from May through September would not exceed six vehicles per hour, but of course there would be periods of both above and below average traffic volume. Traffic levels would be much reduced after completion of construction. Under Alternatives A, B, and C, granting locals hunting access to the developed road system may lead to an increased avoidance response for caribou and other terrestrial mammals beyond those normally observed in the Prudhoe Bay oil fields where hunting is not allowed. Caribou may distance themselves farther from infrastructure and roads as an anti-predator response to interactions with hunters. The road system could also change hunters' access for caribou harvest. Road systems that are accessible by the general public (e.g., Nuiqsut residents) have the potential for increased hunting pressure, although oil field employees (including those who are Nuiqsut residents) are not allowed to hunt while on work status (comment provided by CPAI).

Most of the construction associated with the GMT1 Project would occur during winter, when caribou may be present in the project study area. The proposed development would bring year-round facilities and activities within caribou summer range. Caribou could be disturbed by traffic, humans on foot, and low-flying aircraft (BLM 2012, § 4.3.9.2, p. 191). The response of caribou to disturbance would be highly variable, ranging from no reaction to violent escape reactions, depending on: distance from human activity; speed of the approaching disturbance source; frequency of disturbance; sex, age, and physiological condition of the animals; size of the caribou group; and season, terrain, and weather. Caribou cow and calf groups appear to be the most sensitive to traffic, especially in early summer during and immediately after calving, while bulls appear to be least sensitive year-round (BLM 2012, § 4.3.9.2, p. 191).

Low-level overflights for permit-required studies, routine maintenance, and surveillance of pipelines may cause flight responses, especially in maternal caribou, large caribou groups, and grizzly bears, and would cause the animals to expend extra energy (Corps 2012, § 5.10.3.1, p. 5-286).

Aircraft noise during take-offs and landings could result in the inability of affected animals to hear biologically important sounds such as mating calls, predator alarm calls and approaching predators. This could lead to increased stress levels, decreased reproductive capacity, and decreased survivorship in noisy areas such as airstrips and helipads. Repeated low-level aircraft flights over calving concentration areas at less than 1,000 feet above ground level and over early post-calving concentration areas at less than 500 feet above ground level may reduce calf survival (Corps 2012, § 5.10.3.1, p. 5-286). Landings and takeoffs during the caribou calving period in late May through late June would also potentially disturb caribou.

Tolerance to aircraft, ground vehicle traffic, and other human activities has been reported in several studies of caribou, and it appears that caribou can habituate to structures, noise, and odors, but habituate slowly or not at all to humans on foot or large moving objects such as vehicles (BLM 2012, § 4.3.9.2, p. 191). However, most of the caribou in the NPR-A are from the TH and WAH and have had less exposure to human activities and thus are less likely to be tolerant of disturbances than animals habituated to activities at Prudhoe Bay. The use of the CD5-GMT1 road to access subsistence hunting areas could displace caribou and other mammals further than what is observed in the Prudhoe Bay region, as the caribou may exhibit predator avoidance behaviors around roads that are associated with hunting activities (Corps 2012, § 5.10.3.1, p. 5-305).

The calving grounds of the TH are primarily near Teshekpuk Lake (BLM 2012, § 3.3.6, p. 284 and Map 3.3.6-5). The CAH calves between the Colville and Canning rivers to the east of the NPR-A (BLM 2012, § 3.3.6, p. 292 and Map 3.3.6-3). Little or no caribou calving is expected to occur within the project study area.

Habitat Fragmentation

The movements of small mammals such as lemmings and voles may be blocked by gravel fill during both winter and summer. Although movement may be inhibited by physical barriers, behavioral avoidance of the increased predation risk that open environments pose may lead to increased avoidance of gravel roads. Additionally, small mammals crossing gravel roads during winter would be exposed to decreased air temperatures and higher winds compared to the protected environments of subnivean tunnels, which could also increase their risk of predation (Corps 2012, § 5.10.3.1, p. 5-286).

Gravel roads would potentially affect the movements of caribou in the project study area, which could delay or deflect movement between inland and coastal insect-relief habitats. Gravel road berms 4 feet or more in height create a visual barrier that can lead to deflection of caribou movements (Corps 2012, § 5.10.3.1, p. 5-286). As discussed in Chapter 2, all proposed gravel roads associated with the proposed project would be a minimum of 5 feet thick (height above surrounding grade), although the depth of gravel will vary depending on the hydrology and topography of the area. Some caribou movement could be obstructed between CD5 and GMT1 during construction of the road and pipeline (Lawhead et al. 2013).

The pipeline/road crossing near the GMT1 pad would have effects on caribou movements in the area, but it is unclear whether they would be negligible, positive or negative because there would be trade-offs. In one relatively short section, the pipeline would be lower to the ground and closer to the road (actually going all the way down to the ground and all the way to the road); this may hinder caribou movements in this short section as a result with additive impacts to caribou crossings. However, the pipeline would also be buried under the road at the crossing which would result in a short area where there is only road and no pipeline to cross. This may create a positive effect on caribou crossing for a very short distance.

Mortality

Construction of ice and gravel roads would likely result in some small mammal mortality. Some winter active small mammals (e.g., lemmings, voles, shrews) may be able to avoid being covered by gravel or ice, while those animals in hibernation during construction would be lost if gravel or ice construction were to occur over occupied burrows. Arctic ground squirrels would be in hibernation during winter gravel and ice road construction and would not be able to avoid the construction area. There is a potential for a few terrestrial mammals to be involved in collisions with vehicles each year, including small mammals (e.g., Arctic ground squirrels), Arctic foxes, and caribou.

During winter, vehicle collisions with Arctic foxes may occur. Mortality events for fox may include these as well as disease (e.g., rabies) and defense of life and property (DLP). Vehicle collisions with caribou during winter may occur, particularly during reduced visibility in winter when the hard surfaces of ice roads are attractive to caribou for travel (Corps 2012, § 5.10.3.1, p. 5-286). Caribou, moose, muskoxen and bears on roads are uncommon; however higher traffic during construction and dark driving conditions in the winter could lead to vehicle strikes (BLM 2004, § 4A.3.4, p. 575). Speed limits on oil field roads are enforced and the Applicant (CPAI) has instituted wildlife avoidance policies and training at APF, which would be applied to the GMT1 Project as well.

Caribou may attempt to use the airstrip to escape parasitic insects. Planes would have a potential to collide with caribou during landings or takeoff; however, for pilot and passenger safety, caribou would not be allowed to remain on the airstrip and collisions would be unlikely to occur.

Predators, particularly bears and foxes, may be killed to defend human life. Bears may charge humans in a predatory manner or become conditioned to humans and overly aggressive towards humans. Foxes may become conditioned to humans and bite or threaten to bite a human. These animals would be considered nuisance animals and would likely be destroyed. Grizzly bears and foxes may have increased occurrence of DLP kills, but those are generally uncommon occurrences in the oil fields. Increased access to hunting from local residents (Nuiqsut Village) may increase mortality of caribou, moose, musk oxen and grizzly bears. Bears within 600 feet of construction activities may abandon dens, which would result in negative impacts to individuals and newborn cubs, including mortality (BLM 2004, § 4A.3.4.1, p. 575). The Applicant has proposed to implement design measures that would minimize the potential for wildlife to become attracted to humans and human development, thus minimizing the potential need to destroy nuisance animals.

Altered Survival or Productivity

Terrestrial mammal displacement from preferred habitats could result in reduced survival and productivity. Caribou displaced from habitats with more nutritious forage, and caribou that expend energy responding to disturbances may not be able to compensate for these energetic losses, which would potentially reduce the individual's survival and reproduction; recent studies of calf growth and survival for caribou displaced by or exposed to oil and gas infrastructure disturbance during calving, however, did not conclude significant survival or growth impacts (Corps 2012, § 5.10.3.1, p. 5-291).

Improperly managed human food or garbage, and the availability of infrastructure for thermal protection, escape cover, or den sites can benefit Arctic foxes, bears, and weasels, potentially increasing their survival and productivity (Corps 2012, § 5.10.3.1, p. 5-291). Staging of construction materials and equipment would create additional crevices and voids that may provide cover for terrestrial mammals. Studies of foxes and grizzly bears in the Prudhoe Bay oil fields generally conclude that these benefits have been responsible for increased densities and productivity of Arctic foxes and bears (Corps 2012, § 5.10.3.1, p. 5-291). Operational procedures and controls established to protect terrestrial mammals, as described in the Applicant's proposed mitigation, would minimize factors that commonly attract Arctic foxes and bears to oil field infrastructure; e.g., maintaining a clear space under modules and buildings to prevent creation of artificial den sites for foxes and managing food materials and food wastes such that they are unavailable to wildlife.

Spills could involve crude oil, refined products, produced water, or seawater. The extent of environmental impacts would depend on the type, location and amount of materials spilled or released, and the effectiveness of the response. The majority of small spills would be contained on the gravel pad and would have no impact on terrestrial mammals or their habitat. Caribou and other terrestrial mammals could be coated with oil (in the case of a blow-out, or from lying on oiled tundra) or ingest contaminated vegetation. The extent of the disturbance to the animals would depend on a variety of factors, including spill/release size and location, response actions, and season.

Drilling and Operation

The drilling and operation phase of the action alternatives would affect terrestrial mammals and their habitats through habitat alteration and disturbance, potential for vehicle collision and human safety mortality, and altered survival or productivity.

Habitat Loss and Alteration

Storage areas for drilling equipment would require no additional habitat loss/alteration beyond what is described for construction (Section 4.3.4.1). Dust fallout from gravel infrastructure would result in impact over the life of the project. Habitat alteration of tundra foraging areas may result from delayed melt of ice roads and pads, which would be a long-term impact under Alternatives D1 and D2 with required ice roads throughout the life of the project.

Disturbance

Disturbance from additional traffic on gravel and ice roads, as well as from additional air traffic would occur during drilling and operation. Maximum traffic levels would likely occur when construction and drilling activities occur simultaneously. Activities in support of drilling would occur primarily during February through August. Noise from the drill rig, rig camp, and people walking on or around the production pads may cause some additional disturbance, especially during summer; but most disturbances to terrestrial mammals, primarily caribou, muskoxen, and grizzly bears, would result from vehicle traffic on the roads as described under construction (Section 4.3.4.1).

Traffic on the CD5-GMT1 road would most likely affect caribou of the TH during the fall migration period. (See average traffic volume under “Construction” section above.) Maps 4.3-3 and 4.3-4 show a “Brownian bridge” analysis of caribou location data collected from satellite and GPS collars during fall migration, roughly September 30 through November 18, 1990-2012, for female and male caribou, respectively. These analyses include data for 186 females and 41 males. The much smaller sample size of males may have contributed to the appearance of less use for males than for females. Use levels are split into four even quantiles and are represented qualitatively as high, moderate-high, moderate-low, and low. The proposed CD5-GMT1 road extends into the edge of the broad, high-use area for females.

The Wilderness Society developed a simulation model of caribou response to the proposed road between CD5 and GMT1 during fall migration (see Chapter 8, communication #16). Because the modeling effort was unable to use actual location data of caribou movements, several assumptions based on a literature review had to be made causing the model results to be artificial. Nonetheless, the results indicate possible caribou migration paths and responses to infrastructure in the vicinity of the project area during fall migration. In this simulation, less than 20 percent of caribou beginning their fall migration from the Teshekpuk Lake area came within 9.3 miles of the proposed road, and roughly 80 percent of those went on to approach within 9.3 miles of Nuiqsut. The figures presented above corroborate the Wilderness Society’s assumption that less than 20 percent of migrating caribou would be likely to encounter either the road or Nuiqsut due to their position on the migratory corridor. The Wilderness Society's results, though artificial, suggest that project road construction may cause a reduction in the proportion of fall-migrating caribou that approach Nuiqsut due to their potential to be diverted or delayed by the road.

Winter mobilization and resupply of the drill rig over the ice road under Alternatives D1 and D2 would contribute to additional traffic with associated winter disturbance primarily for Arctic foxes. In Alternative D2, the drill rig would also be demobilized each winter season and ice roads would be required for 36 years (first season drilling, 24 years of infill drilling and 11 years of post-drilling operations). In Alternative D1, once year-round drilling is completed, the drill rig would be transported off the pad during the ice road season.

Habitat Fragmentation

No additional habitat fragmentation or blockage of movements would be expected during drilling (as compared to construction), although traffic levels on infield roads (Alternatives A, B, and C) would be increased when the drill rig is active on the GMT1 pad.

Mortality

Additional vehicle collision, aircraft, and human safety mortality may occur as numbers of personnel, rig camps, and more vehicles are active during drilling. The causes and effects of such collisions and mortality are described under construction (Section 4.3.4.1).

Vehicle collisions would likely be reduced during operation (post-drilling) because of reduced personnel and transportation requirements on the CD5-GMT1 road for Alternatives A, B, C, and for the ice road in D1. In Alternative D2, year-round operation would overlap with seasonal drilling for 19 years. Once seasonal drilling ends, there would be 11 years of year-round post-drilling operation under Alternative D2. Occasional animal mortality would still be likely. In addition to collision mortality, other types of wildlife mortality, such as exposure to flares, entanglement, and trapping and destruction of nuisance animals, could occur during operations, as exemplified in the Prudhoe Bay oil field (Corps 2012, § 5.10.3.1, p. 5-293).

Altered Survival or Productivity

Survival and productivity alterations during operations would be similar to those described in the construction phase (Section 4.3.4.1).

Comparison of Alternatives

The direct impacts of gravel placement on all habitats and potential caribou use habitats are summarized in Table 4.3-15. Each alternative would have a total gravel fill footprint representing less than 1 percent of the total area of habitat in the approximately 116,448-acre project study area, and would impact less than 1 percent of specific habitats identified as potential caribou use habitats. Indirect impacts based on a 300-foot zone surrounding gravel infrastructure would also impact less than 1 percent of the total project study area with Alternatives A, B, D1, and D2 (Table 4.3-16).

Alternative C would impact slightly more than 1 percent of the total area of the project study area with gravel fill (but less than 5 percent), and it would impact more than 3 percent each of the moist sedge-shrub tundra, riverine complex, and tussock tundra habitats that are found within the project study area; the other action alternatives would impact lower percentages of these habitats.

Gravel mining at the ASRC Mine site would also impact potential habitat for terrestrial mammals; the footprint of impact would vary according to the alternative and the gravel demand (see Section 2.4.4, *Gravel Supply Options*). In general, the differences in amount of vegetation impacted as a result of gravel mining are similar between alternatives. The only vegetation type expected to be impacted as part of gravel extraction for the GMT1 Project from the ASRC Mine site is wet sedge meadow tundra, which is a potential caribou use vegetation. Between 26.0 and 35.7 acres will be disturbed as part of gravel extraction (26.0 acres, 28.3 acres, 35.7 acres, 35.1 acres, and 34.5 acres for Alternatives A through D2, respectively), which is between 0.09 percent and 0.12 percent of total wet sedge meadow tundra in the mapped project area.

Alternatives A, B, and C would have similar impacts to terrestrial mammals, with impacts due to habitat loss and alteration expected to be of low intensity, long-term duration, and local extent (Table 4.3-17). The affected resources, which in this case include important subsistence food resources for the local community, are rated important because caribou fill a distinctive ecosystem and ecological service role within the locality and region (Section 4.4.5, *Subsistence*). Alternatives D1 and D2 would involve intermediate levels of habitat loss due to gravel fill, being greater than Alternatives A and B, but less than Alternative C.

As the project study area is not within the reported caribou calving area of NPR-A (BLM 2012, Map 3.3.6-5, Teshekpuk Lake Caribou Herd - Calving Areas), potential impacts are rated low intensity to reflect the low likelihood of calving or impacts to calving. Impacts would be long-term and local extent, but unlikely to occur. Although non-calving caribou could be disturbed at moderate levels of intensity for the long-term duration from drilling and vehicle disturbances, the impact would be limited in extent to the local area (within the project study area).

Alternatives A, B and C will lead to increased vehicle traffic in the area, as some industrial use, and some traffic from local residents including subsistence use could occur once the Nuiqsut Spur Road is constructed. See Chapter 2 vehicle trips tables for detailed vehicle traffic information. Overall, Alternatives A, B, and C are expected to result in minor impacts to terrestrial mammals.

The use of aircraft to access the site under Alternatives D1 and D2 differentiates these alternatives from the others with respect to potential impacts to caribou. The high number of flights required for transport of personnel and for special studies for both Alternatives D1 and D2 (see Tables 2.8-5 and 2.9-5) is expected to result in moderate impacts to caribou in the project study area, and could extend into adjacent areas beyond the project study area, causing a regional-level extent of impact.

The aircraft traffic under Alternatives D1 and D2 would be additional to the existing activity in the APF and Nuiqsut airspaces, and would continue for long term. Under Alternatives A, B, and C, additional new flights each month would be required during construction and would decrease significantly once construction is completed; under Alternative D1 flights would continue to increase to support drilling but would decrease once drilling is completed. Under Alternative D2, flights would increase when drilling and operational support occur simultaneously. The air traffic specific to these alternatives would likely follow the general route of the proposed access road to GMT1. Annual ice roads would require construction activity and potentially disturb caribou throughout the project life. Re-use of annual ice road routes and ice pad locations could damage tundra, a potential long-term impact (Table 4.3-18). The affected resource is rated important in context for impacts under this alternative.

Alternatives D1 and D2 are expected to result overall in minor to moderate impacts to caribou and minor impacts to other terrestrial mammals.

Alternative E would result in no impacts to terrestrial mammals.

Table 4.3-15. Estimated Direct Impacts of Action Alternatives to Potential Caribou Use Habitats

Potential Caribou Use Vegetation [a]	Mapped Project Study Area [b] (acres)	Veg Type as % of Mapped Area	Veg Type as % of Total Study Area	Direct Impacts									
				Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
				acres	(%)	acres	(%)	acres	(%)	acres	(%)	acres	(%)
Barren	4,756.1	4.3	4.1					2.0	--				
Moist Sedge–Shrub Tundra	16,791.9	15.2	14.4	19.1	0.1	24.6	0.1	29.2	0.2	24.7	0.1	23.4	0.1
Riverine Complex	299.4	0.3	0.3	0.2	0.1			0.3	0.1	--	--	--	--
Tussock Tundra	18,766.1	17.0	16.1	41.1	0.2	39.6	0.2	58.3	0.3	50.0	0.3	50.0	0.3
Wet Sedge Meadow Tundra	29,251.5	26.4	25.1	5.2	--	10.9	--	7.2	--	9.6	--	9.5	--
Total of Impact for Alternative				**65.6**		**75.2**		**97.0**		**84.2**		**82.9**	

See notes for Table 4.3-16.

Table 4.3-16. Estimated Indirect (300-Foot Zone) Impacts of Action Alternatives to Potential Caribou Use Habitats

Potential Caribou Use Vegetation [a]	Mapped Project Study Area [b] (acres)	Veg Type as % of Mapped Area	Veg Type as %of Total Study Area	Indirect Impacts									
				Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
				acres	(%)	acres	(%)	acres	(%)	acres	(%)	acres	(%)
Barren	4,756.1	4.3	4.1					20.1	0.4				
Moist Sedge–Shrub Tundra	16,791.9	15.2	14.4	181.1	1.1	217.0	1.3	461.1	2.7	75.1	0.4	75.3	0.4
Riverine Complex	299.4	0.3	0.3	2.8	0.9			5.9	2.0				
Tussock Tundra	18,766.1	17.0	16.1	250.1	1.3	248.6	1.3	461.3	2.5	155.4	0.8	155.4	0.8
Wet Sedge Meadow Tundra	29,251.5	26.4	25.1	55.9	0.2	94.0	0.3	130.6	0.4	11.5	--	11.4	--
Total of Impact for Alternative				**492.8**		**559.6**		**1,078.9**		**242.0**		**242.0**	

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the vegetation type is not present within area considered for impact analysis.

[a] Includes potential forage and insect relief areas as discussed in Methodology, Section 4.3.4.1.

[b] Percent of vegetation type acreage within the mapped vegetation portion of the project study area. Note that 5,842.4 acres (5 percent) of the project study area extends outside of the vegetation map coverage. This area also represents the 2.5-mile buffer for indirect impacts.

Table 4.3-17. Impact Criteria Summary for Terrestrial Mammals – Alternatives A, B, and C

Alternatives A , B, and C					
Impact Type and Affected Population		**Intensity**	**Duration**	**Context**	**Geographic Extent**
Habitat Loss and Alteration	Small Mammals	Low	Long Term	Common	Local
	Caribou Potential Use Habitats (within 300 feet)	Low	Long Term	Common	Local
Disturbance	Arctic Fox Dens/Den Habitat	Low	Long Term	Common	Local
	Grizzly Bear Dens/Den Habitat (within 2.5 miles)	Low	Long Term	Common	Local
	Caribou (non-calving; within 2.5 miles)	Low	Long Term	Important	Local
	Calving Caribou [a] (within 2.5 miles)	Low	Long Term	Important	Local
	Muskoxen and Grizzly Bear (within 2.5 miles)	Low	Long Term	Common	Local

[a] The project study area is not within the reported caribou calving use areas in NPR-A (BLM 2012, Map 3.3.6-5, Teshekpuk Lake Caribou Herd - Calving Areas).

Impact criteria definitions are presented in Table 4.3-1.

Table 4.3-18. Impact Criteria Summary for Terrestrial Mammals – Alternatives D1 and D2

Alternatives D1 and D2					
Impact Type and Affected Population		**Intensity**	**Duration**	**Context**	**Geographic Extent**
Habitat Loss and Alteration	Small Mammals	Low	Long Term	Common	Local
	Caribou Potential Use Habitats (within 300 feet)	Low	Long Term	Common	Local
Disturbance	Arctic Fox Dens/Den Habitat	Low	Long Term	Common	Local
	Grizzly Bear Dens/Den Habitat (within 2.5 miles)	Low	Long Term	Common	Local
	Caribou (non-calving; within 2.5 miles)	Medium	Long Term	Important	Regional
	Calving Caribou [a] (within 2.5 miles)	Low	Long Term	Important	Local
	Muskoxen and Grizzly Bear (within 2.5 miles)	Low	Long Term	Common	Local

[a] The project study area is not within the reported caribou calving use areas in NPR-A (BLM 2012, Map 3.3.6-5, Teshekpuk Lake Caribou Herd - Calving Areas).

Impact criteria definitions are presented in Table 4.3-1.

Mitigation

Avoidance or reduction of potential impacts to terrestrial mammals and their habitat would be accomplished by implementing siting and design features and other mitigative measures described in Section 4.7. In particular, design requirements for elevating pipelines 7 feet above ground surface, aligning the placement of VSMs from CD4 to APF to avoid a picket-fence effect, and road and pipeline separation that allow for passage of caribou and other terrestrial mammals would reduce impacts on caribou movements.

Mitigation is provided through the following protective measures in BLM (2013: A-1 through A-8, A-11, A-12, C-1, E-7, E-8, E-12, E-19, F-1, I-1, L-1, M-1, and M-4); see Appendix E. CPAI has requested that BLM authorize a deviation from Stipulation E-7 for the GMT1 Project (Appendix F).

The existing Alpine Project, operated by the Applicant, uses a Wildlife Avoidance and Interaction Plan and Predator Management Plan that includes methods to discourage scavenging. A similar plan should be developed for the GMT1 Project to further mitigate wildlife interaction impacts.

Potential New Mitigation Measure 1 (Adapted from BMP K-5.e.1 and 2): Minimize Potential Ground Vehicle Traffic Disturbance of Caribou

Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements, by vehicle traffic on the CD5-GMT1 gravel road during the oestrid fly-relief and fall-migration seasons.

Requirement/Standard: The following ground vehicle traffic restrictions shall apply to permitted activities using the GMT1 to CD5 road in the time periods indicated:

1. Along the GMT1 to CD5 road, from July 16 through November 30, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips or using convoys, to the extent practicable.

2. The permittee or a contractor shall observe caribou movement from July 16 through November 30. Based on these observations, traffic will be stopped temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent.

3. The permittee shall submit, prior to road construction, a vehicle use plan that considers these and any other appropriate mitigation measures. The vehicle use plan shall also include a vehicle-use monitoring plan and specify that the road is only to be used by residents of the local community and authorized CPAI personal and contractors. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable.

4. The permittee will consult with the Authorized Officer every three years to determine if the seasonal restrictions, and restrictions described in paragraphs 1 and 2 above are still appropriate given possible changes in migration patterns. In light of ongoing caribou monitoring, the Authorized Officer may modify the restrictions as appropriate to achieve the objectives of this measure.

Potential Benefits and Residual/Unavoidable Impacts: Limiting vehicle traffic during caribou migration will help reduce impacts and disturbance to caribou. Unavoidable impacts would continue due to the presence of the road and continued traffic.

Potential New Mitigation Measure 2: Roadkill Monitoring System for Wildlife

Objective: Implement a reporting system to monitor roadkill of birds and mammals on transportation routes.

Requirement/Standard: The permittee shall provide an annual report to the Authorized Officer reporting roadkill of birds and mammals, to help BLM determine whether additional preventative measures on vehicle collisions should be made.

Potential Benefits and Residual/Unavoidable Impacts: Knowledge about bird and mammal mortality due to vehicle traffic will help managers to develop methods to reduce collision rates with vehicles.

Conclusions

Terrestrial mammals may be impacted during the construction, drilling, and operation of the action alternatives through habitat loss and alteration, disturbance, habitat fragmentation, mortality, and altered survival or productivity.

The magnitude of the overall impacts vary among the alternatives, with Alternatives A, B, and C having a lower level of overall impact (minor), compared to Alternatives D1 and D2 (moderate).

4.3.4.2 Marine Mammals

In general, marine mammals are not expected to occur either within the project study area, or north of the project study area along the coastline of Harrison Bay. The water along the coast is either out of geographical range, or too shallow for most species to utilize during limited migrations through the area. The exceptions are polar bear, which are covered under Section 4.3.5, *Threatened and Endangered Species*, spotted seal, bearded seal, and the beluga whale.

Spotted Seal

Spotted seal are known to utilize haul outs as far as Ocean Point along the Colville River during summer and late fall (discussed in detail in Section 3.3.4.2, *Marine Mammals*). The greatest concern for spotted seals in respect to the GMT1 development, is disturbance of terrestrial haul-out locations and the potential for oil spills (BLM 2012, § 4.3.10.2). The number of animals affected by spilled oil would depend on the number of animals present, spill size, location, and timing of such an event. If spilled oil were to reach a haul-out location, large numbers of spotted seal could be negatively impacted (BLM 2012, § 4.3.10.2, p. 230). The potential for an onshore spill of any size to reach marine or marine-connected waters is minimized by stipulations K-1 and K-6, as stated and provided in BLM (2012, § 4.3.10.2 p. 225).

Disturbance from noise impacts are not expected to reach the marine environment, outside of increased air traffic (BLM 2012, § 4.3.10.2, p. 221). Aircraft, under the Marine Mammal Protection Act (MMPA), are expected to maintain an altitude greater than 1,000 feet over water, except take-off and landing. At 1,000 feet, the potential for disturbance to seals is greatly reduced (BLM 2004, § 4A.3.4.2, p. 593).

Bearded Seal

Bearded seals prefer drifting pack ice or ice floes in deep water off-shore habitats and they are not expected to occur in the Tiŋmiaqsiġvik (Ublutuoch) River or Fish Creek delta (discussed in detail in Section 3.3.4.2, *Marine Mammals*). Although conceptually it is possible that individual bearded seals could be present in locations where noise from construction activity could be perceived, the likelihood of their presence is remote, and the potential for disturbance is negligible.

No facilities or pipelines are proposed on or immediately adjacent to the marine coastal zone. The species is not likely to be in areas affected by the GMT1 Project. The sources of potential spills are generally small enough and far enough from marine waters that there would be no or very little impact to marine water quality or resources. As noted in Section 4.5, *Impacts of Oil, Saltwater, and Hazardous Material Spills*, the probability of a large spill to marine waters is very low. Manual and automated valves on both sides of the Tiŋmiaqsiġvik (Ublutuoch) River will be in place to control flow in the oil pipeline, and would substantially reduce the potential risk of an oil release to the river. The Tiŋmiaqsiġvik (Ublutuoch) River is a tributary of Fish Creek that flows north approximately 7 river miles, connecting to Fish Creek approximately 10 river miles upstream from Harrison Bay. The Tiŋmiaqsiġvik (Ublutuoch) River is a slow moving, meandering, river, with many oxbows, allowing for opportunities to intersect the majority of oil before it could travel to Fish Creek, or farther to the Fish Creek delta.

Overall, the potential impacts to bearded seals as a result of the GMT1 Project are expected to be negligible. There would be no impacts to bearded seals under Alternative E.

Beluga Whale

Beluga whales are known to be seasonally present (in small aggregations) off the coastline north of the project study area (discussed in detail in Section 3.3.4.2, *Marine Mammals*). Belugas could be impacted in the unlikely case of a spill to land reaching a river that carries spilled oil to the marine environment. The number of animals affected by spilled oil would depend on the number of animals present, spill size, location, and timing of such an event. An oil spill is unlikely, but if it did occur, there could be some mortality and longer-term impact to reproduction or survival of some individuals, but not a population-level effect. On-shore spills during winter would not have any effect on beluga whales if they are cleaned up prior to spring breakup, as belugas winter in the Bering Sea (BLM 2012, § 4.3.10.2, p. 221).

Disturbance impacts from noise associated with construction or operations are not expected to reach the marine environment (BLM 2012, § 4.3.10.2, p. 221). Air traffic altitude restrictions under MMPA are the same as discussed for spotted seals and are not expected to disturb beluga whales.

Conclusions

There would be no difference in impacts to marine mammals under each of the action alternatives, because the GMT1 pad location is similar under any of the action alternatives. Activities associated with construction or operations for the proposed GMT1 Project are not expected to impact spotted seals, bearded seals, beluga whales, or other marine mammals rarely occurring off the coastline of Harrison Bay. In the unlikely event of a large oil spill reaching open water during summer or fall, small numbers of beluga whales, bearded seals, and larger groups of spotted seals could be negatively impacted. Details of the resultant impacts from contact or ingestion of hydrocarbons for these three species are discussed in BLM (2012, § 4.3.10.2, p. 226). Assuming that no large oil spills occur, or reach the open water environment, impacts to marine mammals are expected to be negligible (see also Section 4.5, *Impacts of Oil, Saltwater, and Hazardous Material Spills*).

4.3.5 Threatened and Endangered Species

Impacts to threatened and endangered species are described in BLM (2004, § 4F.3.5) and BLM (2012, § 4.5.11). The threatened and endangered species that have been reported to occur in or near the project study area are: Steller's eider, spectacled eider, and polar bear. When this SEIS process began, the yellow-billed loon, which also occurs in the area, was a candidate species under the ESA. On October 1, 2014, the USFWS made the decision that listing the yellow-billed loon under the ESA was not warranted (Federal Register, Vol. 79, No 190, p. 59195). The loon no longer has status under the ESA, but the species is still recognized as a special status species by the BLM and as a species of conservation concern by the USFWS. Additional information can be found in BLM (2004, § 4F.3.3.1), BLM (2012, § 4.5.11.2), and in this section. There are only two records of Steller's eider breeding east of Barrow in the last three decades (on the Colville River delta in 1987 and in Prudhoe Bay in 1994; USFWS 1997). Therefore, this species was not analyzed in depth for the GMT1 project.

This section addresses the potential impacts with specific regard to spectacled eider, yellow-billed loon, and polar bear. The bowhead whale and ringed seal are addressed in this section to a lesser extent, because of their restriction to coastal marine habitats and not within the project study area.

The impact evaluation criteria for threatened and endangered bird species are based on the general impact criteria described in Section 4.1.2, *Impact Criteria,* as presented in Table 4.3-19.

Table 4.3-19. Impact Criteria—Threatened and Endangered Species, Birds

Impact Category	Magnitude	Definition
Intensity	High	Potentially affecting 25 percent or more of a single high value habitat present within the project study area.
	Medium	Potentially affecting more than 5 percent but less than 25 percent of a single high value habitat present within the project study area.
	Low	Potentially affecting 5 percent or less of a single high-value bird habitat present within the project study area.
Duration	Long Term	Lasting longer than ten years.
	Interim	Lasting longer than two years, but less than ten years.
	Temporary	Lasting less than two years.
Context	Unique	The affected resource is rare or is depleted either within the locality or the region, and is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Important	The affected resource is protected by legislation or the portion affected fills a distinctive ecosystem role within the locality or the region.
	Common	The affected resource is considered usual or ordinary in the locality or region; it is not depleted in the locality or region and is not protected by legislation.
Geographic Extent	Statewide	Extends beyond the ACP.
	Regional	Extends beyond 300 feet from project components but within the ACP.
	Local	Within the footprint and extending 300 feet from project components.

The types of potential impacts to threatened and endangered species is similar to that of other birds and mammals, and includes habitat loss and alteration, disturbance and displacement, mortality, obstruction of movement, and predation. Section 4.3.3, *Birds,* and 4.3.4.2, *Marine Mammals,* provide discussion of potential impacts to birds and marine mammals in general.

Potential impacts to threatened and endangered species from project elements and activities vary among the different action alternatives during construction, drilling, and operations (i.e., production). Discussion of the potential impacts and comparison of alternatives is presented below.

Overall, the potential impacts to the threatened and endangered species that could potentially be affected by the action alternatives are expected to be of low intensity, local in extent, and long term in duration. Considering all threatened and endangered species as a group, the GMT1 Project is estimated to have negligible impacts (see Table 4.1-2). However, as discussed below, impacts for each particular threatened or endangered species range from no impacts to minor impacts.

4.3.5.1 Steller's Eider

Nest searches in the Colville River delta, Kuparuk River Unit, and northeast NPR-A over approximately 20 years have found no nests or indications of breeding by Steller's eiders (Johnson et al. 2013). In a similar time period, only a few sightings of individuals have been recorded (Johnson et al. 2013). Therefore, there is a low probability for their future presence in the future at the project study area (Johnson et al. 2013). There is no designated critical habitat for this species on the North Slope. No impacts to Steller's eiders are expected to occur as a result of any of the action alternatives and they are not further addressed in this section. There would be no impacts under Alternative E.

4.3.5.2 Spectacled Eider

Impacts to spectacled eiders from construction and drilling and operation within the project study area are discussed in BLM (2004, § 4A3.5.2) and in BLM (2012, § 4.3.11.2). Results from these previous analyses are summarized in this section and a comparison of alternatives with regard to project activities and infrastructure is provided, as well as conclusions regarding potential impacts to spectacled eider.

As indicated by the impact criteria (Table 4.3-19), this evaluation primarily utilizes habitat to make impact rating determinations. Potential high-value habitats, along with their areas of potential direct and indirect impact are listed for spectacled eider in Table 4.3-20 and Table 4.3-21, and were selected using statistical analysis which identified species preference for select habitat types within the ASDP and Colville River delta (Johnson et al. 2013).

Table 4.3-20. Direct Impacts to Potential High-Value Habitats of Spectacled Eider and Yellow-Billed Loon within the Project Study Area

			Alternative A		**Alternative B**		**Alternative C**		**Alternative D1**		**Alternative D2**	
Habitat Type [a] (Focal Species [b, c])	**Project Study Area Mapped [d] (acres)**	**Percent of Total Project Study Area [e]**	**Direct Impact (acres)**	**Percent of Habitat Type Impacted in Project Study Area**	**Direct Impact (acres)**	**Percent of Habitat Type Impacted in Project Study Area**	**Direct Impact (acres)**	**Percent of Habitat Type Impacted in Project Study Area**	**Direct Impact (acres)**	**Percent of Habitat Type Impacted in Project Study Area**	**Direct Impact (acres)**	**Percent of Habitat Type Impacted in Project Study Area**
Grass Marsh (YB, SE)	463.6	0.4%	--	--	▨	▨	--	--	--	--	--	--
Patterned Wet Meadow (YB)	22,936.3	19.7%	5.2	--	10.9	--	7.0	--	9.6	--	9.5	--
Salt Marsh (SE)	625.1	0.5%	--	--	▨	▨	--	--	--	--	--	--
Sedge Marsh (YB)	1,055.1	0.9%	0.8	0.1%	▨	▨	0.9	0.1%	--	--	--	--
Shallow Open Water with Islands or Polygonized Margins (SE)	1,142.1	1.0%	--	--	▨	▨	--	--	0.8	0.1%	0.8	0.1%
Shallow Open Water without Islands (SE)	873.6	0.8%	--	--	--	--	--	--	--	--	--	--
Total SE [f]			**--**	**--**	**--**	**--**	**--**	**--**	**0.8**	**--**	**0.8**	**--**
Total YB [f]			**6.0**	**--**	**10.9**	**--**	**7.9**	**--**	**9.6**	**--**	**9.5**	**--**

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the habitat is not present within area considered for impact analysis.

[a] Source information for habitat preferences of pre-nesting SE based on Monte Carlo analysis in Tables 5 and 8 of Johnson et al. 2013
Source information for habitat preferences of nesting and brood-rearing YB based on Monte Carlo analysis in Tables 11 and 16 of Johnson et al. 2013

[b] ESA-listed Threatened bird species analyzed for habitat preferences/use: Spectacled Eider (SE)

[c] Yellow-billed loon (YB) was an ESA candidate species until the October 1, 2014 decision that the listing of the yellow-billed loon was not warranted under the ESA.

[d] Note that 5.842.4 acres (5 percent) of the project study area extends outside of the habitat map coverage. All the project facilities under all action alternatives are within areas of mapped vegetation.

[e] Total acreage in project study area, inclusive of mapped and not mapped portions = 116,447.7 acres

[f] Percentages listed in Total for both SE and YB is the total high-value habitat impacted for each species divided by the total high-value habitat available within the project study area (YB= 41,065.3 acres ; SE= 6,926.9 acres).

Table 4.3-21. Indirect Impacts to Potential High-Value Habitats of Spectacled Eider and Yellow-Billed Loon within the Project Study Area (300-Foot Zone of Influence)

Habitat Type [a] (Focal Species [b, c])	Project Study Area Mapped [d] (acres)	Percent of Total Project Study Area [e]	Alternative A		Alternative B		Alternative C		Alternative D1		Alternative D2	
			Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area	Indirect Impact (acres)	Percent of Habitat Type Impacted in Project Study Area
Deep Open Water with Islands or Polygonized Margins (YB, SE)	3,478.5	3.0%	0.4	--	2.5	0.1%	0.4	--				
Deep Open Water without Islands (YB)	9,414.1	8.1%	1.8	--	1.2	--	1.8	--	0.3	--	0.3	--
Grass Marsh (YB, SE)	463.6	0.4%	1.4	0.3%			1.4	0.3%				
Patterned Wet Meadow (YB)	22,936.3	19.7%	55.1	0.2%	93.4	0.4%	119.4	0.5%	11.5	0.1%	11.4	--
Sedge Marsh (YB)	1,055.1	0.9%	16.5	1.6%	6.1	0.6%	17.1	1.6%				
Shallow Open Water with Islands or Polygonized Margins (SE)	1,142.1	1.0%	2.5	0.2%	2.5	0.2%	2.5	0.8%	2.4	0.2%	2.4	0.2%
Shallow Open Water without Islands (SE)	873.6	0.8%	1.8	0.2%	5.1	0.6%	1.9	0.2%	0.8	0.1%	0.7	0.1%
Total SE [f]			**6.1**	**0.1%**	**10.1**	**0.1%**	**6.2**	**0.1%**	**3.2**	--	**3.1**	--
Total YB [f]			**75.1**	**0.2%**	**103.2**	**0.3%**	**140.0**	**0.3%**	**11.8**	--	**11.6**	--

Values that are greater than zero but less than 0.1 are noted with a dash (--).

Shaded cells indicate the habitat is not present within area considered for impact analysis.

[a] Source information for habitat preferences of pre-nesting SE based on Monte Carlo analysis in Tables 5 and 8 of Johnson et al. 2013
Source information for habitat preferences of nesting and brood-rearing YB based on Monte Carlo analysis in Tables 11 and 16 of Johnson et al. 2013

[b] ESA-listed Threatened bird species analyzed for habitat preferences/use: Spectacled Eider (SE)

[c] Yellow-billed loon (YB) was an ESA candidate species until the October 1, 2014 USFWS decision that the listing of the yellow-billed loon was not warranted under the ESA.

[d] Note that 5.842.4 acres (5 percent) of the project study area extends outside of the habitat map coverage. All the project facilities under all action alternatives are within areas of mapped vegetation.

[e] Total acreage in project study area, inclusive of mapped and not mapped portions = 116,447.7 acres

[f] Percentages listed in Total for both SE and YB is the total high-value habitat impacted for each species divided by the total high-value habitat available within the project study area (YB= 41,065.3 acres ; SE= 6,926.9 acres).

There is no designated critical habitat for the spectacled eider on the North Slope. Data collected in multi-year surveys indicate the spectacled eider is present in the project study area: with the species occurring in high concentrations on the Colville River delta, and north of Nuiqsut. Habitats utilized by the spectacled eider adjoin the conceptual location of the major components proposed in the GMT1 development action alternatives (e.g., CD5-GMT1 road, GMT1 pad, pipeline, and airstrip. The spectacled eider could be impacted by the proposed project under all action alternatives as a result of habitat loss and alteration, disturbance and displacement, obstruction of movement, various sources of mortality (e.g., vehicle collisions, nest predation), or spills.

Construction

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality under any of the action alternatives would occur during the construction phase.

Habitat Loss and Alteration

Spectacled eiders and their habitat could be impacted during construction by habitat loss and alteration, disturbance and displacement, and mortality.

Long-term spectacled eider habitat loss and alteration would occur during and as a result of construction. Construction activity including gravel extraction and fill placement for roads, pads and airstrips would occur primarily during over the winter (for two years), when spectacled eiders have already migrated to wintering grounds. Areas covered by gravel fill during construction would be lost to use by spectacled eiders. This loss of habitat would continue through the duration of the construction and operations of the project, and would be permanent unless habitat restoration measures were successfully implemented after abandonment of the infrastructure (BLM 2012, § 4.3.8.2, p. 170).

In addition to permanent spectacled eider habitat loss, temporary loss of habitat associated with gravel placement could occur on tundra adjacent to gravel structures, where accumulated snow from snow-plowing activities or snowdrifts would become compacted and lead to a delayed snowmelt. Delayed snowmelt persisting into the nesting season could preclude spectacled eiders from nesting in those areas (BLM 2012, § 4.3.8.2, p. 171).

Tundra ice roads would cause temporary spectacled eider habitat loss and alteration because ice roads can remain in place until after eiders have arrived in the general project study area. Ice roads also compress the vegetation, especially standing dead vegetation that might be used by spectacled eiders for concealment. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (Corps 2012, § 5.9.3.1, p. 5-221).

Relatively slow melting ice roads could act as temporary dams, causing impoundments of water. Impoundments created by ice roads or gravel structures could be ephemeral (drying up early during the summer) and could cause temporary or permanent flooding on adjacent tundra, or they could become permanent water bodies that would persist from year to year. Hydrological impacts along roads and pads, such as impoundments are discussed in Section 4.2.2, *Water Resources*, and depicted in Map 4.2-1. Tundra covered by impounded water could result in a loss of nesting and foraging habitat for spectacled eiders. However, impoundments could also create new feeding and brood-rearing habitat that could be beneficial (BLM 2012, § 4.3.8.2, p. 172).

Water withdrawal from lakes during ice road construction has the potential to lower the level of lakes and affect spectacled eiders that use adjacent habitats, particularly small islands and shoreline areas that may be used for nesting. Changes in the surface levels of lakes due to water withdrawal would depend on the amount of water withdrawn, volume of the lake, and recharge rate. There is also potential for impacts to spectacled eiders resulting from potential impacts to invertebrate and fish food resources from varying winter water levels if pumped lakes do not fully recharge (BLM 2012, § 4.3.8.2, p. 171).

Displacement and Disturbance

Gravel mining and placement of gravel fill would occur during winter when spectacled eiders are not present. Road work such as grading, compacting, and reshaping of roads and pads would occur during summer when these birds are present. The noise and vehicle traffic during these activities would likely disturb and displace spectacled eiders away from gravel roads, pads and airstrips. Disturbance would cause the spectacled eiders to expend energy in responding, although it may not necessarily reduce their survival or productivity (Corps 2012, § 5.9.3.1). Noise would likely cause the greatest disturbance to spectacled eiders between June 1 and July 15 when they would be on nests and would be unable to move away from the disturbance (Corps 2012, § 5.9.3.1).

Some spectacled eiders that may have nested at sites previously not covered by gravel could be displaced and move to adjacent areas to nest. Johnson et al. (2003a) reported that waterfowl nesting near the Alpine oil field that were displaced from nesting sites by gravel placement probably moved their nests to nearby adjacent habitats. In addition, there may be a functional loss of habitat in areas near roads, pads, and airstrips, if development-related disturbances preclude spectacled eiders from utilizing these habitats.

Noise and visual cues from air traffic could disturb spectacled eiders. Responses to aircraft could potentially include alert and concealment postures, interrupted foraging behavior, flight, and a reduction in nest attendance (Corps 2012, § 5.9.3.1). The impacts of routine aircraft flights could range from avoidance of certain areas to abandonment of nesting attempts or lowered survival of young. The potential impact to spectacled eiders from aircraft noise would probably be greatest during the nesting period when the movements of incubating birds are restricted and birds may be energetically stressed and sensitive to disturbance (BLM 2012, § 4.3.8.2, p. 176).

Aircraft noise levels would be highest during take-offs and landings, and most aircraft-related disturbance would be concentrated around an airstrip for brief time periods. Disturbance may also increase as a function of flight frequency, and spectacled eiders in areas that experience many flights may experience larger disturbance impacts than those in areas with few flights. The behavioral response of spectacled eiders to aircraft disturbances near the existing and planned airstrips (see Chapter 2, *Proposed Project and Alternatives*) would not necessarily result in lowered nest success. Johnson et al. (2003a) reported that birds nesting in proximity to the Alpine oil field airstrip, including tundra swans and yellow-billed loons, were not negatively affected by aircraft operations at that time.

Although the potential exists for displacement of some nesting spectacled eiders near routinely used airstrips, as a result of numerous over-flights, landings, and takeoffs, some eiders may habituate to routine aircraft traffic. Within the project study area, the duration of flights would be short and occur in a specific area. Although likely to cause disturbance to spectacled eiders, depending on the time of year disturbance from aircraft traffic may be minimal.

However, disturbance to spectacled eiders could also result in temporary or permanent displacement from high-value habitats, potentially resulting in decreased nesting and nest attendance, nest abandonment, nest predation, and increased energy expenditures that could affect an individual eider's survival or reproduction (BLM 2012, § 4.3.8.2, p. 176). Disturbances could displace spectacled eiders from feeding habitats and negatively impact energy budgets. Disturbances would impact spectacled eiders during the entire time that they would be using the project area, although the impacts may vary depending on reduced forage opportunity during nesting if the disturbance causes the eider on the nest to leave the nest exposing the nest to an increased rate of predation, and during brood-rearing when some eiders exhibit higher rates of alertness in areas near roads than do birds in undisturbed areas. Some evidence suggests that pedestrian traffic may have a greater impact on some species of birds than vehicular traffic (BLM 2012, § 4.3.8.2, p. 173). The mitigation measure of hazing birds at or near airstrips would likely result in temporary disturbance and possible displacement of spectacled eiders.

Mortality

Spectacled eider mortality could result from collisions with vehicles, aircraft, or structures, or predation, as described in Section 4.3.3, *Birds*. Minor impacts could be sustained, but are unlikely, due to the low density of spectacled eiders in the project study area.

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Spectacled eiders may collide with structures necessary for operation such as communication towers, flare towers, buildings, antenna guy-wires, and elevated pipelines. Descriptions of such structures associated with GMT1 are included in Section 2.4.2, *Drill Site Design and Facilities*. Satellite dishes, elevated radio antennae, and radio repeater sites would also add potential collision hazards. Although bird collisions with oil field structures are expected to be infrequent, some collisions and resultant mortality to some spectacled eiders are probable.

Bird collision events with infrastructure during poor weather conditions are rare and episodic, but would have the potential to occur for the life of the project (long term). Facilities would always be lighted, a situation which can attract birds (Corps 2012, § 5.9.3.1). Poor visibility due to fog and low light conditions, which are common in the project study area (See Section 3.2.3.1, *Climate and Meteorology*) would contribute to the risk of collisions with infrastructure. The potential for impact is lessened by the mitigative measure of downward shielded.

Vehicle traffic on infield gravel roads poses the greatest threat to birds during the summer, when the largest numbers of spectacled eiders are present in the project study area, possibly resulting in bird collision mortality. Overall, collision mortality is generally thought to be low within North Slope oil fields, although this is poorly documented (Corps 2012, § 5.9.3.1).

Predation

Ravens, gulls, Arctic fox and red fox, bears, and other predators may be attracted to areas of human activity where anthropogenic sources of food and shelter are present. Survival of these predators could increase due to the availability of anthropogenic food sources. Other food sources for predators can arise from roadkill on new roads creating opportunities for scavenging predators. BLM has included recommendations for a roadkill monitoring and reporting system in Section 4.7, *Mitigation Measures and Monitoring*. Increased levels of bird and egg predation due to elevated numbers of predators could, in turn, impact spectacled eider populations over time (BLM 2012, § 4.3.8.2, p. 177).

In recent years, oil field operators have installed predator-proof dumpsters at camps and implemented new refuse handling techniques to minimize the attraction of predators. In addition, oil field workers undergo training to make them aware of the problems associated with feeding wildlife. At the Alpine oil field, Johnson et al. (2003a) reported that ravens (a predatory species) were rarely observed in the area prior to development of infrastructure, but were commonly observed after development with nests confirmed in 2000 and 2001. Although ravens were commonly observed after the construction of the Alpine development, Johnson et al. (2003a) reported no post-development increase in predation rates of waterfowl nests.

Drilling and Operation

Habitat Loss and Alteration

After initial placement of gravel to construct roads, pads and airstrips in the project study area, some habitat alterations from the indirect impacts of snowdrifts, dust fallout, thermokarst, and ponding could continue during project operation as described in Section 4.3.3.1, *Construction*. An oil spill could impact spectacled eiders using terrestrial or aquatic habitats. Potential impacts to spectacled eiders would depend on the location and size of the spill, and on the time of year. An oil discharge in nesting or brood rearing habitat could impact spectacled eiders that might congregate in these areas. Impact from spills is addressed in Section 4.5, *Impacts of Oil, Saltwater, and Hazardous Material Spills*.

Disturbance and Displacement

The types of disturbance and displacement impacts that occur during construction would continue through the drilling and operations phases, including noise and visual cues from vehicles, aircraft, pedestrians, bird hazing (as a mitigation measure), and other disturbances. However, in general, vehicle and aircraft traffic would significantly reduce after construction is complete.

The potential displacement of spectacled eiders caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase; the impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives except Alternative D2, which would be seasonal only from 2016 to 2023 (year-round operations for D2 commence in 2023 through the life of the project; Table 2.9-5).

Oil spill response training activities using watercraft could be conducted on rivers and lakes during the open-water season. Spill response training activities would have the potential to disturb foraging, nesting, or brood-rearing spectacled eiders.

Mortality

Overall, the potential mortality impact to spectacled eiders is considered minor for all the action alternatives. There would be no mortality impacts under Alternative E.

The potential for mortality such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and more spectacled eiders are present in the project area. Mortality impacts that occur during construction of this project, such as collisions with infrastructure would continue through the drilling and operations phase of the project.

Predation

Increased predation on nests from predators attracted to development is a concern for spectacled eiders nesting in the GMT1 project study area. Predators such as fox, bear, and predatory birds are attracted to the increased scavenging opportunities associated with development and humans.

Abandonment and Reclamation

Abandonment and reclamation of project facilities may involve removing gravel pads, roads and airstrip or alternatively leaving these (or some facilities) in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Winter activities would cause little disturbance or displacement, because most spectacled eiders would be absent from the area. Depending on the types of abandonment and reclamation that actually occurs, summer road and air traffic could cause disturbance, displacement, and mortality to spectacled eiders that would be similar in type, but at potentially lower intensity levels and for shorter durations than caused by traffic during the construction and operations phases.

Gravel pads, roads, and airstrips that are not revegetated would have diminished value to most birds in general. Revegetation without gravel removal would not return the site to its current utility for most birds. If gravel was removed, habitat similar to that currently existing in the area could be created and used by birds, although the precise mix of habitat types would likely not be the same as what prevailed at the time of disturbance (BLM 2012, § 4.3.8.2, p. 179).

Comparison of Alternatives

Comparison of alternatives for bird species known to occur in the project area is presented in Section 4.3.3.3. This following text incorporates information in Section 4.3.3.3 and includes specific information regarding the spectacled eider in this context.

Habitat Loss and Alteration

Spectacled eiders utilize wet, aquatic, and halophytic habitats (saline) during breeding, employing islands, peninsulas, shorelines, hummocks in wet meadows, and polygon rims as nesting habitat. Each action alternative would impact small amounts of wet, aquatic, and halophytic habitat types. Eight such high-value spectacled eider habitat types occur in the project study area and were analyzed for potential direct gravel footprint impacts, and indirect impacts of gravel/dust within 300 feet of footprints (Tables 4.3-20 and 4.3-21, respectively).

Potential loss and alteration of spectacled eider habitat resulting from direct gravel placement under all action alternatives is less than 0.1 percent of any of the four high-value habitats directly impacted (Table 4.3-20). With all spectacled eider high-value habitats (6,926.9 acres total within the project study area) analyzed for direct gravel footprint, only Alternatives D1 and D2 would impact an area greater than 0.1 acre (0.8 acre impacted). Alternatives A, B, and C would all have less than 0.1 acre of direct impact to spectacled eider habitat. There would be no habitat impacts from direct gravel placement under Alternative E, No Action.

Indirect impacts from gravel (based on a 300-foot zone extending out from gravel fill) to spectacled eider high-value habitat are less than one percent of each of the four high-value habitats analyzed under each of the action alternatives (Table 4.3-21). With all spectacled eider high-value habitats combined and analyzed for indirect gravel/dust impacts, none of the action alternatives exceed one percent of the total impacted area (6,926.9 acres total within the project study area; Table 4.3-21). There would be no indirect habitat impacts sustained under Alternative E, No Action.

Disturbance and Displacement

Spectacled eider density in the majority of the GMT1 project study area (67 percent) is between 0 and 0.034 birds per km^2 (Table 3.3-16). Given that a low density of spectacled eiders are present in the project study area, few spectacled eiders would potentially be affected by any of the action alternatives. Project-related activities during the summer when spectacled eiders are present would have the highest potential to disturb or displace birds near gravel roads, pads, and airstrips. Summer activity in Alternatives A, B, and C would include vehicle traffic on the CD5-GMT1 road (year-round use for the life of the project). Summer activity for Alternative D1 would be characterized by increased aircraft traffic during the non ice-road season to access the GMT1 pad (vehicle access is seasonal by ice road). Summer activity for Alternative D2 would be minimal (drilling only during ice road season), if any, during drilling; however, once operation (i.e., production) begins (Year 5), there would be increased aircraft traffic during the non ice-road season to access GMT1 pad for year-round operation for the life of the project.

All action alternatives are expected to have overall low intensity of disturbance and displacement impacts to spectacled eiders. Alternatives A, B and C would all result in industrial and local vehicle traffic in the area. Alternatives A and C, share a common section of the CD5-GMT1 road and disturbance and displacement impacts to spectacled eiders from vehicle traffic on this section of the road would be similar for Alternatives A and C. Alternative C is designed to route additional traffic along the 5.8-mile Nuiqsut Spur Road for access to an improved airstrip in Nuiqsut (Section 2.5.5, *Access*). The CD5-GMT1 road as designed in Alternative B is slightly longer than in Alternative A and is routed through more potential high-value habitat than the other action alternatives (Table 4.3-8). Alternatives D1 and D2 do not include a gravel road across the tundra (as in Alternatives A, B, and C) and instead involve seasonal vehicle traffic traveling across the tundra on ice roads. Spectacled eiders would only be expected in the area from June through October.

Mortality

Overall, the potential mortality impact to spectacled eiders is considered minor for all the action alternatives. There would be no mortality impacts under Alternative E.

Predation

The GMT1 Project could increase the numbers of predators in the area, which could result in increased predation of spectacled eiders and their nests, similar to that described in Section 4.3.3.1 *(Construction, Birds)*. Spectacled eider densities are low in the project study area and predation impacts from the GMT1 Project are unlikely to occur. Overall, the potential predation impact to spectacled eiders is considered minor for all the action alternatives. There would be no additional predation impacts under Alternative E.

Conclusion

Given that a low density of spectacled eiders are present in the project study area, few spectacled eiders would potentially be affected by any of the action alternatives. Spectacled eiders, however, are considered a unique resource given their threatened status under the ESA.

Overall, Alternatives A, B, C, D1, and D2 are predicted to have habitat loss and alteration rated as being of low intensity, long-term duration, and local extent (Table 4.3-19). However, D1 and D2 impacts from air traffic could extend into adjacent areas beyond the project study area, depending on the flight paths for airstrip approach and altitudes, resulting in a limited, regional level extent of impact.

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality to spectacled eiders under any of the action alternatives would occur during the construction phase. Levels of disturbance, displacement would continue into development and drilling phases, but generally would significantly reduce after construction is complete. There would be no additional impacts under Alternative E.

Potential loss and alteration of spectacled eider habitat from placement of gravel on tundra for roads and pads could result in long term, potentially permanent habitat loss, especially if habitat restoration after the development is complete is unsuccessful. Local impacts resulting from direct gravel placement under all action Alternatives would amount to less than the 5 percent low intensity threshold (less than 0.1 percent of each high-value habitat would experience impacts; Table 4.3-20). Alternative D1 and D2 would directly impact the greatest amount (0.8 acre) of high-value spectacled eider habitat.

Potential indirect impacts to spectacled eider high-value habitat under all action alternatives would be long-term and would amount to less than the 5 percent low intensity threshold (less than 1 percent of each high-value habitat analyzed; Table 4.3-21).

Summer fixed-wing or helicopter aircraft activity in support of the GMT1 Project, including related research, could result in disturbance to birds, causing temporary or permanent displacement from high-value feeding, nesting, or brood-rearing habitats in localized areas near areas of activity. All action alternatives are expected to have overall low intensity of disturbance and displacement impacts to spectacled eiders based on impacts to suitable habitat within the proposed development. Disturbance and displacement would only occur during summer months when eiders are present in the region.

Overall, the potential mortality, including predation, impact to spectacled eiders is considered minor for all the action alternatives.

Although impacts to spectacled eiders could occur as a result of the action alternatives, long-term studies of bird density and abundance in the Prudhoe Bay oilfield, located on the ACP, indicate that oil production, as practiced in Prudhoe Bay, does not necessarily lead to substantial declines in bird density or productivity in or near the developed area (Bart et al. 2013).

4.3.5.3 Yellow-Billed Loon

Impacts to yellow-billed loons from construction, drilling and operation within the project study area are discussed in (BLM 2004 § 4A 3.3.1 and BLM 2012 § 4.3.11.2). Results from these previous analyses are incorporated into this section and a comparison of alternatives with regard to project activities and infrastructure is provided, as well as conclusions regarding impacts to yellow-billed loons.

As indicated by the impact criteria (Table 4.3-18), this evaluation primarily utilizes habitat to make impact rating determinations. Potential high-value habitats, along with their areas of potential direct and indirect impact are listed for yellow-billed loon in Table 4.3-20 and Table 4.3-21, and were selected using statistical analysis which identified species preference for select habitat types within the ASDP and Colville River delta (Johnson et al. 2013).

As shown in Map 4.3-1, USFWS aerial survey data indicates there is a concentration of yellow-billed loons associated with the lake area upstream from the confluence of the Tiŋmiaqsiġvik

(Ublutuoch) River with Judy Creek (USFWS 2010b). Deep water lakes containing fish are high-value yellow-billed loon habitat. Several deep water lakes with fish are located within the general project study area and within the larger cumulative impacts evaluation area; none of these lakes are in close proximity (e.g., within 0.5 mile) to proposed facilities for GMT1 under the action alternatives.

There is no designated critical habitat for the yellow-billed loon on the North Slope. Multi-year surveys show the yellow-billed loon is present in the project study area (Map 4.3-2; Section 3.3.5.3). Yellow-billed loons occur in highest concentration westward from the project study area, between the Meade and Ikpikpuk rivers. Habitats utilized by the yellow-billed loon adjoin the conceptual location of the road, production pad, and pipeline system for GMT1. The yellow-billed loon could be impacted by the proposed project under all action alternatives as a result of habitat loss and alteration, disturbance and displacement, obstruction of movement, oil spills, and various sources of mortality (e.g., vehicle collisions, nest predation).

Construction

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality under any of the action alternatives would occur during the construction phase.

Habitat Loss and Alteration

Yellow-billed loons and their habitat could be impacted during construction by habitat loss and alteration, disturbance and displacement, and mortality.

Long-term yellow-billed loon habitat loss and alteration would occur during construction. Construction activity including gravel extraction and fill placement for roads, pads, and airstrips would occur primarily over the winter, when yellow-billed loons have migrated to wintering grounds. Areas covered by gravel fill during construction of roads, pads, and airstrips would be lost to use by yellow-billed loons. This loss of habitat would continue through the duration of the construction and operations of the project, and would be permanent unless habitat restoration measures were successfully implemented after abandonment of the infrastructure (BLM 2012, § 4.3.8.2, p. 170).

Tundra ice roads would cause temporary yellow-billed loon habitat loss and alteration. Few yellow-billed loons would be present in the area during ice road season. Ice roads can remain in place until after yellow-billed loons have arrived within the general project study area. Ice roads also compress the vegetation, especially standing dead vegetation that might be used by yellow-billed loons for concealment. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (Corps 2012, § 5.9.3.1).

Relatively slow melting ice roads could act as temporary dams, causing impoundments of water. Impoundments created by ice roads or gravel structures could be ephemeral (drying up early during the summer) and could cause temporary or permanent flooding on adjacent tundra, or they could become permanent water bodies that would persist from year to year. Hydrological impacts along roads and pads, such as impoundments are discussed in Section 4.2.2, *Water Resources*, and depicted in Map 4.2-1.

Water withdrawal from lakes during ice road construction has the potential to lower the level of lakes and affect yellow-billed loons that use adjacent habitats, particularly small islands and shoreline areas that may be used for nesting. Changes in the surface levels of lakes due to water withdrawal would depend on the amount of water withdrawn, the volume of the lake, and the recharge rate. There is also potential for impacts to yellow-billed loons resulting from potential impacts to invertebrate and fish food resources from varying winter water levels if pumped lakes do not fully recharge (BLM 2012, § 4.3.8.2, p. 171).

Displacement and Disturbance

Gravel mining and placement of gravel fill would occur during winter when yellow-billed loons are not present. Road work such as grading, compacting, and reshaping of roads and pads would occur during summer when these birds are present. The noise and vehicle traffic during these activities would likely disturb and displace yellow-billed loons away from gravel roads, pads, and airstrips. Disturbance would cause the yellow-billed loons to expend energy in responding, although it may not necessarily reduce their survival or productivity (Corps 2012, § 5.9.3.1). Noise would likely cause the greatest disturbance to yellow-billed loons between June 1 and July 15 when they would be on nests and would be unable to move away from the disturbance (Corps 2012, § 5.9.3.1). Construction-related disturbances to birds, in general, are also discussed in BLM (2004, § 4F.3.3, pp. 1138-1140).

Some yellow-billed loons that may have nested at sites previously not impacted by development could be displaced and move to adjacent areas to nest. Johnson et al. (2003a) reported that yellow-billed loons (and tundra swans) nesting near the Alpine oil field that were displaced from nesting sites by gravel placement probably moved their nests to nearby adjacent habitats. In addition, there may be a functional loss of habitat in areas near roads, pads, and airstrips, if development-related disturbances preclude yellow-billed loons from utilizing these habitats. Impacts related to habitat loss may be more severe for yellow-billed loons which have specific habitat requirements (USFWS 2009b).

Noise and visual cues from air traffic could disturb yellow-billed loons. Responses to aircraft could potentially include alert and concealment postures, interrupted foraging behavior, flight, and a reduction in nest attendance (Corps 2012, § 5.9.3.1). The impacts of routine aircraft flights could range from avoidance of certain areas to abandonment of nesting attempts or lowered survival of young. The potential impact to yellow-billed loons from aircraft noise would probably be greatest during the nesting period when the movements of incubating birds are restricted and the molting period when, in addition to being a period of restricted movements, birds may be energetically stressed and sensitive to disturbance (BLM 2012, § 4.3.8.2, p. 176).

Aircraft noise levels would be highest during take-offs and landings, and most aircraft-related disturbance would be concentrated around an airstrip for brief time periods. Disturbance may also increase as a function of flight frequency, and yellow-billed loons in areas that experience many flights may experience larger disturbance impacts than those in areas with few flights. The behavioral response of yellow-billed loons to aircraft disturbances near the existing and planned airstrips (see Chapter 2, *Proposed Project and Alternatives*) would not necessarily result in lowered nest success. Johnson et al. (2003a) reported that birds nesting in proximity to the Alpine oil field airstrip, including yellow-billed loons (and tundra swans), were not negatively affected by aircraft operations at that time.

Although the potential exists for displacement of some nesting yellow-billed loons near routinely used airstrips, as a result of numerous over flights, landings, and takeoffs, some yellow-billed loons may habituate to routine air traffic. Within the project study area, the duration of flights would be short and occur in a specific area and although likely to cause disturbance to yellow-billed loons if they are, depending on the time of year that disturbance may be minimal.

However, disturbance to yellow-billed loons could result in temporary or permanent displacement from high-value habitats, potentially resulting in decreased nesting and nest attendance, nest abandonment, nest predation, and increased energy expenditures that could affect an individual yellow-billed loon's survival or reproduction (BLM 2012, § 4.3.8.2, p. 176). Disturbances could displace yellow-billed loons from feeding habitats and negatively impact energy budgets. Disturbances would impact yellow-billed loons during the entire time that they would be using the project area, although the impacts may vary depending on reduced forage efficiency during nesting if the disturbance causes the yellow-billed loon on the nest to leave and expose the nest to an increased rate of predation, and during brood-rearing when some yellow-billed loons exhibit higher rates of alertness in areas near roads than do birds in undisturbed areas. Some evidence suggests that pedestrian traffic may have a greater impact on some species of birds than vehicular traffic (BLM 2012, § 4.3.8.2, p. 173). The mitigation measure of hazing birds at or near airstrips would likely result in temporary disturbance and possible displacement of yellow-billed loons.

Oil spill response training activities using watercraft could be conducted on rivers and lakes during the open-water season. Spill response training activities would have the potential to disturb foraging, nesting, or brood-rearing yellow-billed loons.

Mortality

Overall, the potential mortality impact to yellow-billed loons is considered minor for all the action alternatives. Yellow-billed loon mortality could result from collisions with vehicles, aircraft, structures, or predation, as described in Section 4.3.3, *Birds*. Minor impacts could be sustained, but are unlikely.

The potential for mortality such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and large numbers of yellow-billed loons are present in the project area. Mortality impacts that occur during construction of this project, such as collisions with infrastructure would continue through the drilling and operations phase of the project.

Yellow-billed loons may collide with structures necessary for operation such as communication towers, flare towers, buildings, antenna guy-wires, and elevated pipelines. Descriptions of such structures associated with GMT1 are included in Section 2.4.2, *Drill Site Design and Facilities*. Satellite dishes, elevated radio antennae, and radio repeater sites would also add potential collision hazards. Although bird collisions with oil field structures are expected to be infrequent, some collisions and resultant mortality to some yellow-billed loons are probable.

Bird collision events with infrastructure during poor weather conditions are rare and episodic, but would have the potential to occur for the life of the project (long term). Facilities would always be lighted, a situation which can attract birds (Corps 2012, § 5.9.3.1*)*. Poor visibility due to fog and low light conditions, which are common in the project study area (see Section 3.2.3.1, *Climate and Meteorology*), would contribute to the risk of collisions with infrastructure. The potential for impact is lessened by the mitigative measure of downward shielded lighting.

Vehicle traffic on infield gravel roads poses the greatest threat to birds during the summer, when the largest numbers of spectacled eiders are present in the project study area, possibly resulting in bird collision mortality. Overall, collision mortality is generally thought to be low within North Slope oil fields, although this is poorly documented (Corps 2012, § 5.9.3.1).

Predation

Ravens, gulls, Arctic fox and red fox, bears and other predators may be attracted to areas of human activity where anthropogenic sources of food and shelter are present. Survival of these predators could increase due to the availability of anthropogenic food sources. Other food sources for predators can arise from roadkill on new roads creating opportunities for scavenging predators. BLM has included recommendations for a roadkill monitoring and reporting system in Section 4.7, *Mitigation Measures and Monitoring*. Increased levels of bird and egg predation due to elevated numbers of predators could, in turn, impact spectacled eider populations over time (BLM 2012, § 4.3.8.2, p. 177).

In recent years, oil field operators have installed predator-proof dumpsters at camps and implemented new refuse handling techniques to minimize the attraction of predators. In addition, oil field workers undergo training to make them aware of the problems associated with feeding wildlife. At the Alpine oil field, Johnson et al. (2003a) reported that ravens (a predatory species) were rarely observed in the area prior to development of infrastructure, but were commonly observed after development with nests confirmed in 2000 and 2001. Although ravens were commonly observed after the construction of the Alpine development, Johnson et al. (2003a) reported no post-development increase in predation rates of loon nests.

Drilling and Operation

Habitat Loss and Alteration

After initial placement of gravel to construct roads, pads and airstrips in the project study area, some habitat alterations from the indirect impacts of snowdrifts, dust fallout, thermokarst, and ponding could continue during project operation as described above (Section 4.3.3.1, *Construction*). An oil spill could impact yellow-billed loons using terrestrial or aquatic habitats. Potential impacts to yellow-billed loons would depend on the location and size of the spill, and on the time of year. Impact from spills is addressed in Section 4.5.

Disturbance and Displacement

The types of disturbance and displacement impacts that occur during the construction phase of this project would continue through the drilling and operations phase of the project, including noise and visual cues from vehicles, aircraft, pedestrians, bird hazing (as a mitigation measure), and other disturbances. The potential displacement of yellow-billed loons caused by the installation of infrastructure, including gravel fill, pipelines, and other facilities would continue through the drilling and operations phase; the impacts of physical displacement by these structures would be exacerbated by the addition of traffic noise and visual activity on and near these facilities. Potential for disturbance associated with drilling would be present year-round for all action alternatives except Alternative D2 which includes drilling only during the ice-road season.

Mortality

The potential for mortality such as direct collisions with ground vehicles would be highest during the drilling and operations phase of the summer season when traffic volume is high and large numbers of yellow-billed loons are present in the project area. Yellow-billed loons attracted to the roadside by altered habitat, described above, would be at risk of mortality by vehicle strikes (BLM 2012, § 4.3.8.2, p. 173). Mortality impacts that occur during the construction phase of this project, such as collisions with infrastructure would continue through the drilling and operations phase of the project.

An oil discharge in molting or brood rearing habitat could impact spectacled eiders that might congregate in these areas. Increased predation on nests from predators attracted to development is a concern for spectacled eiders nesting in the GMT1 project study area. Predators such as fox, bear, and predatory birds are attracted to the increased scavenging opportunities associated with development and humans.

Overall, the potential mortality impact to yellow-billed loons is considered minor for all the action alternatives. There would be no mortality impacts under Alternative E.

Abandonment and Reclamation

Abandonment and reclamation of project facilities may involve removing gravel pads, roads, and airstrip or alternatively leaving these (or some facilities) in place indefinitely. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or by allowing natural colonization. Winter activities would cause little disturbance or displacement, because most yellow-billed loons would be absent from the area. Depending on the types of abandonment and reclamation that actually occurs, summer road and air traffic could cause disturbance, displacement, and mortality to yellow-billed loons that would be similar in type, but at potentially lower intensity levels and for shorter durations than caused by traffic during the construction and operations phases.

Gravel pads, roads, and airstrips that are not revegetated would have diminished value to most birds in general. Revegetation without gravel removal would not return the site to its current utility for most birds. If gravel was removed, habitat similar to that currently existing in the area could be created and used by birds, although the precise mix of habitat types would likely not be the same as what prevailed at the time of disturbance (BLM 2012, § 4.3.8.2, p. 179).

Comparison of Alternatives

Comparison of alternatives for bird species known to occur in the project area is presented in Section 4.3.3.3. This following text incorporates information in Section 4.3.3.3 and includes specific information regarding the yellow-billed loon in this context.

Habitat Loss and Alternation

Potential loss and alteration of yellow-billed loon habitat resulting from direct gravel footprint under all action alternatives is less than 0.1 percent of any of the seven high-value habitats analyzed (Table 4.3-20). With all yellow-billed loon high-value habitats (41,065.3 acres total within the project study area) analyzed for direct gravel footprint, all action alternatives impact less than 0.1 percent of the total area. Alternative B impacts the greatest amount of the total yellow-billed loon habitat available at 10.9 acres (corresponding to less than 0.1 percent). There would be no habitat impacts from direct gravel placement under Alternative E.

Ice roads could cause temporary yellow-billed loon habitat loss and alteration. Ice roads remain in place until after most yellow-billed loons have initiated nesting, causing temporary nesting habitat loss. Ice roads also compress the vegetation, especially standing dead vegetation used for concealment by some nesting birds. Standing dead vegetation would require multiple growing seasons to reestablish, likely resulting in interim duration habitat alteration (Corps 2012, § 5.9.3.1).

In all of the action alternatives, deep water lakes in the project study area could be used for winter water withdrawals. Water withdrawal from lakes during ice road construction could lower the level of lakes and affect yellow-billed loons that use these habitats, particularly small islands and shoreline areas that are used for nesting.

Changes in the surface levels of lakes due to water withdrawal would be dependent on the amount of water withdrawn, the volume of the lake, and the recharge rate. There is also potential for impacts to yellow-billed loons due to potential impacts to invertebrate and fish food resources from varying winter water levels if recharge does not fully recharge pumped lakes (BLM 2012 § 4.3.8.2, p. 171). Lake surveys conducted prior to water withdrawal, limits on the amount of water that may be withdrawn from lakes due to Lease Stipulations, and the ability of lakes to naturally recharge, would likely negate any potential negative impacts related to water withdrawal.

Indirect impacts to yellow-billed loon high value habitat caused by gravel/dust (within 300 feet from gravel footprint) are less than the low intensity impact threshold (Table 4.3-19), 5 percent, to all seven high-value habitats analyzed. Sedge marsh is the single high-value habitat type that exceeds 1 percent, but less than 5 percent, at 16.5 acres under Alternative A, and 19.7 acres under Alternative B of the total available for each high-value yellow-billed loon habitat (1,055.1 acres of sedge marsh total within the project study area). With all yellow-billed loon high value habitats analyzed for indirect gravel/dust impacts (total of 41,065.2 acres of high-value habitat within the project study area), none of the action alternatives exceed one percent of the total area (see Table 4.3-21). There would be no indirect habitat impacts sustained under Alternative E, No Action.

Disturbance and Displacement

Project-related activities during the summer, when yellow-billed loons are present, would have the highest potential to disturb or displace birds near gravel roads, pads, and airstrips. In Alternative D2 (seasonal drilling), activity would be restricted to the ice-road season until year-round operation (i.e., production) begins. In the other action alternatives, drilling and operation would be conducted year-round.

Alternatives A, B, C, D1, and D2 are expected to have overall low intensity of disturbance and displacement impacts to yellow-billed loons. Alternatives A, B, and C may lead to increased vehicle traffic in the area, as some industrial and local traffic via the Nuiqsut Spur Road. Similarly, Alternatives D1 and D2 (without the CD5-GMT1 road) would have a greater intensity of potential disturbance and displacement impacts to yellow-billed loons due to aircraft noise than the other alternatives as described in 4.3.3.3, *Birds – Comparison of Alternatives*. There would be no disturbance or displacement impacts under Alternative E.

Predation

The GMT1 Project could increase the numbers of predators in the area, which could result in increased predation of yellow-billed loons and their nests, similar to that described in Section 4.3.3.1 (*Construction, Birds*). Overall, the potential predation impact to yellow-billed loons is considered minor for all the action alternatives. There would be no additional predation impacts under Alternative E.

Conclusions

Yellow-billed loons are no longer an ESA-listed species, but they remain an in context as an important resource (Table 4.3-19).

Overall, Alternatives A, B, C, and D1 and D2 are predicted to have habitat loss and alteration rated as being of low intensity, long-term duration, and local extent (Table 4.3-19). However, D1 and D2 impacts from air traffic could extend into adjacent areas beyond the project study area, depending on the flight paths for airstrip approach and altitudes, resulting in a limited, regional level extent of impact.

The majority of activity that would result in habitat loss, disturbance, displacement, and mortality to yellow-billed loons under any of the action alternatives would occur during the construction phase. Levels of disturbance, displacement would continue into development and drilling phases, but generally would significantly reduce after construction is complete.

Placement of gravel on tundra for roads and pads could result in long term, potentially permanent yellow-billed loon habitat loss, especially if habitat restoration after the development is complete is unsuccessful. Impacts resulting from placement of gravel on tundra under all action Alternatives amounts to less than the 5 percent low intensity threshold (less than 0.1 percent of any of the seven single high-value habitats analyzed would be impacted; Table 4.3-20). Indirect impacts to yellow-billed loon high value habitat caused by gravel/dust (within 300 feet from gravel footprint) are less than the 5 percent low intensity threshold to all seven high-value habitats analyzed and are considered long-term, for the life of the project (Table 4.3-21).

Activities related to the action alternatives, such as vehicle, aircraft, boat traffic, routine maintenance activities, heavy equipment use, facility noise, and oil spill cleanup activities, could cause disturbances that would affect birds. These activities could result in disturbance to birds, causing temporary or permanent displacement from high-value feeding, nesting, or brood-rearing habitats in localized areas near areas of activity.

Alternatives A, B, C, D1, and D2 are expected to have overall low intensity of disturbance and displacement impacts to yellow-billed loons. Alternatives A, B, and C may lead to increased vehicle traffic in the area, as some industrial and local traffic via the Nuiqsut Spur Road. Similarly, Alternatives D1 and D2 (without the CD5-GMT1 road) would have a greater intensity of potential disturbance and displacement impacts to yellow-billed loons due to aircraft noise than the other alternatives as described in 4.3.3.3, *Birds – Comparison of Alternatives*. Disturbance and displacement would only occur during summer months when yellow-billed loons are present in the region.

Overall, the potential mortality, including predation, impact to yellow-billed loons is considered minor for all the action alternatives.

Although impacts to yellow-billed loons could occur as a result of the action alternatives, long-term studies of bird density and abundance in the Prudhoe Bay oilfield, located on the ACP, indicate that oil production, as practiced in Prudhoe Bay, does not necessarily lead to substantial declines in bird density or productivity in or near the developed area (Bart et al. 2013).

4.3.5.4 Polar Bear

The potential impacts to polar bears are described in BLM (2004, § 4A3.4.2) and BLM (2012, § 4.3.11) and are summarized and incorporated in this section.

The Beaufort Sea coastline, creek and river drainages, and bluffs along lakes throughout the coastal area of NPR-A provide important areas for polar bear resting, feeding, denning, and seasonal movements. There have been no polar bear dens documented within a mile of the proposed infrastructure (for any of the action alternatives) (Map 3.3-14). In addition, the project study area is outside the area where den concentration is expected to be highest. However, den locations are not static, and polar bears have been known to den as far south as the project study area. Female polar bears have fidelity to denning habitat, but not specific denning sites (USFWS 2011b).

Impacts to polar bear could occur as a result of habitat loss or alteration, disturbance or displacement of denning females and cubs, incidental harassment of polar bears transiting the project study area, intentional hazing near occupied work sites, or mortality due to collisions or defense of life kills.

Incidental Take Regulations (ITRs), promulgated in August 2011 under the Marine Mammal Protection Act, authorized nonlethal, incidental, unintentional take of small numbers or polar bears for oil and gas-related activities in the Beaufort Sea and adjacent northern coast of Alaska (76 FR 47010). Under the ITRs, Letters of Authorization can be requested from industry to authorize the take of small numbers of polar bears and Pacific walrus incidental to the development and production operations associated with this project. Project stipulations require that no activities occur within one mile of known or suspected polar bear dens.

Construction

While no dens are known to occur in the project area at this time, man-made features may create suitable denning habitat, in addition to the topographic features that naturally occur. Denning habitat within/adjacent to infrastructure can be created through drifting of snow.

Polar bears also are attracted to infrastructure through the smell of food/food waste. While the GMT1 project area is fairly far inland, as ice becomes scarce, bears may move inland in search of food.

Some polar bear denning habitat may be lost as a result of construction. However, stipulations require that no construction activities occur within one mile of known or suspected polar bear dens, and alternative denning habitat is available.

The primary causes of impact to denning or non-denning polar bears would be related to noise caused by vehicle and aircraft traffic or construction activity. Non-denning polar bears could be attracted to or avoid the construction activity, depending on the individual bear.

Drilling and Operation

Impacts to denning or non-denning polar bears during drilling and operation would mainly be attributed to noise from vehicles, facilities, and aircraft (as described above for construction). Polar bears in the Beaufort Sea rarely venture far inland in the summer (Amstrup 2000). Therefore, they are unlikely to be affected by drilling and operations during the summer.

Drilling and operation would occur year-round in all action alternatives, except Alternative D2 (drilling during ice-road season only; operations year-round).

Comparison of Alternatives

All action alternatives could cause similar impacts to denning or non-denning polar bears during construction. Impacts (if any) during drilling and operation would be primarily during the winter (year-round activity for Alternatives A, B, C, and D1; seasonal drilling, then year-round operation for Alternative D2).

Habitat Loss and Alteration

Polar bears generally den in areas of topographic relief greater than 4.3 feet (e.g., along river and lake banks, coastal areas, and abandoned man-made gravel pads) where drifting snow accumulates early in the winter and provides adequate cover of snow throughout the denning season. Bears will generally select the leeward side of prevailing winds, and generally avoid human activity.

The proposed GMT1 pad location, most of the CD5-GMT1 road (Alternatives A, B, and C), and airstrip and occupied structure pad (Alternatives D1 and D2) is located more than 5 miles (9 km) from the coast of the Beaufort Sea, and thus out of the area where polar bears are more commonly reported.

Map 3.3-14 shows *potential* denning habitat within one mile of proposed infrastructure along the shores of lakes and along the banks of the Tiŋmiaqsiġvik (Ublutuoch) River. This map depicts an estimate of where topographic conditions might create an environment where snow depth is adequate for a polar bear to create a den.

Under all the action alternatives, habitat loss and alteration impacts to polar bears are expected to be minor. There would be no impacts under Alternative E, No Action.

Disturbance and Displacement

Denning female polar bears could potentially be disturbed by project-related activities as described for terrestrial mammals (see Section 4.3.4.1, *Terrestrial Mammals*). Denning polar bear females are sensitive to disturbance, and if disturbance occurs after establishing a den, abandonment of the den could occur and result in mortality of young.

Annual ice road construction could impact potential polar bear denning habitat; however, polar bear den detection methods (e.g., FLIR surveys) prior to road construction could identify den sites along the proposed route prior to construction, and dens would be avoided.

The presence of camps or human activity may attract polar bears to the project study area and could result in incidental or intentional harassment for the protection of the bears and human health and safety. BMP A-8 and USFWS LOA requirements on personnel training and harassment protocols should minimize this impact.

Potential disturbance and displacement impacts to polar bears would be minor for all the action alternatives. There would be no impacts under Alternative E.

Mortality

Polar bears could be killed by project-related activities as described for terrestrial mammals (see Section 4.3.4.1, *Terrestrial Mammals*), or in the event a large oil spill reached marine waters. Polar bear deaths resulting from vehicle collisions, ingestion of hazardous chemicals, and defense of life kills or other impacts are unlikely to occur. Waste management protocols at the work site, personnel training, and permit/lease stipulations are designed to minimize such occurrences.

Subsistence hunters may utilize the project study area; however, it is not expected this would result in an increased level of mortality to polar bears as the GMT1 Project does not increase access to areas where there are higher concentrations of polar bears (along the coastline). Subsistence take quotas are established under the Iñuvialuit-Iñupiat Polar Bear Management Agreement (76 FR 47021), and harvests are generally lower than the quota.

The potential mortality impacts to polar bears resulting from all the action alternatives are expected to be minor. There would be no impacts under Alternative E.

Mitigation

Specific measures to protect polar bears are provided in BLM 2013:

- BMP A-8 – Preparation and implementation of bear-interaction plans to minimize conflicts between bears and humans.
- BMP C-1 – Prohibition of heavy equipment within one mile of known or observed polar bear dens.

Conclusion

The potential impacts to polar bears resulting from all the action alternatives are expected to be minor, with negligible impacts on the population. There would be no impacts to polar bears under Alternative E.

4.3.5.5 Threatened and Endangered Species Evaluated but Unlikely to Sustain Impacts

Ringed Seals

Ringed seals prefer nearshore stable landfast ice or drifting pack ice and neither species is expected to occur in the Tiŋmiaqsiġvik (Ublutuoch) River or Fish Creek delta. Although conceptually it is possible that individual ringed seals could be present in locations where noise from construction activity could be perceived, the likelihood of their presence is remote, and the potential for disturbance is negligible.

Construction of the Tiŋmiaqsiġvik (Ublutuoch) River bridge will occur in winter, when no seals are expected to be present. Additionally, no bridge piers will be located within the main channel. Because the piers are not located in water, noise from installation would not carry to the same extent (distance) as if there was in-water construction activity.

No facilities or pipelines are proposed on or immediately adjacent to the marine coastal zone. Ringed seals are not likely to be in areas affected by the GMT1 Project. The sources of potential spills are generally small enough and far enough from marine waters that there would be no or very little impact to marine water quality or resources. As noted in Section 4.5, *Impacts of Oil, Saltwater, and Hazardous Material Spills*, the probability of a large spill to marine waters is very low. Manual and automated valves on both sides of the Tiŋmiaqsiġvik (Ublutuoch) River will be in place to control flow in the oil pipeline, and would substantially reduce the potential risk of an oil release to the river. The Tiŋmiaqsiġvik (Ublutuoch) River is a tributary of Fish Creek that flows north approximately 7 river miles, connecting to Fish Creek approximately 10 river miles upstream from Harrison Bay. The Tiŋmiaqsiġvik (Ublutuoch) River is a slow moving, meandering river, with many oxbows, allowing for opportunities to intersect the majority of oil before it could travel to Fish Creek, or farther to the Fish Creek delta.

The ringed seals that may occur seasonally along the coast of Harrison Bay could potentially be affected by a catastrophic spill from the pipeline. However, this is considered a highly unlikely event that would require very specific environmental conditions, including the presence of open water, as described in BLM (2012, § 4F.3.4.2) and BLM (2012, § 4.5.11.4).

Conclusion

Overall, the potential impacts to ringed seals as a result of the GMT1 Project are expected to be negligible. There would be no impacts to ringed seals under Alternative E.

Bowhead Whale

Bowhead whales migrate through the Beaufort Sea but generally do not occur in the nearshore waters north of the project study area. However, potential impacts are considered because of the ecological and cultural importance of the bowhead. Impacts to population, habitat, migration, foraging, breeding, survival, and mortality are not expected (BLM 2004, § 4.F.3.5.1).

There would be no marine transportation-related impacts (e.g., barging) to bowhead whales associated with the GMT1 Project, as there is no marine activity involved.

There are no potential impacts to bowhead whales expected to occur resulting from the GMT1 Project.

Other Species

As described in BLM (2012, § 3.3.7) the fin whale and humpback whale (both listed as endangered) do not occur in the project study area. The Pacific walrus (candidate) is also extralimital in the Southern Beaufort Sea (76 FR 47040, August 3, 2011), and there is very low probability of adverse impacts from the GMT1 Project. Potential impacts to these three species were described in BLM (2012, § 4.5.11.4), but due to the proposed GMT1 location within the NPR-A impacts are not further considered in this SEIS. However, it is noted that the fin whale, humpback whale, and Pacific walrus are subject to the same protective measures as other ESA or MMPA-listed species.

4.4 Social Systems

This section analyzes the potential impacts (“Environmental Consequences”) of the GMT1 project on Social Systems. The organization of this section follows that of Chapter 3’s description (*Affected Environment*) of social systems and thus includes cultural resources (including archaeological and traditionally used sites), socio-cultural systems, economic impacts, several aspects of current land use, subsistence, public health, and environmental justice.

4.4.1 Cultural Resources

The following is a discussion of potential environmental impacts for cultural resources from the GMT1 Project alternatives. For a discussion of cultural resources in the GMT1 project study area see Chapter 3, Section 3.4.1.

Direct impacts include any impact to a cultural resource that is caused by an action and occurs at the time of activity in the vicinity of the project. Indirect impacts to cultural resources include those impacts that are reasonably foreseeable, result from the action, and/or are later in time or further removed from the resource by distance (40 CFR 1508.8). In addition to an area of direct and indirect impacts, this analysis includes an additional area of effect for visual and noise impacts to cultural resources. Visual and noise impacts could be direct or indirect impacts, could occur over a larger area than other impacts, and could be temporary or cause lasting impacts to a resource.

For the analysis of impacts on cultural resources, three impact analyses areas are defined for the GMT1 Project:

- Direct impact analysis area is limited to the GMT1 Project footprint;

- Indirect impact analysis area consists of a 2.5-mile buffer surrounding the GMT1 Project footprint (also the project study area); and
- Visual and noise impact analysis area consists of a 5-mile buffer of the GMT1 Project footprint alternatives.

General discussion regarding direct and indirect impacts to cultural resources in the NPR-A are discussed by BLM (2012, §§ 4.3.12, 4.4.12, 4.5.12, 4.6.12, and 4.7.12). Impacts to cultural resources are also addressed in BLM (2004, § 4A.4.5). This analysis of potential impacts is tiered off of those documents but also considers any new or additional information. New and updated data relevant to analysis of impacts of GMT1 on cultural resources include:

- Updated AHRS and TLUI data.
- The Nuiqsut Cultural Landscape

The impact criteria for cultural resources are defined in Table 4.4-1. Each alternative has been evaluated to determine the potential impact levels of project activity on cultural resources.

Table 4.4-1. Impact Criteria – Cultural Resources

Impact Category	Magnitude	Definition
Intensity	High	A change in a cultural resource condition is measurable or observable, and an alteration to the cultural resource's function or cultural context is clearly and consistently observable.
	Medium	A change in a cultural resource condition is measurable or observable, and an alteration to the cultural resource's function or cultural context is detectable.
	Low	A change in cultural resource condition is perceptible, but it does not noticeably alter the cultural resource's function or cultural context.
Duration	Long-term	Impacts to cultural resources would cause a permanent change in the resource that would perpetuate even if the actions that caused the impacts were to cease.
	Interim	Impacts to cultural resources would be frequent or extend for longer time periods (an entire project season).
	Temporary	Impacts to cultural resources would be intermittent, infrequent, and typically last less than a month.
Context	Unique	The cultural resource is protected by legislation (other than the ESA) and the affected resource is depleted either within the locality or the region. The portion of the resource affected fills a distinctive cultural role within the locality or the region.
	Important	The cultural resource is protected by legislation (other than the ESA). The portion of the resource affected fills a distinctive cultural role within the locality or the region.
	Common	The cultural resource is considered usual or ordinary in the locality or region; it is not depleted in the locality and is not protected by legislation. The portion of the resource affected does not fill a distinctive cultural role within the locality or the region.
Geographic Extent	Statewide	Impacts would potentially extend beyond the SEIS project study area and region (e.g., ACP) to include the entire State of Alaska.
	Regional	Impacts would extend beyond a local area, potentially affecting cultural resources beyond the SEIS project study area.
	Local	Impacts to cultural resources would be limited geographically within the SEIS project study area; impacts would not extend to a broad region.

The analysis of impacts on cultural resources includes counts of AHRS and TLUI sites by alternative. In addition, the analysis of impacts addresses cultural resources from additional sources that contribute to the cultural landscape. Limitations of these data are that they may include duplicate features documented within or by other similar studies. Due to time constraints, differences in data collection methods, and location discrepancies, efforts were not made to reconcile duplicate features within and between data sources and counts of these features are not included in the environmental impacts analysis. However, these sources provide additional details and context regarding cultural resource sites in the project study area that are not available in the AHRS and TLUI databases, and the cultural landscape as a whole is addressed in the environmental consequences analysis.

For the GMT1 Project, direct impacts could occur in the project footprint during the construction and/or operation phase of the action. Examples of direct impacts to cultural resources could include physical destruction of or damage to all or part of a cultural resource, removal of the resource from its original location, change in the character of the resource's use or change of the physical features within the resource's setting that contribute to the importance of the resource, change in access to traditional use sites by traditional users, or loss of cultural identity with a resource. Examples of ground disturbing activities that could cause direct impacts during the GMT1 Project include excavation of gravel; construction and maintenance of gravel roads, pads, airstrips, bridges and culverts; construction of ice roads and pads; construction of VSMs for power lines and pipelines; and any other disturbance of the ground surface in the proximity of project components. Other activities and events that could cause direct impacts to cultural resources include damage caused by equipment during the construction, drilling, and operation phases of the project, and unanticipated accidents such as blowouts, spills, or fires and subsequent cleanup activities. BLM (2012, § 4.3.12.2) provides additional discussion of potential direct impacts to cultural resources associated with oil and gas exploration and development.

Indirect impacts to cultural resources for the GMT1 Project could occur in the 2.5-mile project study area around project footprints. Indirect impacts to cultural resources could occur throughout the construction and operation phases of the project and during project closure and reclamation. Examples of indirect impacts to cultural resources in the analysis area could include removal, trampling, or dislocation of cultural resources and culturally sensitive areas by personnel and visitors, complete or partial destruction of a site from erosion, melting permafrost, vibrations, or other landscape changes caused by GMT1 Project components; the loss of traditional meaning or importance of a resource or loss of cultural association with a resource; neglect of a resource that causes deterioration; and transfer, lease or sale out of federal ownership without proper restrictions.

The noise and visual impact analysis area for cultural resources extends 5 miles from proposed GMT1 Project components. This analysis area is based on descriptions of noise and visibility discussed in BLM (2004, §§ 3.2.3, 4A.2.3.3, 3.4.8, 4.4.8) and BLM (2012, § 3.4.9). Examples of lasting impacts to sites may include interrupted views such as direct views of project components from cultural resource sites; disruption of the natural landscape due to mining of gravel for project components; atmospheric pollution visible from cultural resource sites; and loss or degradation of viewshed features such as large caribou herds, clean snow, and clear lakes, streams, and ponds that could add meaning and importance to cultural sites. Noise impacts on cultural resource sites could include changes in ambient sounds near culturally sensitive areas during construction and operations.

Potential cumulative impacts from the GMT1 development are discussed in Section 4.6.

Alternative A

Construction and operation of the Alternative A would occur in the vicinity of known cultural resource sites. Table 4.4-2 summarizes the number of AHRS and TLUI cultural sites within each of the direct, indirect, and visual and noise impact analysis areas. No cultural resources listed in the AHRS or TLUI databases are located within the direct analysis area of Alternative A. Three cultural resource sites listed in the AHRS and TLUI databases are located within the indirect impacts analysis area for Alternative A; a site called Nanuq and two TLUI sites, Apqugaaluk and Tiŋmiaqsiġvik (Ublutuoch) River, which lack site descriptions. The Nanuq site was occupied during the 1920s; it consists of two sod houses, several storage pits, and a scattering of habitation debris. Twelve cultural resource sites listed in the AHRS and TLUI databases are within the 5-mile visual and noise impact analysis area for Alternative A. Cultural resource sites in this analysis area include the three sites described in the indirect buffer as well as Uyagagvit, a rocky beach on the Colville River where people have gathered stones for net sinkers and camped for multiple generations, and the Niglivik 2 settlement with at least one sod house, sod quarry, and cache pit. Additional cultural sites include four sites with the remains of sod houses and other habitation debris, at least two graves, and one site with a scatter of animal bones. In addition to previously documented cultural resources, unidentified cultural resources may also occur within unsurveyed areas of the proposed project. Unidentified cultural resources also be discovered in areas that have been previously surveyed, and these discoveries are addressed by inadvertent discovery protocols.

All project components associated with Alternative A overlap the Nuiqsut Cultural Landscape. As shown on Map 3.3-10, cultural activity occurs throughout the project study area with a heavy occurrence of travel routes, trails, and cultural sites overland area north and west of the community to Fish Creek and along the Nigliq Channel. Subsistence use areas encompass the entire project study area. Therefore, Alternative A will have both direct and indirect impacts on the Nuiqsut Cultural Landscape. Direct impacts to the Nuiqsut Cultural Landscape could include physical destruction or damage to the landscape through ground disturbing activity; restricted access to multi-generational camps, hunting areas, and travel routes used by Nuiqsut residents due to physical barriers and user avoidance of industrial areas; and the destruction or degradation of any, including unknown or unrecorded, cultural sites or areas through construction activities or incidents associated with project activities.

Indirect impacts of Alternative A to the Nuiqsut Cultural Landscape may include altering the way subsistence hunters access hunting and fishing areas away from the community (e.g., a shift from overland travel by snowmachine or four-wheeler to the use of roads); altering routes used to access hunting areas and to travel between villages, cabins, and camps; decreased use of the landscape in the vicinity of project components due to decreased availability of subsistence resources, and accompanying loss of cultural association with those areas; and gradual shifting of cultural activities away from areas within the cultural landscape due to avoidance of project components. Visual and noise impacts to the cultural landscape include disruptions to ambient noise levels caused by construction, operation, and reclamation of project components; changes to the viewshed due to project components; and the introduction of new landmarks associated with industrial infrastructure in culturally sensitive areas.

Table 4.4-2. Number of AHRS and TLUI Sites in GMT1 Analysis Areas by Alternative

Alternative	Direct Impact Analysis Area	Indirect Impact Analysis Area	Visual and Noise Impact Analysis Area	Total Number of Cultural Sites in Analysis Areas
Alternative A	0	3	12	12
Alternative B	0	3	12	12
Alternative C	0	4	17	17
Alternative D	0	5	16	16

All Alternatives overlap the Nuiqsut Cultural Landscape.

Alternative B

Construction and operation of Alternative B would occur in the vicinity of known cultural resources. Direct, indirect, and visual and noise impacts to cultural resources, including the Nuiqsut Cultural Landscape are similar to those identified for Alternative A. Table 4.4-2 summarizes the number of AHRS and TLUI sites within each of the direct, indirect and visual and noise impact analysis areas.

No cultural resources listed in the AHRS or TLUI databases are located within the direct analysis area of Alternative B. Three cultural resource sites listed in the AHRS or TLUI databases are located within the indirect impacts analysis area for Alternative B; these are the same three sites that are within the Alternative A indirect impact area discussed above. Twelve cultural resource sites listed in the AHRS and TLUI databases are within the 5-mile visual and noise impact analysis area for Alternative B; these are the same 12 sites within the Alternative A visual and noise impact analysis area discussed above. Impacts of Alternative B on the Nuiqsut Cultural Landscape are the same as those discussed under Alternative A.

Alternative C

Construction and operation of Alternative C would occur in the vicinity of known cultural resources. Direct, indirect and visual and noise impacts to cultural resources are similar to those identified for Alternative A. Table 4.4-2 summarizes the number of cultural sites (AHRS and TLUI) within each of the direct, indirect, and visual and noise impact analysis areas.

No cultural resources listed in the AHRS or TLUI databases are located within the direct analysis area of Alternative C. Four cultural resource sites are located within the indirect impacts analysis area for Alternative C. The four sites within the indirect impact area of this alternative include *Uyagagvit*, *Nanuq*, and *Niglivik* 2 that are described under Alternative A and *Napasalgun* which is described as a hunting and camping area. Seventeen cultural resource sites listed in the AHRS and TLUI databases are within the 5-mile visual and noise impact analysis area for Alternative C. In addition to 10 sites identified within the visual and noise analysis areas for Alternative A, the visual and noise analysis area for Alternative C also includes the ancestral Iñupiat sites of *Putu, Tirrabruaq*, and *Itkillikpaa,* traditional subsistence sites of *Nappaun, Ixaanibruaq*, and *Napasalgun,* and the undescribed *Tuibauraq* site. The site of *Putu* consists of two sod houses, a scattering of historic artifacts, and a portion of a whaling boat. *Tirrabruaq* consists of the remains of a well-documented 1920s settlement. *Itkillikpaa* is much larger than the other sites discussed and consists of at least 23 sod houses, a cemetery, storage pits, prehistoric artifacts, and modern subsistence debris. The sites of *Nappaun, Ixaanibruaq,* and *Napasalgun* are described as fishing, hunting and camping areas with the remains of one sod house reported at *Nappaun*. Impacts of Alternative C on the Nuiqsut Cultural Landscape are the same as those discussed under Alternative A.

Alternatives D1 and D2

Construction and operation of Alternatives D1 and D2 would occur in the vicinity of known cultural resources. Direct, indirect, and visual and noise impacts to cultural resources, including the Nuiqsut Cultural Landscape are similar to those identified for Alternative A. Table 4.4-2 summarizes the number of cultural sites (AHRS and TLUI) within each of the direct, indirect and visual and noise impact analysis areas. In addition to the impacts discussed above, additional impacts from increased air traffic associated with this alternative would occur. Potential impacts include indirect impact to culturally important hunting areas and sites through the deflection of subsistence resources, and additional visual and noise impacts to culturally sensitive areas important for their remoteness or silence.

No cultural resources listed in the AHRS or TLUI databases are located within the direct analysis area of Alternatives D1 and D2. Five cultural resource sites listed in the AHRS and TLUI databases are located within the indirect impact analysis area for Alternatives D1 and D2; these five cultural sites are also within the indirect impact analysis area of Alternative C and are described above. Sixteen cultural resource sites listed in the AHRS and TLUI databases are within the 5-mile visual and noise impact analysis area for Alternatives D1 and D2; these 16 cultural sites are also within the visual and noise impact analysis area of Alternative C and are described above. Potential visual and noise impacts are similar to those discussed under Alternative A; however, noise impacts may be higher under Alternatives D1 and D2 due to the increased air traffic associated with these alternatives in an area where air traffic was previously low.

Impacts on the Nuiqsut Cultural Landscape under Alternatives D1 and D2 are similar to those discussed under Alternative A. However, because of the increased air traffic under this alternative, impacts related to noise may be higher, negatively affecting residents' experiences while conducting cultural activities within the landscape.

Alternative E

No additional impacts to cultural resources would be expected under Alternative E (No Action).

Mitigation

Design and operational features described in Chapter 2 could help mitigate potential impacts to cultural resources. In addition to the protective measures of BLM (2013: E-13, I-1, K-1, K-2, L-1), and CPAI's built in design mitigation measures, the following measures are recommended for consideration in adopting mitigation to reduce impacts to cultural resources.

Potential New Mitigation Measure 1: Consultation for Cultural Resources

Objective: Ensure meaningful and complete surveys for cultural resources near the Nuiqsut area.

Requirement/Standard:

1. Conduct consultation or interviews with Nuiqsut residents regarding locations of previously unidentified cultural resources to help ensure that no unidentified cultural resources are adversely impacted by construction and operation activities and potentially assist in identifying the significance of sites and mitigating impacts.

2. For future cultural resource surveys, include knowledgeable Nuiqsut residents as cultural resources advisors during surveys prior to ground disturbing activity.

3. Conduct additional research with the community of Nuiqsut for further documentation and analysis of the Nuiqsut Cultural Landscape.

Summary and Comparison of Alternatives

Impacts on cultural resources are similar across all alternatives. When compared to Alternatives A and B, Alternatives C, D1, and D2 include five (Alternative C) and four (Alternatives D1 and D2) additional AHRS and TLUI sites within the indirect and visual and noise impact analysis areas. One of these additional sites is a large settlement containing numerous sod houses, a cemetery, storage pits, prehistoric artifacts, and modern subsistence debris. Alternatives D1 and D2 would have greater impacts related to noise due to the increased air traffic under these alternatives.

Although there are differences between the alternatives in terms of the number of cultural resources affected and the level of potential noise impacts, the nature and overall degree of impacts on cultural resources do not vary substantially by alternative. In contrast to the BLM (2004), the current analysis identifies that the intensity of potential impacts to cultural resources would be moderate, because the impacts to the cultural landscape would result in a detectable alteration. This is supported by the documentation and recent update of the Nuiqsut Cultural Landscape (SRB&A 2013a) and consideration of the impacts of the project on this cultural landscape, which had previously not been assessed in either BLM (2004, 2012).

4.4.2 Sociocultural Systems

Sociocultural systems on the North Slope, as described in Section 3.4.2, are based in large part on the family structure and cultural values of the community, with a particular emphasis on the relationship of the Iñupiat with the land and its resources. Potential impacts on sociocultural characteristics are described in BLM (2004, § 4F.4.1.1) and BLM (2012, §§ 4.5.14.2 and 4.5.21.1). Factors likely to affect sociocultural systems are:

- Employment Opportunities
- Increased or variable income
- Tensions related to the permitting process for GMT1
- Devaluation of the Nuiqsut cultural landscape
- Disruptions to subsistence activities and uses

Several aspects of sociocultural systems in Nuiqsut are affected by nearby oil development but are not likely to be impacted directly by GMT1 or to varying degrees by the GMT1 alternatives. For example, construction and operation of the proposed project is not expected to result in an appreciable temporary influx of new, non-resident workers and visitors to the community of Nuiqsut. Oil industry construction and operations personnel will be housed in temporary camps or at Alpine. Ice road construction personnel [employees of Nanuq and Arctic Frontier Construction (AFC)] will be housed in the Kuukpik Hotel in town and new adjacent camps and possibly in seasonal, in-town camps on ice pads. Interactions between Nuiqsut residents and oil industry workers will likely increase once residents begin to use the project-associated roads. Because industry will provide housing, food, health, and other services for oil industry workers, GMT1 is not expected to result in an appreciable increase in demand on community resources.

Negative sociocultural impacts of an influx of non-resident workers in North Slope communities have been documented and corroborated by resident testimony. Traditionally, industry policies on the North Slope have been designed to minimize the impacts associated with interaction between non-resident workers and residents (e.g., oil industry personnel are not permitted to shop at the local AC store in Nuiqsut). The rationale behind these policies has been to discourage fraternizing, drinking, or sexual relations between employees and younger residents and generally minimize the social impacts of nearby industry. It should be noted that some residents resent these policies and view them as a deterrent to intercultural understanding. This has been documented specifically regarding the situation in Nuiqsut in recent interviews with Nuiqsut residents (i.e., Leavitt 2014a) and through consultation with the Nuiqsut Tribal Council (NVN 2014b). These residents have expressed that they would appreciate it if employees were allowed to purchase merchandise at the store and engage with the community. There is some concern that segregation in the community exacerbates feelings of isolation for Natives who do work in the oil industry. Although cultural orientation programs for industry employees (and strict company policies prohibiting discrimination) are recognized as progress (SRB&A 2013c), BLM does not know of any research regarding the effectiveness of industry policies. Several residents consulted on GMT1 expressed that many of the non-resident workers understand little of Iñupiat culture, spread rumors about Native residents, give the impression that they own the camp, and act as though the relatively few Native employees are exotic intruders. Feelings associated with being an isolated minority in the oil fields are among the reasons that many eligible residents do not wish to continue working in the camps. The residents consulted believe that greater integration would allow non-resident employees to better understand Iñupiat culture and that this would lead to better social situations and thus greater local employment in the oil field industry.

Another result of nearby oil development is the annual ice road that connects Nuiqsut to the Dalton highway. Nuiqsut residents appreciate and support the connection to the Dalton Highway and urban centers that is provided annually to Nuiqsut during ice road season. There are clear social and economic benefits: residents are able to travel to communities on the road system with their own vehicles. This gives them much greater freedom logistically and economically to travel, visit friends and family and shop in places where groceries and other items are much less expensive and for items that are unavailable for purchase in Nuiqsut.

The connection the ice road provides also facilitates the importation to Nuiqsut and other NSB communities of alcohol and drugs. Alcohol and drugs are brought in to North Slope villages by a variety of methods throughout the year, but there is a definite increase in the bootlegging economy in Nuiqsut as well as the availability of drugs during the ice road season (NVN 2014b; Paskewitz 2014). According to the NSB police officer stationed in Nuiqsut, the biggest issue with the road is people traveling on to Barrow with drugs and alcohol (Paskewitz 2014).

The proposed development of GMT1 has increased social and political tensions between different population sectors and community institutions that either support or oppose aspects of development. Nuiqsut operated under a “Trilateral Agreement” between the Kuukpik Corporation, the NVN, and the City of Nuiqsut for several years. The agreement, with the basic tenet that the three entities spoke with one voice on issues of great concern to the community, ended over differing stands on leasing plans in the NPR-A (preferred Alternative B2 of the 2012 NPR-A IAP/EIS). The NVN wrote a letter to the Secretary of the Interior stating their position on leasing, that they had not been adequately consulted during DOI visits to the community, and clarifying that the Kuukpik Corporation did not speak for the NVN (NVN 2013). The NVN Tribal Council has stated that the Council is in no way affiliated with a lawsuit that questioned the Corps’ decision to allow construction of the CD5 bridge and road, but, because some of plaintiffs in that suit have also served as council members, this issue has contributed to impaired relations between community organizations. As an official tribal government with special expertise, the NVN is participating as a cooperating agency on the GMT1 SEIS. The forprofit village corporation, Kuukpik, is not permitted to participate as a cooperating agency under existing regulations; however, Kuukpik is eligible for government-to-government consultation pursuant to DOI Policy. Thus the GMT1 permitting process has brought or exacerbated issues of distrust between community organizations that, in a small and highly interconnected community, can cause multi-faceted layers of stress and anxiety.

In addition to intra-community conflict and tension, some residents of Nuiqsut express an amount of tension and conflict with other NSB communities and the NSB government associated with nearby oil development. A main source of frustration is that the NSB and other communities are eligible for and receive NPR-A impact mitigation funds through the State of Alaska, while some Nuiqsut residents believe that Nuiqsut should be eligible for the majority of those funds because they are the most impacted by development. Other issues involve perceptions on the part of other NSB residents that all Nuiqsut residents are extremely wealthy, while some Nuiqsut residents feel they have the highest cost of living on the North Slope and are the only NSB residents dealing with the negative impacts of development (URS Corporation 2005). Tension over competition for NSB infrastructure funds and other programs are not specific to Nuiqsut or to GMT1 but are heightened in Nuiqsut due to the relatively high-stakes development issues and the debate over GMT1.

As described under Economy in Chapter 3 and Chapter 4, the GMT1 Project will provide economic benefits for the community of Nuiqsut, for the Kuukpik Corporation, for ASRC, the NSB, and the State of Alaska. That section also provides an overview of how all residents of Nuiqsut benefit economically from development: in addition to employment opportunities, Nuiqsut residents pay a flat rate of $25/month for natural gas heating due to an agreement negotiated by Kuukpik Corporation that brought a natural gas pipeline to the community from Alpine. The Kuukpik Corporation and CPAI also regularly donate substantial amounts to various community groups and causes. A possible sociocultural impact related to a disparity of economic benefits is frustration among some residents of Nuiqsut that the Kuukpik Corporation, which is positioned to benefit financially from GMT1, has not extended its shares to Kuukpikmiut residents born since the corporation was established in 1973. The original ANCSA conferred benefits only to Natives who were alive at the time, but this restriction was later removed in an amendment. ANCSA's original division of Natives born before and after the settlement created two classes within families and communities, an issue that was deeply disturbing to many Alaska Natives (Berger 1985). This provision of ANCSA was seen as antithetical to Alaska Native traditions of sharing and threatened to exclude subsequent generations of Alaska Natives, commonly referred to as "afterborns," from their heritage. Although shares could still be acquired through inheritance, the total number of shares would not change, disparities would be unavoidable, and increasingly smaller divisions of the shares would reduce dividends to insignificance. It was foreseen that arguments over the rights of non-shareholders to use Native corporation-owned land would arise, and that the corporation would decide who had the rights while the rising generation would be excluded from decision-making. Division, rivalries, and dismay over this situation were already becoming apparent in Alaska in the 1980s (Berger 1985) and Alaska Natives, foreseeing increasing dissension and distrust in their communities, lobbied successfully to have ANCSA amended. Although it is economically rational for Kuukpik shareholders to maintain value in their stock by not diluting it, there is a degree of distrust of the village corporation partly due to this situation. This is not a situation unique to Nuiqsut, however these issues contribute to intra-community tension in Nuiqsut and the prospect of additional royalties accruing to Kuukpik Corporation from development of GMT1 could exacerbate them.

Comparison of Alternatives

Alternative A

Employment Opportunities

Alternative A would have positive impacts for employment opportunities for the community of Nuiqsut and associated non-economic sociocultural benefits. The ability to commute to work daily in personal vehicles via the existing Kuukpik Spur Road and the GMT1 road that would be constructed and to return home after a shift to be with family, attend social events, and participate in subsistence activities would be beneficial for current employees, potential employees, and the families of those employees. Currently, permanent employees in skilled positions are required to stay at work for two-week shifts and, unless it is ice road season, they are flown back to Nuiqsut for their days off. The community would like to have many more young people take advantage of the numerous seasonal or temporary jobs that do not require technical skills, however many of these jobs are available in the non-ice road season and young people are particularly averse to giving up their social lives for jobs. The road connection to GMT1 that would be provided under Alternative A would make employment at GMT1 (and any future connected facilities) significantly more acceptable for local residents. A strong community desire for this was cited in the 2005 Nuiqsut Village Profile: "*People should be able to come home from Alpine during the workweek*" (URS Corporation 2005).

Tensions Related to the Permitting Process for GMT1

The selection of an alternative for GMT1 will result in various social impacts that are associated with the process for permitting development, and it is anticipated that Alternative A or a similar development scenario would create negligible social and political tension. Anxiety over the continuous bureaucratic and legal processes involved with permitting and development is cited as a prime source of frustration and disenfranchisement.

As noted in the 2005 Nuiqsut Village Profile: "*Planning participation is fragmented. Timelines and meetings are spread out so it is hard to keep track of what is happening*" (URS Corporation 2005). Many Nuiqsut residents express concern that industry-related meetings now dominate their social lives and have led to an impact referred to as being "over met." Some have expressed that they feel as if their community center is no longer theirs because it has been taken over by industry (regular industry presentations, government agency meetings, and a CPAI office in the building). Traditional social activities have been displaced by meetings, which many people believe they must attend to defend their subsistence way of life. Many residents participate in the process to the best of their ability and have been actively foregoing aspects of their personal lives to do so for years. At the government agency meetings, they are instructed to review and provide input and ask relevant questions on large amounts of usually confusing, overwhelming, and technical or bureaucratic information (i.e., a draft EIS). These meetings often exacerbate emotions, anger, and intra-community tensions. Active subsistence hunters may feel particularly conflicted: at the same time that they need to be out harvesting or preparing to harvest, they are asked to spend a great deal of time attending meetings and reviewing and commenting on documents.

Residents are often informed that only certain types of comments and input can be considered in the NEPA process ("substantive comments"). The residents do not have adequate evidence that government agencies are incorporating comments and Traditional Knowledge in planning decisions. Many people remark that they do not know what happens to their input, they conclude that the government is not doing anything with it, and this issue is aggravated when agencies return for each EIS process to request it. The inability for most people to effectively review and comment on an EIS contributes to feelings of disenfranchisement and lack of control over events that will impact their lives. These sentiments have been articulated consistently in regular government-to-government (teleconferenced) consultation with the NVN tribal council. A 2009 survey found that 70 percent of Nuiqsut respondents have reported concerns about EIS deficiencies (SRB&A 2009a). In a review of scoping testimony from three development projects in the Nuiqsut area (Alpine Satellite, Northstar, and Endicott), "lack of influence" was the most commonly identified concern (SRB&A 2013c). These impacts are not felt equally among residents: certain individuals do not participate in the process at all for a variety of reasons, including that they are too busy, they are not convinced that their participation will change anything, and/or they are dissuaded from participating due to the often high levels of intra-community conflict that can affect their personal relationships or professional lives. Other groups, such as the NVN, do not have the institutional capacity to review and comment on NEPA documents with the level of legal and NEPA expertise they feel is required.

In the permitting process for GMT1, the NVN tribal council has felt at a particular disadvantage because the council is not able to regularly employ lawyers and specialists to assist with comments and reviews of the documents, while other stakeholder groups have the capacity to conduct these reviews at an expert level or contract specialists to conduct the work. The NVN tribal council position on GMT1 has shifted throughout the NEPA process. Originally, NVN expressed opposition to the project entirely. When NVN became a cooperating agency on the GMT1 SEIS, it advocated for Alternative C. The inability of the BLM to consider that alternative as its preferred alternative created frustration for the Council. When asked to determine whether they would prefer Alternative A or Alternative B if only choosing between those two alternatives, the Council members decided that Alternative B was preferable to Alternative A. In its official comments on the Draft SEIS, the Council states that due to inadequate mitigation associated with the action alternatives, the Council supports the no-action alternative (Alternative E). Impacts to the type of sociocultural stress related to the permitting process that would occur under Alternative A are moderated by the fact that many of the Nuiqsut entities (including several NVN tribal council members) have agreed on the aspect of an alternative that includes a permanent gravel road from CD5 to GMT1 and have contributed time and thought into the impacts that would be associated with it, including a deliberative process to design mitigation measures. Alternative A would result in several substantial impacts, particularly to subsistence, but a development scenario that includes a permanent gravel road is the basic development scenario that the participating community has determined is the least disruptive.

Devaluation of the Nuiqsut Cultural Landscape

As noted in the discussion of impacts on cultural resources (Section 4.4.1), all project components associated with Alternative A overlap the Nuiqsut Cultural Landscape. Residents believe that the cultural, spiritual, or other personal value that they place on their families' camping, hunting, and fishing sites is substantially diminished when industrial infrastructure is developed nearby. Many express emotions of considerable grief and loss in describing those impacts. In public testimony on the GMT1 SEIS, resident Dora Leavitt (2014b) emphasized that these impacts are distinct from impacts to subsistence, that they have been underestimated by previous EISs, and that they are social impacts. Many residents explain that they have "lost" these areas. As shown on Map 3.3-10, cultural activity occurs throughout the project study area with a heavy occurrence of travel routes, trails, and cultural sites in the overland area north and west of the community to Fish Creek and along the Nigliq Channel. Subsistence use areas encompass the entire project study area. Therefore, Alternative A will have both direct and indirect impacts on the Nuiqsut Cultural Landscape and corresponding impacts on sociocultural systems based on the Kuukpikmiuts' close ties to the environment.

Disruptions to Subsistence Use Areas, Resources, and Activities

Section 4.4.5 discusses potential impacts of Alternative A on subsistence uses. Subsistence hunting and harvesting activities are central to the cultural identity and social cohesion of the community of Nuiqsut. Disruption of subsistence activities may affect social and kinship ties, many of which are based on the harvesting, processing, distribution, and consumption of subsistence resources. If subsistence harvesting opportunities are reduced, then opportunities to engage in cooperative harvesting activities will also decline. Reduced participation in subsistence activities could also negatively impact the community's ability to pass on Traditional Knowledge about subsistence harvesting patterns and cultural values to younger generations. Furthermore, as discussed in Section 4.4.5, the GMT1 development will introduce permanent oil and gas infrastructure into traditional hunting areas to the west of the community, thus contributing to the community's perception that they are surrounded by development. Disruptions to subsistence harvesting patterns or perceptions of exclusion from traditional lands may result in social stresses on residents and on the community as a whole.

Alternative B

Impacts to sociocultural systems under Alternative B are similar in almost all ways to those described above under Alternative A. Alternative B could disturb the same number (12) of cultural sites. Impacts on subsistence harvesting patterns in the Fish Creek area would likely be slightly less than under Alternative A, but the closer proximity of the road and pipeline to the community may have negative impacts for harvesting near town. Most residents consulted preferred the option of one fewer bridge that would result from Alternative B, however it appears that there would be little support for a route that required the height of the road to be any greater than necessary (e.g., more fill for a wetter area). The increased property taxes that are estimated to accrue to the NSB would likely be experienced as a benefit in Nuiqsut. When asked to determine which road route from CD5 to GMT1 would be preferable, the NVN identified the route under Alternative B as preferable due to its greater distance from Fish Creek and the lower number of bridges it would require.

Alternative C

Impacts to sociocultural systems under Alternative C would be of a similar type to those described above under Alternative A, but of a higher degree. As noted above, the NVN prefers this alternative due to the economic benefits they believe would accrue to Nuiqsut under this scenario. The inclusion of this Alternative for analysis in the Draft SEIS exacerbated intra-community tensions between the Kuukpik Corporation and the NVN. Any estimation of the potential impacts of this alternative must be based on the hypothetical scenario wherein the land owner, Kuukpik Corporation, agrees to it. In that scenario, the potential for interactions between Nuiqsut residents and non-local workers would be higher due to the use of the community as a transportation hub for industrial activity and the resulting traffic along the upgraded Nuiqsut Spur Road. Local impacts from traffic (emissions, congested roads, noise, and dust) would be higher under Alternative C than under the other alternatives. There may be slight differences in employment, income and revenues due to differences in capital spending. It is estimated that the added features required under Alternative C would cost an additional 14 percent in capital spending compared to Alternative A. Hence, Alternative C would result in slightly higher employment, income, and revenues (particularly, property tax revenues). Alternative C may also lead to increased economic activity for Nuiqsut due to additional income from use of the Nuiqsut Airport and Kuukpik Hotel. Alternative C would result in disturbance to 17 cultural sites (5 more than Alternatives A or B) and would likely have greater adverse impacts to subsistence activities, particularly those near the community and along the upper section of the Nigliq Channel.

Alternatives D1 and D2

The impacts to sociocultural systems under Alternatives D1 and D2 would be substantially different and, in most cases, greater than under Alternative A. Common impacts of these two Alternatives are analyzed together followed by a brief discussion of the differences between Alternative D1 and D2.

Alternatives D1 and D2 would not result in any of the negative impacts associated with permanent gravel roads (dust, traffic, localized diversion of resources, potential barriers to access). Also, property tax revenues that would occur to the NSB are estimated to be higher under Alternatives D1 and D2 due to the duplicative facilities at the GMT1 pad required by these scenarios.

It is estimated that Alternatives D1 and D2 would involve negative sociocultural impacts for the community of Nuiqsut. These impacts would include impediments for local residents desiring employment at GMT1. Under D1 or D2, residents would not be able to live in the community and commute to work; they would be restricted to flying home periodically on industry aircraft. This would occur with a backdrop of repeated requests to increase local hire, especially for the temporary, less-skilled jobs that are available and that are more attractive to young people and/or people with families and/or people who need to undertake subsistence activities in their off hours.

Alternatives D1 and D2 would result in increases in the annual influx of non-resident workers due to increased annual ice road construction and maintenance crews. The discussion on impacts related to the influx of non-resident workers in the introduction to this section describes that some residents believe greater integration would be beneficial. However, ice road employees are temporary employees (three to four months) and it is unlikely that many individuals could integrate in positive ways in that amount of time.

Alternatives D1 and D2 would result in greater impacts to subsistence due to increased aircraft traffic and the lack of facilitated access to subsistence use areas.

Alternatives D1 and D2 would result in a devaluation of traditional sites located near the GMT1 pad due to the footprint, substantial man camp, airstrip, air traffic, increased emissions, noise, odors, and industrial activity and infrastructure at the GMT1 pad. Alternatives D1 and D2 would impact sixteen cultural sites.

One of the most immediate sociocultural impacts resulting from implementation of Alternative D1 or D2 would be the sense of betrayal and anger engendered in North Slope residents over the permitting process for GMT1. This would be a particularly sensitive impact for those who invested the most time and energy to participate in the GMT1 SEIS process and government-to-government consultation (described above under ‘Tensions related to the permitting process for GMT1’). North Slope residents have participated in that process as well as volunteering time for the NPR-A Subsistence Advisory Panel and the NPR-A Working Group and have been assured that these institutions allow the BLM to work with, understand, and incorporate the knowledge and opinions of local residents. Both the Subsistence Advisory Panel and Working Group (in addition to all other North Slope entities) have clearly stated that an alternative based on gravel road access is much preferred over any alternative where access is provided by air and ice roads. It is possible that under Alternatives D1 or D2, many individuals will discontinue cooperating with government agencies.

Residents of Nuiqsut are well aware of the issues regarding airports, gravel roads, ice roads, and bridges because the community has struggled over the efforts to construct the bridge over the Nigliq Channel, and the road to CD5, for several years. Many residents sense that the GMT1 Project does not present a choice between roaded and roadless development, as the GMT1 Project is sometimes portrayed, but rather a choice between one-time construction of a permanent road that they would be available to use year-round, or annual construction, for several decades, of an ice road system encircling town that brings very few benefits along with notable negative impacts. They are therefore considering the differences associated with being largely surrounded by development with mainly negative impacts or being largely surrounded by development with at least one aspect of the infrastructure that they themselves can use for their own benefit.

Difference in impacts between Alternatives D1 and D2

Primary differences between Alternatives D1 and D2 include:

- All impacts associated with D2 would occur over a longer period of time.
- Impacts associated with infill drilling and mobilization and demobilization of drill rigs would occur over 22 years under Alternative D2 as opposed to 4 years under Alternative D1.

Alternative E

No changes from baseline conditions would be expected under Alternative E, because no action would take place under this alternative. The range of sociocultural benefits associated with increased employment opportunities and investment in the community that is likely to occur under Alternative A would not be realized.

Summary and Comparison of Alternatives

Applying the impact criteria for resources (Section 4.4.2) to sociocultural systems, the evaluation concludes that the intensity of impacts would be “High,” the duration of impacts would be “Long,” the extent of impacts would be “Local,” and the context of impacts would be “Important.” The summary of this metric considering the positive and negative impacts, within a social context, on employment opportunities, cultural resources, subsistence, and tension related to the permitting process, is that impacts to sociocultural systems under all alternatives except Alternative E would be major. Under Alternatives A and B, impacts merit classification as major but it should be noted that they would be substantially less intense than under Alternatives D1 and D2.

The conclusion that impacts to sociocultural systems for all alternatives is major (albeit with substantial differences between alternatives) is based on several sources, including consistent oral and written testimony of residents from disparate entities and opinion groups that social impacts of oil development around Nuiqsut are major and have been underestimated. This testimony expands on examples and explanations of the impacts described here and many others. Beyond the numerous impacts to subsistence that are described in detail in Section 4.4.5, the majority of the examples provided center on the feelings of loss associated with the devaluation of traditional sites, the powerlessness and disenfranchisement experienced by many residents in the ability to exert control over land use decisions, cultural issues that discourage employment in the oil fields, and the multi-faceted intra-community conflict that development has exacerbated in Nuiqsut.

This analysis recognizes that the sociocultural impacts of GMT1 will be different for many individuals. This will likely be true for individuals who do not use or value the project study area as much as others; individuals who have not invested time, energy, and a degree of social capital into the permitting process; and individuals whose economic gain from GMT1 development outweighs the negative impacts they experience from the project. Although the sociocultural analysis recognizes and discloses the many important benefits of GMT1 development and does allow for a balancing of benefits and impacts to a greater extent than for other resources, it is unquestionable that oil development near Nuiqsut is bringing many significant sociocultural changes.

Effectiveness of Lease Stipulations and Best Management **Practices**

Existing mitigation that addresses sociocultural and public health-related issues is provided by the following protective measures of BLM (2013: A-1, A-2, A-4, A-10, A-11, A-12, and I-1). These measures set numerous standards for industry in order to protect health and human safety, from hazardous waste disposal (A-1) to precise fuel containment methods (A-4) and BMP A-10, which prevents degradation of air quality by requiring pre-development monitoring, inventory and monitoring of emissions, and emission reduction plans. BMP A-10 also establishes BLM's authority to establish new measures if air emissions are detected above the maximum acceptable levels. A-12 established that BLM will, in the case of an oil spill, minimize impacts by considering the immediate health impacts and responses for affected communities and individuals and establish long-term monitoring for contamination of subsistence foods and public health. BMP I-1 requires cultural and environmental training of personnel involved in oil field activities. Orientation and training must familiarize personnel with stipulations and BMPs and on the specific cultural concerns of the area. Personnel are trained to avoid disturbing sites, resources, and subsistence activities.

These mitigation measures have been in effect and have been added to and improved on for oil exploration activities in the NPR-A since the 1998 Northeast NPR-A IAP.

There are no mitigation measures that directly address several types of sociocultural impacts that exist in Nuiqsut, including: feelings of loss regarding traditional sites, heritage, and culture; the substantial tensions related to the constant permitting process for development; the lack of control over impacts to subsistence activities; and cultural reasons behind low numbers of local hire in the oil field.

Following federal and Alaska guidance, the BLM has undertaken regular government-to-government consultation with the NVN throughout the GMT1 SEIS process and, in compliance with Executive Order 12898 on environmental justice, has worked with tribal members to identify impacts and to collaboratively create mitigation measures.

A recent report on subsistence mitigation measures related to Nuiqsut (SRB&A 2013c) found that while industry and agencies have become more effective at addressing environmental concerns, several residents expressed the belief that Nuiqsut concerns regarding social impacts were not being adequately addressed (SRB&A 2013c, p. 73).

Impacts and Concerns that cannot be Regulated under BLM's Authority

Numerous sociocultural concerns related to industry have been described to BLM throughout the planning process for GMT1 and merit attention in order to ameliorate community/industry and community/government relations. The BLM has limited or no authority to establish traditional mitigation measures to address the following concerns and impacts identified through the consultation process:

- Lack of a community rehabilitation program: Failure to pass drug tests is one reason that the percentage of local residents employed in the oil field has declined. Many people would like to work temporary seasonal jobs in the field, but if they fail the drug test, they are ineligible until the following year. Oil development and oilfield services companies in Nuiqsut have policies requiring a permanent employee who fails a drug test to undergo evaluation and treatment before the individual can be reconsidered for employment. This can be a straightforward process for non-resident employees who have access to certified drug evaluation and treatment programs in urban centers and can return to employment within a short period of time. Local residents do not have easy access to either of these systems: there is several month waiting list for evaluations. Only once an evaluation has been obtained can the individual make an appointment for the required treatment, but there are only a few counselors who service the entire NSB and thus scheduling treatment is also difficult. The policies themselves are standard, but the system to address violations disenfranchises local residents from the employment opportunities presented by development. The 2005 Nuiqsut Village Profile, based on data compiled during a comprehensive survey of every NSB household, noted this issue as a 'Community Priority': "*Social services – A rehabilitation program, with certified counselors, is needed in the community*" (URS Corporation 2005).
- Inadequate compensation systems: Residents are frustrated because they experience the negative impacts of nearby development but feel that they do not prosper economically in a manner that is proportionate and they feel that mitigation funds are inadequate to respond to impacts. Some residents also feel that the compensation systems that have been put in place have exacerbated intra-community conflicts and conflicts with the NSB (SRB&A 2013c). There is a substantial amount of frustration that the federal government does not have the authority to establish and monitor direct compensation programs.
- Throughout the years of oil development on the North Slope and with regards to GMT1, residents and leaders have asked the government to require industry to:
  - Give preference to local hire
  - Provide training programs for local residents

Suggested Mitigation Measure which BLM will not Implement for GMT1

The standard BLM must follow regarding what new potential mitigation measures must be considered and evaluated in an EIS is found in the BLM NEPA Handbook Q&A, number 19(b). This standard provides that all relevant and reasonable mitigation measures that could improve the project should be identified if they are within jurisdiction of the agency. If BLM finds that a potential mitigation measure is not within BLM's jurisdiction to implement, or should not be implemented for some other reason, the potential mitigation measure would not be adopted in the ROD that is issued after the Final SEIS. The ROD will contain a section in its Appendix for Potential Mitigation Measures Not Adopted, which will document BLM's rationale for not adopting the potential mitigation measures.

The following mitigation measure is not considered to be reasonable, relevant, or effective to addressing impacts identified from the GMT1 permit to drill and right-of-way grant analyzed in this SEIS and thus is not being carried forward for further consideration:

- Requiring the applicant to fund the planning, design, construction, and maintenance of a Nuiqsut heritage/cultural center and an adjacent youth sports center.

There is a limited nexus between the identified sociocultural impacts of the proposed action and the benefits of a new community center and youth sports center. For example, a new cultural center and athletic fields would not redress disruptions to subsistence uses or the identified cultural landscape concerns associated with impacts to camping, hunting, and fishing sites. Other existing, proposed, and potential new mitigation measures would be more effective in addressing a number of the identified impacts that are susceptible to mitigation, such as impacts to subsistence use. The BLM will continue to assess, and explore measures for addressing impacts on the use of Nuiqsut's community center for social events due to the regular development-related meetings that are held there.

4.4.3 Economy

This section addresses the projected potential economic impacts associated with the construction, operations, and abandonment of the various GMT1 development alternatives on the state, the NSB, and the community of Nuiqsut.

The primary economic impacts of the action alternatives are expected to be moderate and would include the following:

- Increased economic activity in the state, in the NSB, and in the community of Nuiqsut, resulting from direct industry spending on goods and services during the construction phase, operations phase, and until the abandonment of facilities.
- Increased revenues to the State, the NSB, and the City of Nuiqsut, resulting from shared royalties, state corporate income taxes, severance taxes, property taxes, bed taxes, NPR-A grants, and other fees.
- Increased revenues to Alaska Native corporations from shared royalties.
- Increased job opportunities for Alaskans, including residents of Nuiqsut and other communities in the NSB.
- Additional indirect (or spin-off) impacts resulting from spending of income earned by workers, as well as government spending of revenues for capital and operating programs.
- Increased oil production in the Alaska North Slope that will result in additional secondary economic impacts such as increasing TAPS throughput (and State revenues).

Impact criteria used to analyze potential impacts to the economy from project alternatives are presented in Table 4.4-3.

Table 4.4-3. Impact Criteria — Economy

Impact Category	Magnitude	Definition
Intensity	High	Changes in economic indicators (employment, income, revenues) are well outside normal limits and trends.
	Medium	Changes in economic indicators are slightly outside normal limits or trends.
	Low	Changes in economic indicators are difficult to perceive or generally within normal limits and trends.
Duration	Long-term	Changes in economic indicators persist after project activities that caused the impacts cease; impacts exceed the life of the projects.
	Interim	Changes in economic indicators extend through the life of the project and would return to pre-activity levels sometime after project activities cease.
	Temporary	Changes in indicators last less than 1 year or the period of the project construction phase.
Context	Unique	Project activities affect minority or low-income communities.
	Important	Not applicable.
	Common	Project activities affect communities that are not minority or low income.
Geographic Extent	Statewide	The project activities affect communities throughout the state; extends beyond the project study area.
	Regional	The project activities affect communities throughout a region (North Slope Borough).
	Local	The project activities affect areas within a sub-region, such as the community level (Nuiqsut).

These economic impacts associated with the GMT1 development action alternatives are within the range of impacts analyzed in BLM (2004) and BLM (2012). The impacts to the state, regional, and local economy are described in BLM (2004, § 4F.4.2) and BLM (2012, § 4).

However, both BLM (2004; 2012) considered broader development scenarios than the GMT1 development. BLM (2004) evaluated development of five satellites (including GMT1) — two in the Colville Delta (CD3 and CD4) and three in the NPR-A (CD5, GMT1 [formerly CD6], and GMT2 [formerly CD7]). On the other hand, BLM (2012) addressed development scenarios encompassing the entire NPR-A. The development scenarios included oil production in the Mooses Tooth and Bear Tooth units, as well as at Umiat. The analysis also considered production of yet to be discovered oil and gas resources in other parts of the NPR-A.

The economic impacts presented in the following subsections are specific to the proposed GMT1 development and the other alternatives as described in a previous section of this document.

The proposed GMT1 development as described in a previous section of this document includes construction of drilling and processing facilities, pipelines, roads, and power and fiber optic lines. Following the construction of these facilities, expected annual average production at GMT1 is expected to peak at 20,000 barrels per day in 2018, declining to about 5,000 barrels per day in 2026, then goes to a steady decline of about 6 percent per year through 2050. This projection is different than the assumption used in BLM (2004, § 4A.4.2.1, p. 620). The revised production volume estimates (as shown in Table 4.4-4) are based on new information on peak production and decline rates provided by ConocoPhillips Alaska, Inc. and analyzed independently by a third-party contractor.

Table 4.4-4 shows the Alaska Department of Revenue's (ADOR) projections of crude oil production at Alpine and the total for the Alaska North Slope through 2022. Note that the

ADOR production volumes at Alpine include production at Alpine, Fiord, Nanuq, Qannik, and Mustang[11] (after 2016).

As shown in Table 4.4-4, oil production in the North Slope is expected to continue its declining trend in the future. With development of GMT1, the annual production volumes at Alpine would increase by approximately 46 percent at GMT1's peak production during the years 2018 through 2022. In these same years, oil production at GMT1 would add about 4 percent to the total North Slope oil production.

Any additional oil production in the North Slope extends the life of the TAPS and benefits the State. As noted in Section 3.4.3, the State of Alaska relies heavily on oil revenues. Oil revenues are dependent on the oil production levels and the price of oil at the wellhead. The State of Alaska would receive revenues from oil production in the NPR-A. However, revenues from the NPR-A are treated differently than those from state lands and the outer-continental shelf (federal OCS). As noted in Section 3.4.2.2, federal law designating the NPR-A established a requirement that 50 percent of lease sale revenues, royalties, and other revenues be paid to the State of Alaska, and the other half be paid to the General Fund of the U.S. Treasury. As stated in BLM (2012), the State of Alaska General Fund receives shared revenues from federal leases two times a year and the State makes these available as grants to eligible municipalities in the following fiscal year. Communities in the NSB have historically benefited from these grants. Additional grants for planning, construction, maintenance of essential public facilities, or for provision of essential public services can be expected by municipalities in the North Slope region, with revenues associated with production at GMT1.

As described in Section 1.1, the GMT Unit has mixed land status with federal land, Native interim conveyed, and Native selected lands. CPAI's plan incorporates horizontal drilling which may involve drilling into ASRC minerals. The GMT1 pad is centrally located in three different proposed Unit Participating Areas (PA). The Lookout PA is the first proposed stage of the three individual development phases from GMT1 pad, for which the first 9 well slots are dedicated. The remaining two Participating Areas are Mitre and Flat Top. ASRC's estimated mineral interest in the Lookout PA is upwards of 90 percent, as well as selected or conveyed acreage in Mitre PA, meaning a large portion of the GMT1 production will be ASRC royalty bearing. The Flat Top PA is expected to be entirely BLM mineral interests.

Until these proposed PAs are formally established in the GMT Unit, the exact acreage of each lease dedicated to each PA is unknown. While the actual production area from these wells has yet to be formally delineated, ASRC will receive the royalties for the percentage of PA contribution from ASRC-owned leases. Note that the GMT1 development is located in part on Kuukpik surface lands and as such will recover subsurface hydrocarbon resources owned by ASRC, on which Kuukpik has an overriding royalty interest. The associated revenue will benefit ASRC and Kuukpik shareholders, and other Alaska Natives as well through application of Section 7(i) and 7(j) revenue sharing provisions of ANCSA.

Production from federal leases would result in royalties paid to BLM as well, and the state will receive 50 percent of these royalties. Tract allocations will be finalized at the time adequate Geology, Geophysics, and Reservoir Engineering information exists to appropriately describe each reservoir area. Participating area boundaries and tract allocations will be established

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[11] Development plans for Mustang indicate that oil will be processed on-site, and will tie into the Alpine, Kuparuk, and TAPS pipelines.

pursuant to the requirements of 43 CFR 3137 and the GMT Unit Agreement between ASRC, CPAI and BLM, and royalties will be paid according to that agreement.

An assumed royalty rate is assessed based on the federal royalty rate of 16.67 percent of wellhead value for high oil potential areas (BLM 2012). Given expected production volumes at GMT1 and the ADOR projected ANS wellhead values through 2022 (as reported in the 2013 Spring Revenue Forecast), averaging $95.16 per barrel of oil (in real terms, 2013 $), it is estimated that total royalties from GMT1 production over the period 2017 to 2050 would amount to about $1.02 billion in 2013 $, or $1.04 billion in 2014 $. As noted above, these royalty payments will be shared among the resource owners. The allocation of royalty payments among resource owners will be determined according to the GMT Unit Agreement.

In addition to the royalties, the State of Alaska and the NSB would receive property tax payments associated with the taxable oil infrastructure that will be developed at GMT1. The property tax payments would be based on the assessed valuation of the facilities developed onsite. The annual levy is based on the full and true property 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 the proven reserves. Pipeline property on the other hand is treated differently from production facilities in that 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 value for oil and gas property within a city or borough and is subject to local property tax limitations. The current NSB property tax rate is 18.5 mills, hence, the state portion of the property tax is 1.5 mills. Based on the above approach, it is estimated that the proposed GMT1 development would generate total property tax revenues of about $275 million (in 2014 $) through 2050.[12] Of this amount approximately $255 million would accrue to the North Slope Borough and about $20 million to the State of Alaska.

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[12] The property tax estimates are based on the results of the economic modeling conducted by a 3rd party contractor using a discounted cash flow model developed by the Alaska Department of Natural Resources. It should be noted that the original model was modified to fit the 3rd party contractor's understanding of project costs and logistics associated with the different GMT-1 development alternatives being considered in this SEIS. This involved consultations with CPAI and staff from the Alaska Department of Natural Resources and the Alaska Department of Revenue. While the economic evaluation was requested by BLM to specifically assess the effects of imposing a seasonal drilling restriction on the viability of the project, the modeling exercise also provided estimates of potential property taxes that would be generated given capital cost assumptions (i.e. facilities, pipeline, and tangible drilling expenses).

Table 4.4-4. Projected Crude Oil Production: Alpine, Total Alaska North Slope, GMT1

Year	Alpine	Total Alaska North Slope	GMT1*
	Barrels Per Day		
2013	66,700	538,300	
2014	64,300	526,600	
2015	60,300	512,800	
2016	60,500	499,700	
2017	55,500	476,900	2,000
2018	47,200	443,300	20,000
2019	40,100	422,400	18,075
2020	34,400	399,400	16,250
2021	29,800	372,300	14,375
2022	26,000	344,500	12,500
2023			10,596
2024			8,750
2025			6,875
2026			5,000
2027			4,696
2028			4,435
2029			4,176
2030			3,933
2031			3,694
2032			3,488
2033			3,285
2034			3,094
2035			2,906
2036			2,744
2037			2,584
2038			2,434
2039			2,286
2040			2,159
2041			2,033
2042			1,914
2043			1,798
2044			1,698
2045			1,599
2046			1,506
2047			1,414
2048			1,336
2049			1,258
2050			1,185

Source: 2013 Spring Revenue Forecast, Alaska Department of Revenue, Tax Division (Alpine and Total ANS crude production).GMT1 production volume estimates were developed based on new information on peak production volume and decline rates provided by CPAI. These estimates assume peak production of 20,000 bopd in 2018 down to 5,000 bopd by 2026, with higher decline rates in the first ten years of operations and a steady decline rate of about 6 percent per year from 2028 to 2050.

The State of Alaska would also receive additional corporate income tax on petroleum activity as well as severance taxes from oil production. The corporate income tax is calculated as 9.4 percent of the Alaska share of worldwide income for each corporation. The Alaska income is calculated using a "modified apportionment formula," which averages the Alaska share of corporate worldwide property, sales, and extraction and applies that formula to calculate the Alaska share of worldwide income. The Alaska tax base for the special corporate income tax on petroleum depends not only on activity and profits within Alaska, but also on activity and profits in other locations. However, the model[13] used to estimate state corporate income taxes for the proposed GMT1 Project does not take into consideration the modified apportionment formula as it is difficult to determine the project proponent's worldwide income. The model simply evaluates all of the GMT1 Project costs and revenues and the resulting state income tax, as if the project proponent did not have any other projects in Alaska or elsewhere. Based on the model, it is estimated that the proposed project would generate approximately $279 million (2014 $) in total state corporate income taxes through 2050. Finally, based on the State of Alaska's current fiscal terms for petroleum activity (known as More Alaska Production Act, or MAPA), it is estimated that GMT1 would generate approximately $455 million[14] (2014 $) in total severance taxes net of credits through 2050.

The City of Nuiqsut is also projected to benefit from bed taxes resulting from higher hotel occupancy during construction and even through the operations phase of the project. The City of Nuiqsut has a 7 percent bed tax. It is however difficult at the point to estimate bed taxes associated with the proposed project.

Employment

Project-related employment would include temporary jobs during the construction season, permanent operations and maintenance jobs, and then again temporary jobs during the abandonment phase. The peak construction workforce is estimated at 300 which includes specialized tradesmen (at particular short periods during construction). Construction seasons will be two consecutive years.

Operations manpower requirements for GMT1 production pad was presented in BLM (2004), (see Table 4.4-5). Each 12-hour position represents two people and is equivalent to 4,380 man-hours per year. The manpower forecast is an estimate of the number of 12-hour positions (that is, two people per position) that would work on site at the production pad location.

Table 4.4-5. Operations Manpower Requirements for GMT1 Production Pad

Field Personnel	Number of Positions
CPAI Operator	1.00
CPAI Maintenance	1.00
Contract Operator	0.00
Contract Maintenance	0.00
Heavy Equipment Operator	2.50
Heavy Equipment/Vehicle Repair	1.00
Incremental Number of 12-hour positions at production pad	5.50
Cumulative Number of 12-hour positions at production pad	9.20

Source: *Alpine Satellite Development Plan (ASDP) Final Environmental Impact Statement (EIS)* (BLM 2004, Volume 1, page 59)

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[13] The model used to estimate state corporate income taxes and severance taxes is the same model (that was developed by ADNR and modified to fit the GMT1 project) used in estimating property taxes, as described in the comment above.

[14] Note that various credits allowed under the current fiscal terms reduce total severance tax payments received by the State of Alaska.

Periodic workovers of the wells, as well as removing facilities and rehabilitating the land will also generate additional employment for several years.

As noted in BLM (2004), many of the construction workers hired would need skills and experience in drilling and pipeline construction. However, it is expected that there will be employment opportunities for residents of Nuiqsut and other NSB communities. For example, as noted by CPAI, during the 2013-2014 winter construction activities at CD5, 32 Nuiqsut residents and Kuukpik shareholders were employed as construction workers including subsistence representatives and ice road monitors. Year-round employment opportunities during the operations of the project would also be available for local NSB residents and other Alaskans. With on-going and future training programs geared towards special skills required in oilfield services sponsored by both public and private entities, it is anticipated that local hire will be higher than historical rates. However, not all residents of Nuiqsut are interested in working for the oil industry due to employment demands, perceived prejudice, and their views of impacts from industry on their community.

Indirect and Induced Economic Impacts

Indirect and induced economic impacts, also referred to as multiplier or spin-off effects, would result from in-state industry spending on goods and services, workers' spending of wages, and government spending of royalties and tax payments during the construction, operations, and abandonment phases of the proposed project. The proposed development of GMT1 is estimated to cost about $1.54 billion[15] (in 2014 $). This includes the costs of all the facilities – drill site, road, pipeline, and other ancillary facilities, as well as the drilling costs. The total cost of the project during the operations phase (from 2017 to 2050) is estimated to amount to over $1.09 billion[16] (in 2014 $). Like other development projects in the North Slope, it is expected that many of the materials and equipment would be purchased outside of Alaska and would be shipped to the job site. Still, a significant portion of the total project costs, both capital and operating costs, will be paid to companies in Alaska for construction, transportation, logistics, and other oilfield services. It can be expected that some of the contracts for construction and operations and maintenance of the facilities would be awarded to Alaska private corporations, including the North Slope regional and village corporations. These payments to local businesses will in turn generate additional economic activity within the state, resulting in indirect economic effects in the form of additional business sales, employment, and labor income.

Likewise, local spending by workers as well as government spending of revenues resulting from the proposed project would also generate multiplier effects statewide.

Comparison of Alternatives

The section above describes the projected economic effects of Alternative A, the proponent's preferred alternative. This section discusses how the projected economic effects of Alternative A compare with the expected economic effects of the other alternatives being considered.

The following table summarizes the differences in estimated capital expenditures and projected royalties and taxes among the alternatives being considered. Estimated capital expenditures

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[15] The estimated project cost is based on information provided by CPAI and other cost data developed by the 3rd party contractor from interviews conducted in 2010 with contractors and service providers operating in the North Slope, along with extensive internet research. The cost data from the interviews are confidential.

[16] Estimated total cost of the project during the operations phase is based on estimates of operating expenditures on a per barrel basis ($ per barrel of oil) of other existing oil fields in the North Slope. The model assumes that OPEX cost is about $17 (in 2014 $) per barrel of oil produced.

are based on information provided by the project proponent for Alternative A and from a third-party analysis of the project economics.[17] The differences in capital expenditures are primarily due to the differences in infrastructure, including drilling expenditures, required under each alternative. The additional facilities and differences in logistics are explained in more detail in the discussion below under each of the alternatives.

Table 4.4-6. Comparison of Estimated Capital Expenditures, Royalties, and Taxes (in 2014 $ millions) by Alternative

Alternative	Description	Total CAPEX	Royalties	Property Tax	SCIT	Severance Tax	Royalties + Tax
Alternative A	CPAI Proposed GMT1 Project	$1,540	$1,041	$275	$279	$455	$2,050
Alternative B	Avoid Fish Creek Setback	$1,596	$1,041	$288	$275	$431	$2,034
Alternative C	Alternative Access (via Nuiqsut)	$1,739	$1,041	$316	$264	$362	$1,982
Alternative D1	Roadless Access to GMT-1	$1,955	$1,041	$345	$194	$127	$1,707
Alternative D2	Roadless Access with Seasonal Drilling Restriction	$2,353	$921	$399	$120	-$92	$1,348

As noted in the discussion of economic effects of Alternative A, property taxes are based on the assessed value of oil and gas property. Alternatives B, C, D1, and D2 would all require additional facilities and for the case of Alternative D2, higher mobilization and demobilization costs relative to Alternative A (and the other alternatives as well). Estimated property taxes are lowest under Alternative A, as this alternative requires less infrastructure and drilling costs compared to the other alternatives.

Employment effects were only quantified for Alternative A. Information on direct manpower requirements for the other alternatives is not available. However, information from the description of the logistics and additional infrastructure provide an indication of whether the employment effects would be similar, lower, or higher compared to Alternative A.

Alternative B

Alternative B is very similar to Alternative A, as it would involve the same drill site location and facility design but the location of the road and the pipeline would be outside of the Fish Creek setback and intersect with the CD5 road and pipeline east of the CD5 drills site at a new tie-in pad. Alternative B would also eliminate the need for a bridge over Crea Creek. This alternative would require a slightly longer road and pipeline, as well as an additional pad. The slightly larger gravel requirements and longer road and pipeline routes would result in slightly larger capital expenditures for this alternative compared to Alternative A.

The impacts to the economy under Alternative B would be similar but slightly higher compared to Alternative A. Royalties would be the same as production schedule and production volumes are the same for both alternatives. However, there will be slight differences in employment, income, and taxes due to the differences in infrastructure requirements and value of facilities (capital costs) as noted above. It is estimated that the total capital cost of Alternative B would be 4 percent higher than the cost of Alternative A. While it is expected that property tax payments under Alternative B would be slightly higher, other state taxes (such as corporate

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[17] Other cost data was developed by the 3rd party contractor from interviews conducted in 2010 with contractors and service providers operating in the North Slope, along with extensive internet research. The cost data from the interviews are confidential.

income tax and production taxes would be slightly lower due to the State of Alaska's current tax structure that is based on net profits. Employment and income, particularly during the construction phase are expected to be slightly higher given the additional facilities required under Alternative B.

Alternative C

Alternative C would have different access and logistical features than Alternative A as described in Section 2.7. Additional features of Alternative C are described below:

- Upgrade of the 5.8-mile Nuiqsut Spur Road between the CD5 Access Road and the Nuiqsut Dump Road.
- Upgrade of the Nuiqsut Dump Road further upgrading of that segment between the intersection of the Nuiqsut Spur Road and the new Airport Access Road.
- Construction of an approximately 1.2-mile new Airport Access Road between the Nuiqsut Dump Road and a new logistics pad at the Nuiqsut Airport.
- Construction of a 400-foot x 400-foot (3.7-acre) logistics pad with a 1.4-acre taxiway-apron connecting to the existing airstrip.
- Construction of a 500-foot extension of the existing runway on the west end, resulting in an approximately 1.7-acre of footprint.

Upgrade of the Nuiqsut Airport would allow for its use as a logistics center for the GMT1 Project whereby personnel and certain supplies would be brought to Nuiqsut rather than to APF, then transported to GMT1 by road vehicles. The additional features associated with Alternative C result in larger capital expenditures compared to Alternative A. It is estimated that Alternative C would cost an additional 13 percent compared to the total estimated capital cost of Alternative A.

The impacts to the economy under Alternative C would be similar to those for Alternative A; however, there will be differences in employment, income, and government revenues due to differences in infrastructure requirements, value of facilities, and logistics of the project during the operations phase. Royalties would be the same as under Alternative A because the production schedule and volumes will be the same for both alternatives. Employment, income, and property tax payments will be higher under Alternative C compared to Alternative A, given the additional facilities required. However, other state taxes (production and corporate income taxes) are expected to be lower under Alternative C due to the net-profit based tax structure in Alaska.

Alternative C may also lead to increased economic activity in Nuiqsut due to additional income from use of the airport and hotel.

Alternative D1

Alternative D1 would not have year-round road access between GMT1 and the existing APF. In this limited access scenario, transportation to GMT1 from the existing APF would be primarily by aircraft, approximately 9 months of the year (May through January), and via ice road approximately 3 months of the year (February through April). To access the drill site during the winter season, an ice road would be constructed along a corridor from the seasonal Alpine ice road to the airstrip. Drilling would continue year-round to achieve economic and production goals. Alternative D1 would have the same drill site location and pipeline route to CD5.

With limited surface access, certain services, equipment, and supplies otherwise provided at the APF would need to be duplicated at the drill site. A full-time workforce at GMT1 would also be required. GMT1 would be re-supplied during the ice road season, requiring long-term storage of drilling and operating fluid and supplies. A tank farm would be needed to provide appropriate storage volumes for all operating fluids such as methanol and anti-corrosion chemicals. A new mud plant and bulk cement facility would be required for drilling because the existing plant at APF must remain in place to service drilling operations at the other satellites. Diesel fuel for powering the drill rig would be transported to the site via a new 2-inch diesel pipeline from APF. Waste fluids from drilling would not be transported for disposal at APF; therefore, a new Class 1 disposal well with injection facilities would be required at GMT1.

Additional construction and drilling camp facilities would be required when there is no dependable access to lodging at Alpine. Construction activities in the summer months would require either an onsite man-camp, commuting via aircraft to APF, or a combination of both. The shift from an unmanned facility (post-drilling) to a manned facility would require permanent full-service living quarters to support long-term operations. On-site potable water supply and wastewater management would be required. During the summer months, other wastes would require on-site management. The additional facilities would increase the required gravel pad space requirement and associated footprint of this alternative. For this alternative, the GMT1 pad was designed to separate occupied facilities (e.g. housing) from the drilling operations to comply with safety regulations.

The need for additional facilities at GMT1 under this alternative results in much larger capital as well as operating expenditures compared to Alternative A. It is estimated that the total capital cost of Alternative D1 would be 27 percent higher compared to the cost of Alternative A.

While royalties under Alternative C would be the same as under Alternative A because production schedule and production volume are the same, employment, income, and property tax revenues under Alternative D1 would be higher compared to Alternative A due to the additional facilities and amenities that would be required during the construction and operations phase as noted above. However, as shown in Table 4.4-6, state corporate income taxes and severance taxes under Alternative D1 would be much lower compared to Alternative A. It is estimated that the net present value of the state tax revenues under Alternative D1 is negative due to the large amount of tax credits issued early in the project life.

Alternative D2

Northern Economics (NE) was contracted to provide an independent third-party analysis, based on economic models from the State of Alaska, to determine the economic feasibility of a seasonal drilling restriction alternative (Alternative D2). To make this determination, NE modeled the after-tax cash flow (EMV) of each alternative (A, B, C, D1, and D2) based on project information (projected production and expected capital costs) provided by CPAI and other data gathered from a variety of sources. The results of their analysis indicate that Alternative D2 is not a viable project. Alternative D2 has a negative after-tax cash flow (EMV) of about $363 million which is almost $160 million larger than the $274 million of negative after-tax cash flow for Alternative D1.

Alternative D2 is very similar to Alternative D1 with respect to required infrastructure, with the exception that a potential seasonal drilling restriction would preclude drilling activities when surface access (i.e., ice road) is not available. This restriction would result in about an 80-day drilling season, including the time to mobilize and de-mobilize the drilling rig from GMT1, which could result in about 1.5 wells being drilled per season. Total capital expenditures for

Alternative D2 is estimated to cost about 50 percent more compared to Alternative A. Compared to Alternative D1, the intangible drilling costs under Alternative D2 is expected to cost twice as much. Intangible drilling capital expenditures include items such as administrative costs in connection with drilling contracts, cost of drilling, grading and other dirt work to prepare a drill site, cost of constructing roads to drill site, costs of setting rig on drill site, transportation costs of moving rig, technical services engaged in drilling the well, drilling supplies, equipment rental, costs of removing rig from the drill site, cost of obtaining an operating agreement for drilling operations, etc. Much of the increase in intangible drilling costs is due to the need to mobilize and demobilize the drilling rig for the 22 drilling seasons.

Royalties under Alternative D2 are expected to be lower compared to Alternative A due to the delay in drilling and production schedule resulting from the seasonal restriction. Property taxes under this alternative are estimated to be higher compared to Alternative A due to higher capital expenditures, while state corporate income taxes are expected to be lower compared to Alternative A. Estimated severance tax payments under this alternative are expected to be much lower compared to Alternative A. Table 4.4-6 shows a negative total severance tax payment under this alternative. Note that the tax payment considers the associated state tax credits for this project which are affected by the capital expenditures. Under the current tax system, the project proponent would be able to apply tax credits accrued in certain years to future tax liability or to other projects in the North Slope. Total state taxes are also expected to be negligible given the much higher capital and operating expenditures.

Employment and income impacts under this alternative will be higher compared to Alternative A. The economic effects stated here, however, may not be realized as it is unlikely that the project will proceed under this alternative because the project is not economically viable (see Summary section below); hence there may not be any beneficial economic effects to the local, regional, and state government.

The project specifications associated with Alternatives C, D1, and D2 will affect the financial viability of the project from the perspective of the project proponent (see Table 4.4-7). An independent analysis that evaluated the project economics of the various alternatives indicated that these three alternatives could result in the project proponent deciding not to proceed with the development. Several factors contributed to this finding, including higher investment requirement as well as the estimated financial returns falling below current industry thresholds. Additional factors affecting the financial viability of Alternative D2 include the delay in oil production from when drilling activity will begin and lower total oil production.

Table 4.4-7. Comparison of Financial Metrics of Alternatives (Discounted to 2014 $)

Alternative	Description	Expected Monetary Value (2014 $ Millions)	Internal Rate of Return (%)	Discounted Profitability Index
Alternative A	CPAI Proposed GMT1 Project	$90	15%	1.09
Alternative B	Avoid Fish Creek Setback	$54	14%	1.05
Alternative C	Alternative Access (via Nuiqsut)	-$36	11%	0.97
Alternative D1	Roadless Access to GMT1	-$68	10%	0.94
Alternative D2	Roadless Access and Seasonal Drilling	-$343	3%	0.69

Note: The values presented in the table assume a nominal discount rate of 12 percent.

Alternative E

There will be no impacts to the state and local economy under the No Action Alternative. The range of economic effects associated with construction and operations as described under Alternative A would not be realized.

Summary

Projected royalties paid to the royalty owners are the same for Alternatives A, B, C, and D1 since they have the same production and price forecasts. Alternative D2 would generate lower royalties due to the lower total production volumes associated with the deferred production schedule. Instead of oil production starting in late 2017, under Alternative D2, oil production would start in year 2023.

The estimated taxes include severance (production) tax, ad valorem (property tax), and state corporate income tax (SCIT). Local governments, in this case, the NSB, only participate in the shared ad valorem taxes; the other taxes are paid to the State of Alaska. Note that under the State of Alaska's oil and gas fiscal system (known as More Alaska Production Act or MAPA), the severance tax is based on the net value of oil and gas produced, which is the value at the point of production, less all qualified lease expenditures. Qualified lease expenditures include certain capital and operating expenditures. The State also has various tax credits that can partially offset the severance tax, including qualified capital expenditure credit, carried-forward annual loss credit, well Lease expenditures credit, transferable tax credit certificate, transitional investment expenditure credit, new area development credit, small producer credit, and per-taxable-barrel credit.

As shown in Table 4.4-6, Alternative A would generate the highest tax revenues but as CAPEX increases for the other alternatives and the associated loss carry forward (LCF) tax credit increases, the net (severance taxes less the various tax credits) state tax revenue diminishes. The other tax credits mentioned above can also reduce the net tax revenue to the state.

The higher costs associated with Alternatives C, D1, and D2, will affect the economics of the project. An independent analysis that evaluated the project economics of the various alternatives indicated that the higher investment requirements under these three alternatives could result in the project proponent deciding not to proceed with the development. Hence, the beneficial economic effects stated in the section above may not be realized.

4.4.4 Land Use

Any of the action alternatives would result in impacts to land use during construction, drilling, and operation. These impacts are described in detail by BLM (2004, § 4B.4.6). The following discussion summarizes the impacts and is supplemented with information from BLM (2012) and the Point Thomson FEIS related to potential impacts to land use and ownership (Corps 2012, §§ 3.13.4 and 5.13).

Impact analysis criteria used in this assessment for land use and ownership are presented in Table 4.4-8. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts. The potential impacts to land use and ownership would depend on the proposed project and any action the land owners or managers deemed necessary to take as a result.

Land use in the project study area largely reflects ownership of the surface and subsurface resources. Land ownership is complex and has evolved since 2004 with additional surface land now owned by the Kuukpik Corporation (Village Corporation of Nuiqsut) and additional subsurface conveyed to ASRC. When the surface and subsurface have both been transferred out of federal ownership, the BLM waives management of the federal oil and gas leases. The State also owns both the surface and subsurface resources east of the NPR-A, of lands not conveyed to ASRC or the Kuukpik Corporation, as well as the beds of navigable waters such as the Colville

River. Kuukpik also has selected surface acreage and ASRC subsurface acreage in the vicinity of the conceptual GMT2 facilities. BLM remains the manager of selected land until ownership has been conveyed. There is one Native allotment in the project study area (AKFF 011723), approximately 1.5 miles east of Nuiqsut.

As explained in BLM (2004), BLM continues to manage selections and land ownership options made under the provisions of ANCSA and ANILCA. The end result of the selection process is a transfer of ownership and management of the surface estate and subsurface estate to the village and regional corporations, respectively, which were established by ANCSA.

Table 4.4-8. Impact Criteria—Land Use and Ownership

Impact Category [a]	Magnitude	Definition
Intensity	High	Land owner must respond in substantial ways to the action—change in ownership (condemnation) or substantial change in management–major inconsistency with land plan that forces amendment of plan. Complete change in land use not anticipated in plans.
	Medium	Land owner must respond to the action, but response is minor, routine. Action is neither wholly consistent nor wholly inconsistent with existing plans. Substantial change in land use but anticipated in plans.
	Low	Land owner need not respond to action in any substantive way; action is substantially consistent with existing management plans. Substantially similar land uses.
Duration	Long Term	Land use, ownership, or management changes are expected to last the length of the project and beyond (effectively permanent).
	Interim	Land use, ownership, or management changes may reasonably be expected to convert (or revert) to another use within less than the life of the project.
	Temporary	Land use, ownership, or management changes are expected to last through construction or some equally clearly limited time that is substantially less than the life of the project.
Context	Unique	The supply of land or water for an affected use or management category is constrained and is identified as having special, rare, protected, or unique characteristics in an adopted management plan.
	Important	The supply of land or water for an affected use or management category is moderately available, serves a specialized function but is not identified as having special, rare, protected, or unique characteristics in an adopted management plan.
	Common	The supply of land or water for an affected use or management category is extensively available, serves no specialized function and is not identified as having special, rare, protected or unique characteristics in an adopted management plan.
Geographic Extent	Statewide	Affects land use, ownership, and management over a large area—beyond the project study area.
	Regional	Affects land use in the project study area only.
	Local	Affects land use, ownership, and management in the immediate vicinity of the project footprint.

[a] See Section 4.1.2, *Impact Criteria*, for term definitions.

Construction

Human uses of the project study area fall into four main categories: subsistence and traditional uses by local residents, research, outdoor recreation, and industrial land uses associated principally with oil and gas construction and operations. Human use during construction would be low by comparison to urban and most rural areas.

During construction, land use in developed portions of the project study area would change. Human presence is most intense during construction. Common causes of impacts on land use among the action alternatives include construction of gravel pads, pipelines, roads, and airstrips; excavation of gravel at the mine sites; and installation of VSMs. Ice roads and ice pads would be constructed to assist in development of the project infrastructure. All of this construction requires a labor force to complete the work, thus increasing human activity.

Land within the western portion of the project study area (Map 2.5-2) is generally natural in character, undeveloped, and roadless. The APF is in the eastern portion of the study area, along with the community of Nuiqsut. The study area can be broadly characterized as the Arctic lowlands on the ACP. Nuiqsut is the only community in the study area. Iñupiaq Natives use the study area for subsistence hunting, fishing, and gathering, as described in Section 3.4.5.

If there were a typical municipal or borough land use map for the North Slope, actual land use in the immediate vicinity of the project study area prior to the Alpine development would likely be classified as “vacant” or “open public lands.” With the proposed project construction, the actual land use would change from primarily undeveloped land used principally for wildlife habitat, subsistence, research, and some recreation, to further oil and gas development (industrial use), which is consistent with the State’s oil and gas management intent, including the State’s certification order and the intent of the oil and gas and gas-only lease program. With the project construction, industrial land uses would dominate in the immediate vicinity of the project footprint.

Drilling and Operation

After the construction phase, drilling is expected to take 4.75 years (for Alternatives A, B, C, and D1). Drilling would be seasonal for Alternative D2 and is expected to be completed in 25 years (first year drilling and 24 seasons of infill drilling). Once drilling is completed, human presence would be determined by operation, maintenance, and inspection needs. These activities are within the range of development activities evaluated in the BLM (2004; 2012). Excluding mine site development, the action alternatives would directly impact various amounts of land as described in Section 4.4.5.12, *Summary and Comparison of Alternatives*.

The BLM has determined the subsurface resources should be offered for oil and gas leasing with requirements for environmental protection and for due diligence to explore for oil and gas to maintain ownership of the lease. When a federal oil and gas lease is renewed, previous conditions are reviewed to see if they comply with current land use plans. For GMT1, federal oil and gas lease AA-87852 (Unit Case File Number) reflects stipulations in BLM (2008a). Surface uses on BLM land must meet the land use plan currently in effect (e.g., those BMPs in BLM [2013]).

Comparison of Alternatives

All action alternatives include drill site development on federal land and construction of aboveground pipelines (from GMT1 to CD5) that would cross both federal and private lands (Native patent or interim conveyed). The CD5-GMT1 gravel road (in Alternatives A, B, and C) would cross both federal and private lands. Alternatives D1 and D2 do not include the CD5-

GMT1 road – for these alternatives, the 1.3-mile access road, GMT1 pad, occupied structure pad, and airstrip are all on federal land. The approximate distribution of federal and private land crossed by each of the action alternatives is listed in Table 4.4-9. There would be no change in current land use west of CD5 and the Nuiqsut Spur Road associated with Alternative E because development of GMT1 would not occur under this alternative.

Table 4.4-9. Land Ownership

Linear Component	Land Owner	Land Ownership (Approximate Percentage [%])			
		Alternative A	Alternative B	Alternative C	Alternatives D1 and D2
Pipeline Length GMT1 to CD5	Federal BLM	65%	62%	65%	65%
	Native Patent or IC	35%	38%	35%	35%
CD5-GMT1 Gravel Access Road	Federal BLM	66%	62%	29%	0%
	Native Patent or IC	34%	38%	71% [a]	0%

IC = Interim Conveyed

[a] The 7 miles of gravel road to Nuiqsut comprising 5.8 miles of upgraded Nuiqsut Spur Road and 1.2 miles of new road to the Nuiqsut Airport is not included in the 71 percent. This Nuiqsut access road is all on Native land.

The different route and design elements (between the action alternatives) would cause small differences in the area of land use modification, from the current state of near natural to small areas of intense development for the purpose of hydrocarbon production. Development of GMT1 is consistent with the IAP adopted by BLM in 2013 (BLM 2013). Impacts related to subsistence use of the area are described in Section 4.4.5.

In addition to differences in ownership of land affected, the use of the land and access would be changed by the construction of the CD5-GMT1 road (Alternatives A, B, and C). The CD5-GMT1 road would provide vehicle (e.g., ORV) access to new areas (with permission to use and cross the road for subsistence use). The impacts to land use regarding subsistence are addressed in Section 4.4.5.3, *Impacts under Alternative A*.

Excluding mine site development, the action alternatives would directly impact various amounts of land depending on the footprint. The ASRC Mine site (not federal land) is the Applicant's preferred material source and is a commercial operation that has been operating for more than 15 years, and will continue to be mined as long as marketable gravel resources are available at the site (Section 2.4.4). Once mining is complete and the material source no longer viable, the ASRC Mine site will be reclaimed under the terms of the approved Reclamation Plan as required by ASRC.

Mitigation

The Applicant has included the following design measures as part of the project design to avoid or minimize impacts on land ownership, use and management:

- Consulting with land owners or managers within or adjacent to the project area,
- Ensuring project activities do not encroach on Native allotment or traditional land use sites through survey and demarcation, and
- Avoiding any trespass or impact to any allotment.

Potential impacts to land use are also mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and BMPs of BLM (2013) will reduce the impacts and total area of disturbance; these include: A-1, A-3, A-4, A-5, A-10, C-2, C-3, E-1, E-5, E-8, F-1, I-1, K-1(e) and K-1(g).

Conclusions

The direct impacts of the action alternatives on land use include construction of gravel pads, roads, and airstrips; excavation of gravel from the mine site; and installation of VSMs. The overall impacts to land ownership, land management, and land use among the action alternatives would be similar. Under all action alternatives (based on data listed in Table 4.4-9), the intensity of land ownership, land management, and land use changes would be expected to be low to moderate, primarily because of the need for the Applicant to request exceptions to current BMPs. All impacts to land use would be of temporary to long-term duration. The geographic extent of impacts to land use would be local to the project area. The context of the land is common for all alternatives. While the context of the land is common, the land use by the Applicant is dependent on their federal oil and gas leases. Overall, construction and operation of all the action alternatives would result in moderate impacts to land use and ownership.

4.4.4.2 Local Transportation

Impact analysis criteria used in this assessment for transportation systems are presented below in Table 4.4-10. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts.

Table 4.4-10. Impact Criteria—Local Transportation

Impact Category [a]	Magnitude	Definition
Intensity	High	Acute or obvious change in air or land transportation volume.
	Medium	Noticeable change in air or land transportation volume.
	Low	Change in air or land transportation volume may not be measureable or noticeable.
Duration	Long Term	Impacts would continue for the life of the project.
	Interim	Impacts would last more than one phase of project development.
	Temporary	Impacts would last for a single phase of project development.
Context	Unique	Impacts to unique transportation opportunities and constraints.
	Important	Impacts to transportation opportunities and constraints within the locality or region protected by legislation.
	Common	Impacts to usual or ordinary transportation opportunities and constraints.
Extent	Statewide	Affects transportation volume beyond a regional scale.
	Regional	Affects transportation volume on a regional scale, outside of the project study area.
	Local	Within project study area

[a] See Section 4.1.2, *Impact Criteria*, for term definitions.

Construction

Under Alternatives A, B, C, D1, and D2 construction activities would vary by season, but most construction-related vehicle traffic would occur on industry-constructed ice roads with no public access. Minor impacts to local transportation resulting from these alternatives are anticipated. For Alternatives A, B, and C, most construction in the vicinity of rivers would occur during winter until the CD5-GMT1 road and bridge(s) (no bridge at Crea Creek in Alternative B) have been constructed. Construction activities may interfere with some winter travel on frozen channels, but this would be an interim impact, occurring only during construction. Travel of local residents could be allowed through construction areas if needed.

Alternatives D1 and D2 would not have year-round road access to the drill site and would rely on seasonally constructed ice roads and aircraft for transportation to support construction. The estimated number of flights that would be required during construction are listed for each action alternative in Chapter 2 flight requirements tables.

Drilling and Operation

Operation of the facilities under the action alternatives would result in lower levels of vehicle traffic than is anticipated during construction. Traffic on the CD5-GMT1 road would be limited to the transportation of personnel and supplies between GMT1 and APF. The regional and statewide transportation systems have adequate capacity to accommodate the level of activity anticipated during construction and operation of the GMT1 Project. During drilling and operation for Alternative D1 and D2, vehicle traffic would be limited to use of seasonal ice roads (for access between GMT1 pad and APF) and the 1.3-mile access road connecting GMT1 pad and the occupied structure pad and airstrip in Alternatives D1 and D2.

The estimated number of flights that would be required during drilling and operation are listed for each action alternative in Chapter 2 flight requirements tables.

Comparison of Alternatives

In general, all the action alternatives would impact common transportation opportunities and constraints within the region, which include both air and land transportation modes.

Transportation components are similar under Alternatives A, B, and C, linking GMT1 to existing infrastructure by the CD5-GMT1 road. There would be impacts of low intensity, interim duration (limited to the construction phase), and regional extent. The proposed Nuiqsut Spur Road would link Nuiqsut by gravel road to the proposed CD5 road and CD5-GMT1 road. If constructed, residents of Nuiqsut would have an additional local transportation option available, particularly during times outside of the ice road.

There are several hazards commonly associated with roads in the area. Ice fog exacerbated by emissions can impede visibility and white outs are frequent in the winter. Heavy industrial traffic on the road can lead to increased accidents involving residents traveling on or across the road, particularly when residents will likely be traveling in smaller passenger vehicles or on snowmachines or ATVs. Hunters traveling overland by snowmachine or ATV may not be able to see if there is traffic on the road before they gain speed to cross it. Seasonally, conditions may make it very dangerous to go around the road by the bridge.

Under Alternative C transportation infrastructure would be enhanced at the Nuiqsut Airport including a runway extension, a logistics pad and apron, and a new airport access road to direct project-related traffic around the community. The proposed Nuiqsut Spur Road would be widened to accommodate project-related traffic. Air traffic at Nuiqsut would increase as workers and supplies are flown in for delivery to the project construction sites and facilities. Commercial flights at Nuiqsut may increase as a result of greater demand, depending on the volume and the decisions of private aviation companies.

Under Alternatives D1 and D2, there would be no CD5-GMT1 road and all access to the GMT1 pad would be by vehicle on the ice road and/or aircraft. The estimated number of flights required during construction and drilling are listed in Tables 2.8-5 and 2.9-5. Data indicate a large increase in air traffic would occur at the APF airstrip and in the regional airspace between APF and GMT1 pad. The increased air traffic to access GMT1 pad under Alternatives D1 and D2 would be mostly small, fixed-wing aircraft. Helicopter flights would more than double, mostly to transport special studies personnel that would otherwise travel by road under Alternatives A, B, or C; these include flights to perform work required by permits; most are necessary during the summer season when fish, wildlife, and other resources can be monitored. Emergency response depending on the severity and the timing could increase air traffic use under Alternatives D1 and D2. Overall, impacts to local transportation under Alternatives D1 and D2 are expected to be medium intensity, long-term duration, and of regional extent.

Under Alternative E, no new transportation components would be added and there would be no impact to local transportation. Opportunities for gaining road transportation to access subsistence use areas would not be realized. Flights for studies and other permitted activities would likely continue.

Mitigation

The transportation components of the GMT1 Project are designed to tie into existing transportation infrastructure without additional modification. The CD5-GMT2 road would extend only to APF, but not to an existing network. The CD5-GMT1 road would also connect with the Nuiqsut Spur Road allowing local residents to travel further into the NPR-A for subsistence hunting and fishing.

Potential impacts to transportation are also mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and BMPs of BLM (2013) will reduce the impacts and total area of disturbance; these include E-1, E-5, and F-1. The Applicant's *GMT1 Aircraft Plan* is provided in Appendix H.

Conclusions

Overall, impacts to local transportation, including hydrocarbon transportation, are expected to be minor under Alternatives A, B, and C. Impacts would be moderate overall for Alternatives D1 and D2, due to the increased demand for air transportation service to transport personnel and equipment to a GMT1 pad without a CD5-GMT1 road. Alternative E would have no impacts to local transportation. For all action alternatives, the impacts would be of medium intensity, common in context, with temporary to long-term duration, and regional in extent. This determination is based primarily on transportation of produced hydrocarbon from GMT1, which will have a beneficial impact by assuring continued operations of existing facilities (APF). These impacts are within the range of impacts analyzed by BLM (2004, 2012).

4.4.4.3 Recreation

All action alternatives would result in minimal impacts to recreation during construction, drilling, and operation. These impacts are described by BLM (2004, § 4F.4.7) and generally for the Northeast NPR-A (BLM 2008, §§ 4.3.16, 4.4.16, 4.5.16, and 4.6.16) and the entire NPR-A (BLM 2012, § 4.3.16). The following discussion summarizes the impacts, and uses impact criteria from the Point Thomson FEIS related to recreation (Corps 2012, § 5.18).

There are no public recreational facilities in the project study area. Existing recreational opportunities in the project study area are a function of the natural setting. Public recreational use in the project study area is low intensity and primarily represented by non-local visitors that float the Colville River between Umiat and Nuiqsut. The project study area offers opportunity, but limited access, for primitive unconfined recreation to backpack, sightsee, and hunt.

Limited access and the remote nature of the area inherently restrict the ability of the public and local residents to access outdoor recreational opportunities in the project study area. Under existing conditions, a person who does not live on the North Slope has limited access, with most recreational access currently provided by chartered aircraft landing at or near their specific destination. From the landing spot, land access would continue by chartered aircraft during the summer or by snowmachine/dog sled during the winter. The proposed gravel road (Nuiqsut Spur Road) extending northward from Nuiqsut would provide pickup/car/ORV travel to the Alpine gravel road system (which can be used by the local population, but not outside recreational users) for subsistence activities and to the GMT1 pad vicinity in all action alternatives except Alternatives D1 and D2. Except for ice roads, there is no road access between Nuiqsut and the Dalton Highway or any other airport. Construction in the project study area would have negligible impact on the limited recreation potential.

Impact analysis criteria used in this assessment for recreation are presented below in Table 4.4-11. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts.

Table 4.4-11. Impact Criteria—Recreation

Impact Category[a]	Magnitude	Definition
Intensity	High	Change in recreational environment, recreational opportunity, or the quality of the experience that would likely be felt by most recreationists in the area or contemplating use of the area; change that is likely to be controversial for users and/or land managers.
	Medium	Change in the recreational environment, recreational opportunity, or the quality of the experience that would likely be felt by some recreationists in the area; likely to generate little controversy for users or land managers.
	Low	Little or no evident change in the recreational environment, recreational opportunity, or quality of the experience.
Duration	Long Term	Impact would be irreversible or so long term that no end would be known; there would be no plan for elimination of impact at end of project.
	Interim	Impact would last for several years but less than life of project, or known elimination of impact as part of the project’s end.
	Temporary	Impact would last through project construction or similar clearly limited time frame that would be substantially less than the life of the project.
Context	Unique	Impacts to unique recreation opportunities and constraints.
	Important	Impacts to recreation opportunities and constraints within the locality or region protected by legislation.
	Common	Impacts to usual or ordinary recreation opportunities and constraints.
Geographic Extent	Statewide	Likely to be felt by recreationists beyond the local geographic extent (i.e., outside the Northeast NPR-A) e.g., by ‘the idea’ of loss of recreation opportunity; impact perceptible in the project study area in such a way as to change the recreation experience that is currently available.
	Regional	Extending beyond the project study area but within the northeastern part of the NPR-A
	Local	Within the project study area

[a] See Section 4.1.2, *Impact Criteria*, for term definitions.

Construction

Most construction of features such as roads, pipelines, gravel pads, and airstrips, would occur during the winter to minimize impacts to the tundra. Very little organized recreation occurs during these harsh winter months, and only limited recreation occurs in the area during the summer.

During construction in any of the action alternatives, the extra activity and noise of mobilizing equipment to the site and the outdoor activity associated with gravel mining and construction of road, airstrip, and pads would make the site somewhat more conspicuous to recreationists than during drilling and operation.

Drilling and Operation

Similar to construction, drilling and operation would cause minimum impact on the limited recreation activity or potential in the project study area. The drilling and operations phase for any of the action alternatives is expected to result in the same kinds of recreational impacts at the same intensity and geographic extent.

Comparison of Alternatives

Under all of the alternatives, residents of Nuiqsut will continue to have access to existing Alpine Field transportation facilities including limited access on winter ice roads.

BLM has determined that adverse impacts to primitive recreational uses associated with a community generally are indistinguishable to users that are at least 5 miles distant from a community, and by inference, at least 5 miles from a permanent oil and gas facility (BLM 2012, § 4.8.7.19, pp. 279 and 122). Impacts to primitive, unconfined recreation would have low intensity beyond 5 miles, a long-term duration, and localized spatial extent.

Alternatives A, B, C, D1, D2, and E would not provide year-around surface transportation to the Dalton Highway. Public access via road between the Dalton Highway and Umiat does not exist, but a road to Umiat that could provide public recreation access to the Colville River has been considered by the State. Alternatives A, B, C, D1, and D2 would not affect a future decision on whether a road to Umiat is, or is not, constructed. Conversely, Alternative E would deny development of GMT1. This decision has the potential to adversely impact public access to Umiat for recreational use of the Colville River. The State road to Umiat could be delayed or abandoned due to the potential implication that remote oil and gas resources will not be approved by the responsible federal entities.

Mitigation

In the reasonably foreseeable future, development of oil and gas facilities is unlikely to change the overall number of visitors that would participate in outdoor recreation in the project study area.

BMPs and design features that would reduce the visual impact and noise could also reduce the area of impact on recreation, including: A-1, A-5, C-2, C-3, C-4, E-5, E-6, E-7, E-17, F-1, H-3, I-1, and M-2. Impacts are expected to be minor and within the range described in BLM (2004, § 4F.4.7).

Conclusions

Impacts to recreation are expected to be negligible as a result of all the alternatives. Recreation use in the project area could be negatively impacted under all of the action alternatives due to the presence of permanent facilities and associated noise. However these impacts would be common and only local in nature. The duration of impacts would be temporary to long term depending on the activity taking place. The impact intensity of the proposed project would be moderate as the change would be recognizable to a local subsistence user, but not necessarily an outside recreational visitor.

Wild and Scenic Rivers

The Colville River has been determined to be not suitable for inclusion in the National System; primarily because federal ownership stops at mean high water of the west bank of the Colville River and there is a general lack of support by the State and Native land owners of the river bed and the east river bank.

Alternatives A, B, C, D1, and D2 would have no impact on existing or future potential of the Colville River to be added to the National Wild and Scenic Rivers System. Given the general priority for oil and gas resource exploration and development on the North Slope in this area, it is unlikely that Alternative E would increase the future potential that the Tiŋmiaqsiġvik (Ublutuoch) River or Fish Creek be added to the National Wild and Scenic Rivers System at some future date.

Wilderness

The project study area is not within a federally designated wilderness area, adjacent to an existing Wilderness Area, and does not include lands recommended for Wilderness designation. The Secretary of the Interior recommended that an area of NPR-A adjoining Gates of the Arctic National Park and Preserve Wilderness not be opened to oil and gas leasing that would otherwise forego potential Wilderness designation at some future date (BLM 2013d). At the same time, the BLM (2012 and 2013d) did not recommend existing CPAI oil and gas leases or other oil and gas ownerships be cancelled so the federal lands surrounding GMT1 could be added to the National Wilderness Preservation System. Adherence to lease stipulations and BMPs of BLM (2013) will reduce the impacts to wilderness characteristics; these include: A-1, A-4, A-5, A-6, C-2, C-3, E-5, F-1, I-1-, and M-2.

4.4.4.4 Visual Resources

This section discusses potential impacts to visual resources that could result from the proposed project. The level of impacts on visual resources will be based on levels of intensity, duration, extent and context as shown in Table 4.4-12. These impact criteria were developed based on a range of possible outcomes and to provide a frame of reference for impacts.

Table 4.4-12. Impact Criteria—Visual Resources

Impact Category[a]	Magnitude	Definition
Intensity	High	Acute or obvious disturbance to visual resources.
	Medium	Noticeable disturbances to visual resources
	Low	Disturbances in visual resources may not be measurable or noticeable.
Duration	Long Term	Impact would be irreversible or of such long duration that it appeared permanent; no plan for elimination of impact at end of project.
	Interim	Impact lasts for several years but less than the life of the project or known elimination of impact as part of the project’s end.
	Temporary	Impact lasts through project construction or similar clearly limited time frame that would be substantially less than the life of the project.
Context	Unique	Impacts to unique visual resources or resources protected by legislation.
	Important	Impacts to visual resources within the locality or region or resources protected by legislation.
	Common	Impacts to usual or ordinary visual resources; not protected by legislation.
Extent	Statewide	Likely to be seen beyond 2.5 miles from project developments and across much of the project study area or farther.
	Regional	Likely to be seen within 2.5 miles.
	Local	Likely to be seen at close range within 0.5 mile.

[a] See Section 4.1.1, *Impact Criteria*, for term definitions.

Based on BLM (2013), approximately 8.4 million acres of federal land in the NPR-A including the GMTU are classified as VRM IV (see BLM 2013, Map 3). VRM IV is the least restrictive visual classification, allowing high relative change to the existing visual character of the area. Developments in VRM IV may attract attention and dominate the view, but are still mitigated. The buffer around the proposed project also crosses into an area classified as VRM III; the area of land located in the area classified as VRM III varies by action alternative. VRM III is more restrictive than VRM IV, with the objective of retaining the existing character of the landscape while allowing moderate changes. VRM considerations do not apply to land owned by the Kuukpik Corporation within NPR-A. Until transferred from BLM ownership, pending valid selections by the Kuukpik Corporation continue to be managed by BLM (i.e., VRM considerations will apply).

Oil and gas activities, including the action alternatives would change the existing undeveloped visual character of federal land in the project study area, but still be consistent with VRM IV. The BLM (2004a) approved the authorization of the proposed GMT1 Project, and BLM (2013) assumes that GMTU, and specifically GMT1, would be developed under the lease stipulations, and BMPs described in Section 4.7. There has been little change in the existing or prospective use of the project study area for oil and gas or other uses that could impact visual resources of federal land in the project study area that were not considered in BLM (2004; 2004a) and the subsequent authorizations for construction and operation of production facilities in the Alpine Field that were contemplated in 2004. The BLM (2012; 2013) considered the visual resources associated with: the development facilities constructed since 2004, and assumed the GMTU would be developed by both the GMT1 Project and the conceptual GMT2 Project. The proposed GMT1 Project has only been slightly modified from the project authorized for permitting in BLM (2004a).

Construction

Activities such as GMT1 pad construction and CD5-GMT1 road construction would have a minor impact as construction activities would occur in winter when snow and darkness make viewing these activities difficult. Pipelines are addressed below, under *Drilling and Operation*.

Drilling and Operation

Under the action alternatives the drill rig would be the most noticeable and direct impact during the drilling phase. During the summer season, when drilling is ongoing (Alternatives A, B, C, and D1), the drill rig would create a moderate contrast when viewed from a distance of 5 miles or less, resulting in an interim adverse impact. During the summer when there is adequate daylight, the drill rig would introduce vertical lines and dominate the landscape, except in Alternative D2, because the drill rig would be demobilized from the GMT1 pad each ice road season. Pad facilities would introduce a strong contrast with the natural landscape. Most buildings associated with the action alternatives are less than three stories high. However, communication towers can be as much as 200 feet high, in contrast to the predominant horizontal line of the surrounding landform. These facilities would also contrast in color with natural vegetation. Bridges across water bodies (Alternatives A, B, and C) and pipelines would repeat the horizontal line of the landform, but would contrast with the colors in the surrounding landscape. Emergency response containers strategically placed along water channels would also contrast with the colors of the surrounding landscape.

Lighting on tall structures could have a negative impact unless design criteria are included, such as directing artificial light inward and downward, rather than upward and outward. BMP E-10 requires artificial exterior lighting to be directed inward and downward from August 1 through October 31.

Comparison of Alternatives

Alternative B essentially would have the same impact on visual resources as Alternative A. Alternative B includes slightly more gravel road (CD5-GMT1 road) and pipeline system. Alternative C also would be similar, but would increase the footprint of the Nuiqsut Spur Road and Nuiqsut Airport. Both the Spur Road and the Nuiqsut Airport are on non-federal land and not subject to VRM IV development considerations. Alternatives D1 and D2 would not create the visual impact associated with the CD5-GMT1 road but would include an elevated pipeline (as in other alternatives). This would be counterbalanced by the establishment of a 5,000-foot gravel airstrip and instrumentation for all-weather aircraft use. However, the visual impact of an airstrip would be more focused in the GMT1 pad vicinity, and not across the tundra. Alternative E would have no effect on the existing VRM IV classification.

Mitigation

The BLM (2004) recommends mitigation that would blend structures and permanent facilities into their surroundings and reduce impacts from lighting on facilities over 20 feet high. Potential mitigation measure for visual resource impacts, as described in BLM (2004), including:

> *"All structures would be painted to blend with the natural environment. All colors would be pre-approved including emergency spill containers along river channels. BLM will use computer-generated colors to determine the color for structures that blend in best with the background colors of the natural landscape and may do a color test onsite. Self-weathering steel, or best management practice, will be used on all metal structures not otherwise painted, including but not limited to pipelines, communications towers and drill rigs, thus providing a more natural color of brown."*

Adherence to lease stipulations and BMPs of BLM (2013) will reduce the impacts and total area of disturbance; these include: A-1, A-3, A-4, A-5, A-6, C-2, C-3, E-5, E-17, F-1, I-1, and M-2. BMP E-17 requires the Applicant to submit a plan to the BLM to describe how they will minimize visual impacts consistent with the VRM class for the lands on which facilities would be located.

Conclusions

Overall, construction and operation of all the action alternatives would result in moderate impacts to visual resources. Pad and road construction activities would have a minor impact as these activities would occur in the winter when snow and darkness make viewing more difficult. Summer introduces more daylight and increases the opportunities for viewing operational activities. Facilities and structures (e.g., CD5-GMT1 road, airstrip) would introduce a moderate contrast with the natural landscape when viewed from the foreground-middle-ground zone. In Alternatives A, B, and C, the CD5-GMT1 road structure would be visible across the tundra. Whereas in Alternatives D1 and D2, there would be no CD5-GMT1 road across the tundra, but the airstrip and occupied structure pad unique to these alternatives would create contrast in the vicinity of GMT1 pad. For all action alternatives, the visual impacts would be of medium intensity, common in context, with temporary to long-term duration, and ranging in extent from local to regional. There would be no impacts to visual resources under Alternative E.

4.4.5 Subsistence

4.4.5.1 Introduction

Specific impacts to subsistence areas and uses in the Nuiqsut area are discussed and analyzed in BLM (2004, 2008) and BLM (2012, §§ 4.3.13, 4.4.13, 4.5.13, 4.6.13, and 4.7.13). The relevance and degree of intensity of those impacts are informed through surveys done in recent decades on subsistence harvests and research on culture and land use in the Nuiqsut area.

Subsistence data on the area (surveys and other resource information) include those conducted by the NSB Department of Wildlife Management (Brower and Hepa 1998, Brower and Opie 1997, George and Nageak 1986), Impact Assessment Inc (1990a), and the Alaska Department of Fish and Game (Braem et al. 2011, Pedersen 1995, Pedersen et al. 2000, Pedersen and Taalak 2001). Of particular relevance for this analysis is the body of work undertaken by SRB&A that focuses on subsistence in Nuiqsut (2003, 2009a, 2009b, 2010a, 2010b, 2011a, 2012, 2013b).

Ethnographic research into Nuiqsut history, land use, traditional sites, and associated cultural values includes *Nuiqsut Paisangich – Nuiqsut Heritage: A Cultural Plan* (Brown 1979); *Land Use Values Over Time in the Nuiqsut Area* (Hoffman et al. 1988) (originally published in 1979 as an NPR-A 105(C) report), a baseline report contracted by MMS entitled *Ethnographic Study and Monitoring Methodology of Contemporary Economic Growth, Socio-Cultural Change and Community Development in Nuiqsut, Alaska* (RFSUNY 1984), and *Sociocultural Impacts of the Alpine Field on the Colville River Community of Nuiqsut* (CRA 2002).

Original sources considered in analyzing the potential relevance and intensity of impacts to subsistence that could be a result of GMT1 development include input provided by Nuiqsut residents during recent decades on federal government land use plans and permitted oil and gas activities. These sources include testimony at BLM public hearings (Napageak 1990; BLM 1997, 2010, 2014b) and recommendations made at NPR-A Subsistence Advisory Panel meetings held since 1998 (NPR-A SAP 2014). The BLM 2013 NPR-A IAP/EIS ROD established the formation of the NPR-A Working Group, which is composed of representatives from the NSB, the Iñupiat Community of the Arctic Slope, ASRC, and NPR-A and North Slope city and tribal governments and village corporations. A committee of Working Group members has produced a draft document of general principles for development infrastructure in the NPR-A that the BLM intends to consider in planning and decisions.

Nuiqsut is the first Alaska Native village to have an oil production facility located in close proximity; and the types, intensity, and changing nature of impacts on subsistence from oil development in the area have been most closely monitored. Iñupiat residents of the North Slope have experienced widespread impacts from oil exploration periodically since the 1940s. Most modern exploration and development in the NPR-A, however, has been focused in the northeastern area near Nuiqsut, which was established in 1973. An ethnographic baseline study of Nuiqsut conducted before nearby oil development occurred found that "*Iñupiat perceive oil development as decreasing the availability of subsistence resources, both in absolute terms and in terms of access*" (RFSUNY 1984 p. x). The primary impacts to subsistence identified in EISs, ethnographic reports, and testimony of residents in recent decades were reduced availability of subsistence resources, reduced access to subsistence use areas, and hunter avoidance of industrial areas. Since oil development has increased near Nuiqsut, impacts of these kinds have commonly been the subject of testimony and have been corroborated by research.

There has been one critically important shift in residents' and BLM's understanding of impacts on subsistence that has occurred since the development of Alpine and its satellites in the Colville Delta. In preparing for that development, Nuiqsut residents and the Kuukpik Corporation perceived the impacts of roads as the potential impact of oil development that they most wanted to avoid. To eliminate potential impacts from roads, Alpine was developed with an unprecedented and innovative roadless design that was welcomed by all interested parties as a significant evolution in reducing the footprint of development. Since the construction of those fields, disturbance from aircraft traffic has emerged as the most commonly reported impact on subsistence activities. In comments and testimony received on the GMT1 Draft SEIS from North Slope residents, there is universal opposition to development options that include more airstrips and thus increased air traffic. Impacts from aircraft traffic are described in the analyses for each alternative below, but this fundamental shift should be recognized in introducing the discussion because of the strong sentiments of local residents and because, while it affects the relative intensity of other impacts (i.e., roads), it does not affect the degree of intensity of other impacts.

Impacts on subsistence could result in increased investments in time, money, fuel, and equipment and could potentially change hunting success. The impacts would last for multiple generations and affect key subsistence use areas and overall Nuiqsut subsistence activities. Apart from the understanding of aircraft disturbance, the types of impacts are expected to be similar to those identified in BLM (2004) and BLM (2012). Additional survey data, testimony from residents, and new information gathered since these EISs provide additional context and information. Taken together, this information indicates that the intensity of these impacts and the overall degree of impacts may be higher than previously anticipated.

New information since BLM (2004) and BLM (2012) includes SBR&A's caribou use area and harvest data from the *Nuiqsut Caribou Subsistence Monitoring Project* (2010b, 2011a, 2012, 2013b) that provide additional insight into the potential impacts of the GMT1 development. This information includes geographically specific data that document the types of resources, percent of harvest (for caribou), percent of harvesters, timing of activities, and method of transportation within the project study area. This new systematically documented information is corroborated by Traditional Knowledge and documentation of impacts to caribou hunting that have occurred since the development of Alpine satellites.

4.4.5.2 Impacts Common to All Alternatives

Spills

Impacts that are not analyzed separately for the alternatives include oil spills and rehabilitation of infrastructure. As discussed in BLM (2012 § 4.3.13.2), impacts to subsistence species could occur as a result of an oil spill although the impacts would depend on the size and location of the spill. A history of spills and potential impacts are discussed in Section 4.5 of this SEIS. Spills contained on a road or pad would likely have little impact to subsistence species as state and federal regulations require spill reporting and cleanup. Spills to tundra could affect a small number of terrestrial mammals or birds in the immediate vicinity of the spill, if they were unable to avoid the spill. Population level impacts are not anticipated. Spills to water resources or that reach water resources, such as fish-bearing streams, could spread and thus have a wider potential impact area; in the case of a large spill, areas that could be impacted include nearshore or marine waters. Spills of this nature could have a regional impact, which could vary in duration based on migration of the spill and ease of cleanup. Subsistence users would be unlikely to harvest subsistence resources in the vicinity of a spill or an area perceived to have been impacted, which could result in additional travel time or energy expenditures for subsistence harvesters. Iñupiaq elders who lived in Barrow in 1944 remembered decades later that a spill in Elson Lagoon (20,000 gallons of heavy fuel oil) suffocated seals and birds and caused whales to deter their migration from the area for four years, which led to suffering for local families who were accustomed to catching small whales in the area for their winter food supply (Perkins 2014). The potential for spills is present under all alternatives. Although the risk of a large spill to water is low, the impacts to subsistence would be high.

Rehabilitation of Infrastructure

If BLM requires the CD5-GMT1 gravel road (under Alternatives A, B, and C) be removed upon project abandonment, travel benefits to Nuiqsut residents related to the road would cease. Road removal may provide a benefit to the extent that rehabilitation is successful in restoring some degree of natural conditions; however, data are inconclusive on whether such rehabilitation is achievable. According to the NPR-A Working Group's draft *Guiding Principles for Development of Infrastructure in Northern Alaska*, situations, technologies, and scientific and Traditional Knowledge may change over time and a full understanding of the best ways to rehabilitate infrastructure generally cannot be known at the time development is planned. A principle set forth in the document states that rehabilitation of infrastructure should only be planned for and executed in consultation with local communities.

Community Participation

Impacts on subsistence related to the proposed project could result in reduced harvests of resources, particularly caribou, geese, and furbearers and reduced opportunities to participate in subsistence harvesting and associated activities. While some hunters respond to changes in resource availability by taking more trips and increasing costs in order to harvest what they need, others may choose to take fewer trips because of lack of funds or reduced success. Direct and indirect impacts to subsistence are associated with indirect impacts to the community and cultural traditions.

In addition to the pre-oil development ethnographic baseline study of Nuiqsut data contracted by MMS in 1984 (RFSUNY 1984), a 1997 study was undertaken to collect information about the positive and negative influences of the Alpine Project on Nuiqsut and another in 2000 to collect data on the period following several years of construction activity and immediately prior to the start of production at Alpine. A draft final report of that study was produced in 2002 (CRA). SRB&A's annual surveys in Nuiqsut since 2009 address many similar issues. In 2000, the survey (CRA 2002) found increases in:

- The percentage of residents who believed that the amount of game available for harvest had declined in the preceding five years.
- The number of households where Native food constituted less than half of the total food consumed.
- The number of households reporting they did not share wild resources

When SRB&A surveyed households in Nuiqsut in 2011, several households said they avoided the Alpine area altogether because they believe they may experience impacts in the area (SRB&A 2012, p. 79, Table 41). At least one subsistence hunting cabin built on the east bank of the Nigliq Channel was abandoned by its owner (Joeb Wood) and his family due to its proximity to Alpine and the reduced availability of resources at the site (NVN 2014b).

When subsistence users' opportunities to engage in subsistence activities are limited, their opportunities to transmit knowledge about those activities, which are learned through participation, are also limited. If residents decrease use of the project study area for subsistence purposes, either due to avoidance of development activities or reduced availability of subsistence resources, the opportunity to transmit Traditional Knowledge to younger generations about that traditional use area would be diminished and eventually lost. Individuals' and families' loss of intimate familiarity with an area could constitute a permanent reduction in Nuiqsut's subsistence use area. If harvests of subsistence resources (particularly caribou, geese, and furbearers) decline because of the effects of infrastructure, noise/traffic, contamination, or changes in resource availability, then there would be fewer opportunities to teach younger generations the skills necessary to hunt, harvest, and process subsistence resources. There would also be fewer opportunities for residents to participate in the distribution and consumption of subsistence resources, ultimately affecting the social cohesion of the community. Any changes to residents' ability to participate in subsistence activities, to harvest subsistence resources in traditional places at the appropriate times, and to eat subsistence foods could have long-term or permanent effect on culture by diminishing social ties within the community that are strengthened through harvesting, processing, and distributing subsistence resources, and by weakening overall community well-being.

Eli Nukapigak, a Nuiqsut pioneer who helped establish the town with his family in his youth, summarized his general concerns on the impacts of GMT1 in testimony:

> *"How are we going to do in the long run of what we're going to lose? My identity as Iñupiaq shrink, my subsistence way of life to the land I used to hunt shrink. What are we going to do when it happens? ... My identity has an impact here in the community that I plan to help out my younger generations. What are they going to do from there on, the next 30 years? ... How do you compromise something like this when industry takes away my living hood on the west? Help us and we'll compromise to do what is best for our people, because Nuiqsut will still be subsistence hunters, no matter what is going on around us."* (Nukapigak 2014b)

4.4.5.3 Impacts under Alternative A

Subsistence Uses of the Project Study Area

The GMT1 Project facilities and proposed drill site are located entirely within the northeast NPR-A, on the North Slope of Alaska, immediately west of the Colville River delta. New pipeline components for GMT1 would also be located in the Colville River delta (from CD4 to APF) within existing Rights of Way, parallel to two existing pipelines. The project study area consists of the land within 2.5 miles of all components of GMT1, including the pad, the pipeline, the CD5-GMT1 gravel road (in Alternatives A, B, and C) and the Alpine/CD5 road which be used for GMT1 under all alternatives. Alternative C would include an industrialized Kuukpik Spur Road from Nuiqsut as a GMT1 Project component, and the Kuukpik Spur Road as it is currently designed and permitted and the surrounding 2.5 miles, including the community of Nuiqsut, are included in the project study area in analyses for all alternatives.

Resources have a varied geographic scope (i.e., broad for air quality and narrow for soil analysis). The SEIS uses the standard of 2.5 miles to evaluate direct impacts to subsistence activities (i.e., access issues in overland areas where project components are proposed, loss of traditionally used land) while also analyzing indirect impacts to the larger Nuiqsut subsistence use area (i.e., hunter avoidance). Recent EISs for North Slope development projects evaluate broad areas for subsistence impacts: the 2004 Alpine Satellite Development Plan 890,000-acre plan area was bounded by the west side of Harrison Bay, south for approximately 45 miles, north by the Beaufort Sea and east by the Colville River.

The importance of particular traditional subsistence use areas that could be impacted by GMT1 can be determined through archaeological and ethnohistorical studies on the area and people. A "cultural plan" for Nuiqsut, proposed as the foundation for Nuiqsut area management to help the Nuiqsut people protect their homeland and traditional way of life, was produced in 1979 with support of the NVN, the NSB Planning Commission, and the NSB Commission on History and Culture (Brown 1979). The plan states that the villagers desired to return to a life in which hunting and fishing were mainstays, that they chose to establish modern Nuiqsut in its location because it is a place rich in animals to hunt and fish, and that it was their families' heritage of using that area that qualified them for selection of village lands under ANCSA. A degree of ASRC and NSB support that made establishing the village possible was motivated by the opportunity to select village corporation land in the Colville Delta with its known oil reserves. The cultural plan (Brown 1979) emphasizes that the Nuiqsut pioneers moved (or returned) to the Colville Delta to perpetuate traditional values of maintaining a close relationship to the land and teaching this knowledge to the young. The plan used a cultural landscape map that depicted Nuiqsut's intensive subsistence use area as the land bounded on the west by the eastern side of Teshekpuk Lake, south to Umiat and the lower section of the Anaktuvuk River, west to Prudhoe Bay, and north to include the Beaufort Sea. The "Settlement Area" described in Nuiqsut Paisangich encompasses the GMT1 project study area and is described in the report as requiring "*strict controls severely limiting non-traditional uses*." The plan stated that the extended subsistence area requires "*careful mitigation to minimize effects of selected non-traditional uses*" (Brown 1979).

When the Naval Petroleum Reserves Production Act was drafted in 1976, NSB Mayor Eben Hopson succeeded in including Section 105 (C) (1) that created an inter-agency NPR-A Task Force to join the NSB with ASRC and a number of Department of Interior and state agencies to produce a comprehensive NPR-A land use plan. Nuiqsut village leaders decided in 1977 that the survey should first visit three sites on the Nigliq Channel (Nigliq/Woods' Inaat, Nanuq, and Uyagagvik) and Fish Creek (Hoffman et al. 1988). The survey led to detailed histories and status reports on 14 sites in the Nuiqsut area.

Hazardous travel conditions prevented the NPR-A Task Force trip to Fish Creek, thus archaeological sites on Fish Creek were not surveyed at that time for the work. The report does note that fishing at Fish Creek begins in July and continues throughout the summer and that caribou from the TH start moving up the Tiŋmiaqsiġvik (Ublutuoch) River over to the Colville River in September but that "*some caribou always stay through the winter near Fish Creek*" (Hoffman et al. 1998, p. 16). In October and November, people would travel to fish camps on Fish Creek for ice fishing for cisco and qaaktaq and opportunistically hunt female caribou during this time (Hoffman et al. 1998, p. 16).

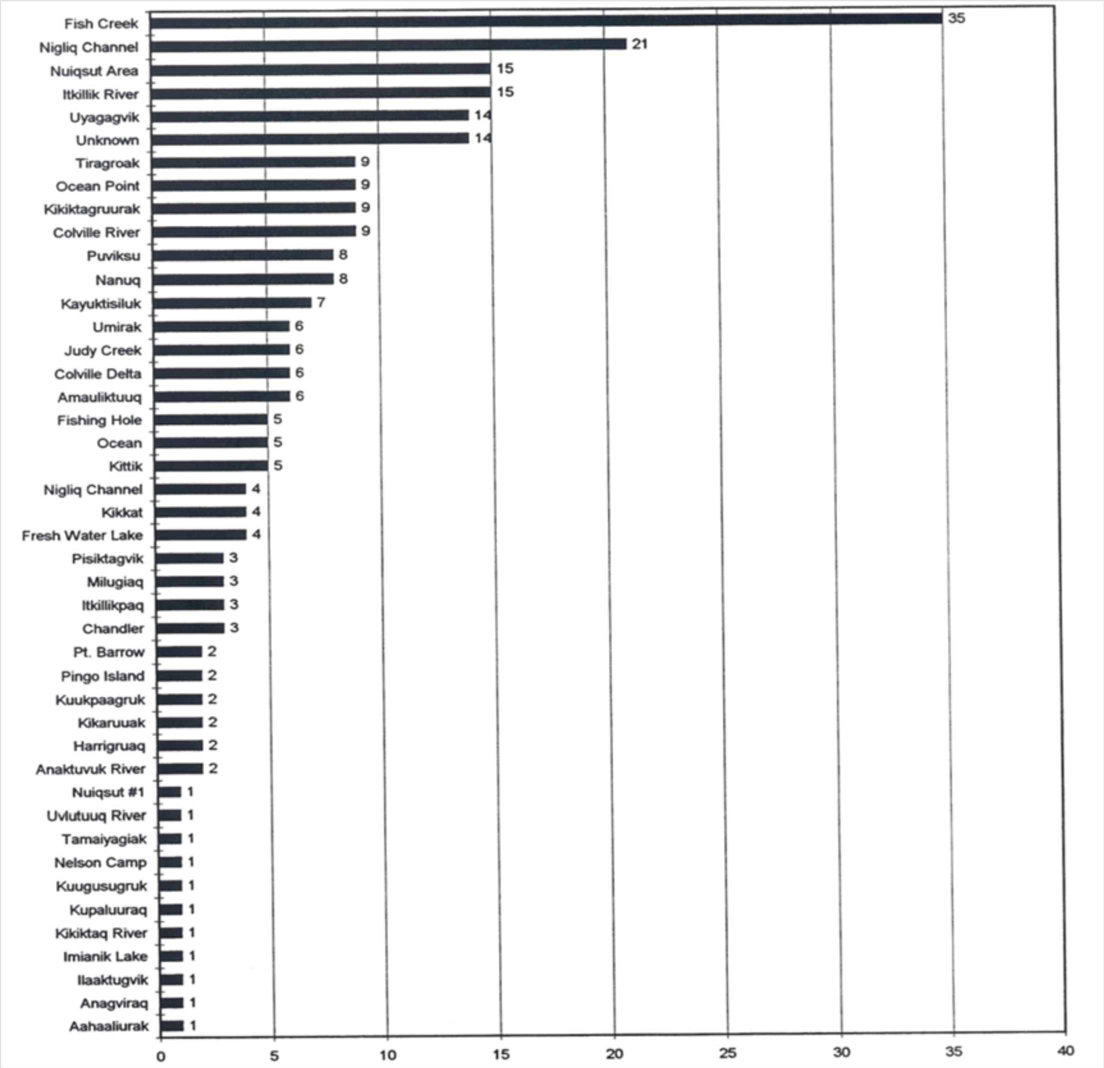
The Fish Creek area, like other nearby areas, is of particular importance to hunters. The NPR-A 105 (C) report notes that varying expenses for different subsistence resources create a gradient of access. Whaling is the most expensive and spring hunting for wolf and wolverine is the second most expensive. These are relatively "elite" hunting occupations, while other resources require less cash and greater chances for success. Bird and seal hunting are more accessible but also expensive (geese are not particularly plentiful near Nuiqsut, thus fewer are harvested at one time and seal hunting requires a large, seaworthy boat and 20 to 30 miles of travel). Hunting for caribou, by contrast, is the "*bread-and-butter component of the Nuiqsut subsistence complex…It is possible to hunt caribou with a relatively small cash outlay. Since the founding of Nuiqsut, there have been some caribou in the Fish Creek area each year, throughout the year. This area is only about 12 miles (19 km) from the village and the cost of traveling there by snowmachine is small*" (Hoffman et al. 1988, pp. 18-19). An example is given of a poorer individual who was normally unemployed, did not speak English, and did not whale in Nuiqsut or Barrow. "*This man's most important subsistence activity is fall fishing at Fish Creek. He hunts caribou by snowmachine, which he shares with a relative, while at fall fish camp*" (Hoffman et al. 1988, p. 21). *Nuiqsut Paisangich (Nuiqsut Heritage: A Cultural Plan)* also notes that regulations and restrictions on hunting caribou "*have definitely hurt the people of Nuiqsut, especially those unable to pursue 'expensive' subsistence resources*" (Brown 1979).

In the early 1980s, when oil exploration was ongoing in the NPR-A and before development and production was permitted, a company (Sohio) requested to drill an exploratory well near Fish Creek, approximately 32 miles northwest of Nuiqsut. Researchers conducting an ethnographic study for MMS at the time noted that this proposal could potentially affect Nuiqsut due to its proximity to town and because Fish Creek "*is also one of their most important subsistence resource areas, both for fish and caribou.*"

Residents of Nuiqsut continue to stress the importance of the Fish Creek area in terms of harvesting resources and as a cultural value. Tony Cabinboy testified at the public meeting on the GMT1 Draft SEIS:

> *"…I have a campsite near the mouth of Fish Creek and I take my family there every summer, every spring, summer and fall. We geese hunt there in the spring. We set nets in the summer. We hang fish to dry. All the time, we go caribou hunting for the prime caribou in the fall. [I]n the 25 years I've been going to Fish Creek with my family and seen the caribous come and go, I've gone up the river all the way up to Judy Creek seeing caribou. …it scares me to think that the next generations with this GMT1 going up, are not going to be able to experience the good hunting that we have in the Fish Creek/Judy Creek area…"* (Cabinboy 2014)

NSB Department of Wildlife subsistence research specialists documented Nuiqsut harvest success and locations in 1994-1995 (Brower and Opie 1997), as shown in Figure 4.4-1. Of the 43 known harvest locations reported, the location used most often for harvesting resources was Fish Creek, the second most used location was the Nigliq Channel, and the third most used location was immediately around the community. Of the 255 times that the 43 known harvest locations were used during the study period, locations were within harvest areas overlapped by the GMT1 project study area 111 times (43.5 percent of the time) using a metric that considers sites that are within use areas (as defined by Braem et al. 2011) that are partially overlapped by the GMT1 project study area, referred to as Fish Creek, Nigliq, Nuiqsut Area, Uyagagvik (on the Nigliq Channel), Nanuq (on the Nigliq Channel), Fishing Hole (immediately east of town on the Nigliq Channel), Fresh Water Lake, and Kupaluuraq (Nigliq Channel). This is a conservative metric: the GMT1 project study area also overlaps with the eastern edge of what is called the "East Colville Delta" use area and the eastern edge of the "East of Putu" use area (Braem et al. 2011). A metric that included the 1994-1995 NSB report harvest locations within those two other areas or harvest locations within the larger GMT1 indirect impacts analysis area would conclude that a higher percentage of harvest locations could potentially be impacted by GMT1.



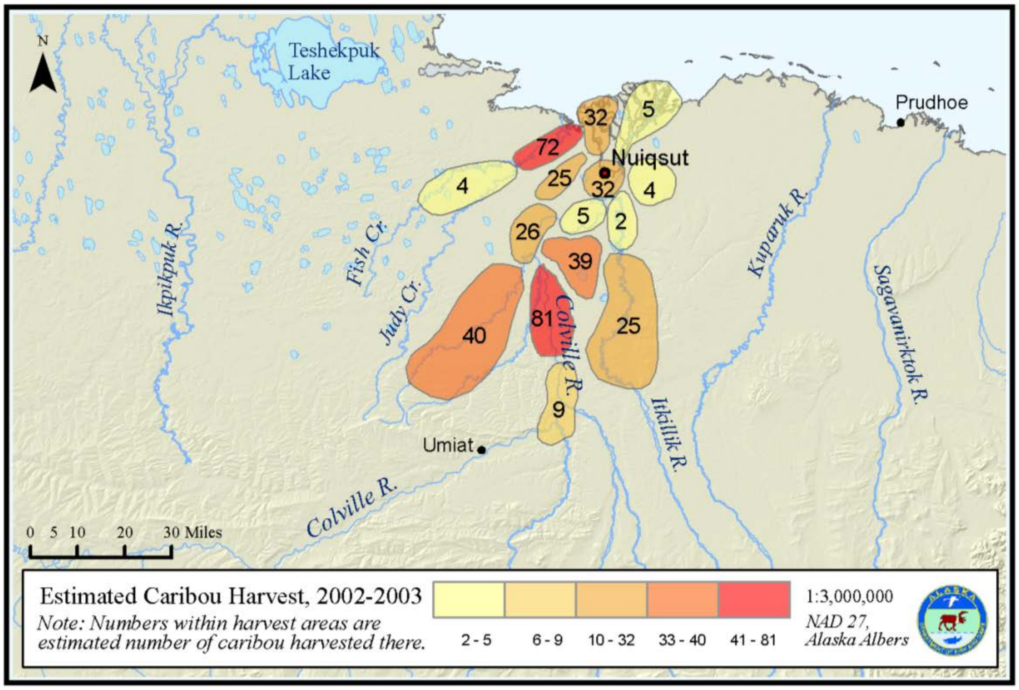
Source: Brower and Opie 1997, p. 25

Figure 4.4-1. Number of Times Each Harvest Location was Used by Nuiqsut Hunters, July 1, 1994 to June 30, 1995

The NSB subsistence documentation project surveyed 82 households and conducted interviews in 71. Forty-nine households reported harvesting and all 49 shared (gave away) some of their resources. Of a total of 259 harvests, 87 percent resulted in sharing. Terrestrial mammals (caribou and moose) accounted for 69 percent of the edible pounds of the subsistence harvest by Nuiqsut hunters during the study period. This is a much higher percentage than other years, which possibly was due to an unsuccessful bowhead hunt during this study period. The number of caribou harvested (249) did not vary greatly that year, but caribou dominated the subsistence harvest in edible pounds with 48 percent. Other data show that in 1985 approximately 270 caribou were harvested (Pedersen, unpublished data, cited in Brower and Opie 1997, p. 26). In 1992, an estimate of 278 caribou were taken (Fuller and George 1999) and in 1993 an estimate of 485 caribou were taken (Pedersen, unpublished data, cited in Brower and Opie 1997, p. 26). The number (249) of caribou harvested during the study period is low compared to the limited data available for other years. The report notes that:

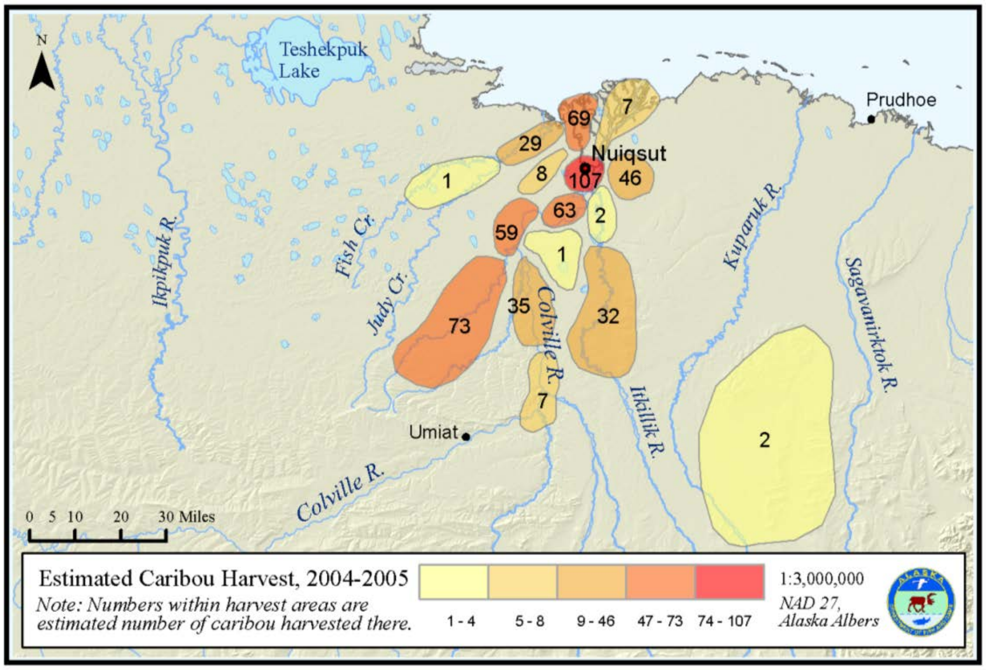
> *"The low level of harvest reflects the long distance they [hunters] had to travel to harvest caribou…Another comment made by Nuiqsut hunters relates to their traditional subsistence land use areas, which have been restricted due to oil and gas exploration and development. For example, areas used ten years ago for hunting and fishing may have restricted access today due to being within development and exploration areas."* (Brower and Opie 1997, p. 30)

The ADF&G delineated and quantified caribou harvest areas using the caribou area around Nuiqsut based on information obtained through the viewpoint of Native subsistence users (emically) (Braem et al. 2011). The GMT1 project study area overlaps substantially with sections of at least four of those caribou hunt areas: the Fish Creek area, the Tiŋmiaqsiġvik area, the Nigliq area, and the Nuiqsut area. As noted above, the project study area overlaps less substantially with the East Colville Delta and the East of Putu caribou hunt areas. Figures 4.4-2 through 4.4-5 document the number of caribou harvested in the various caribou harvest areas for the years 2002-2007.



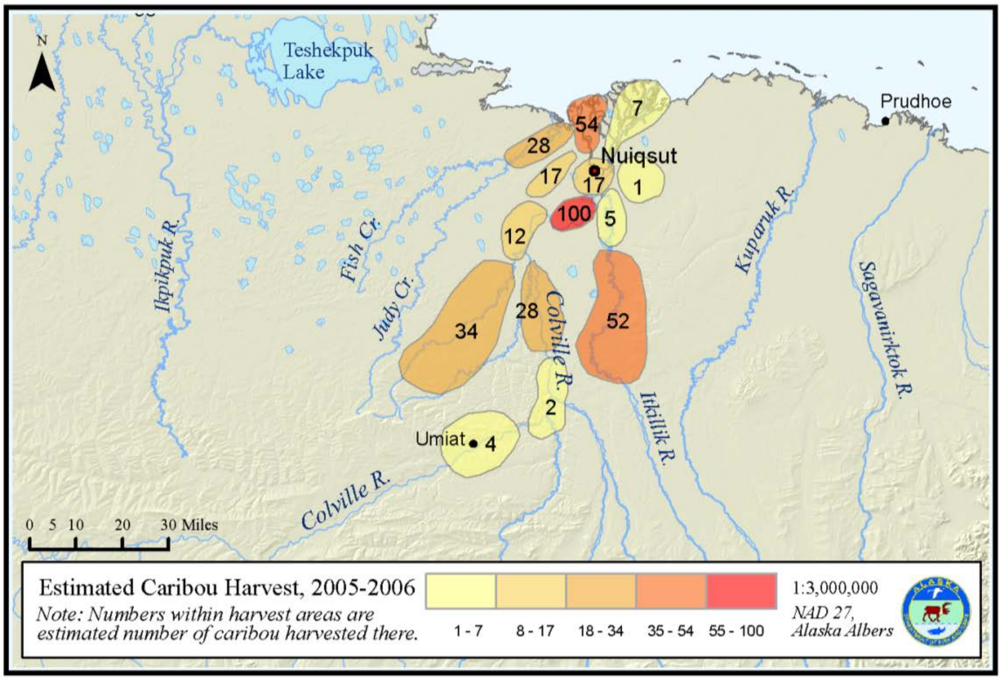
Source: Braem et al. 2011

Figure 4.4-2. Estimated Caribou Harvest, 2002-2003



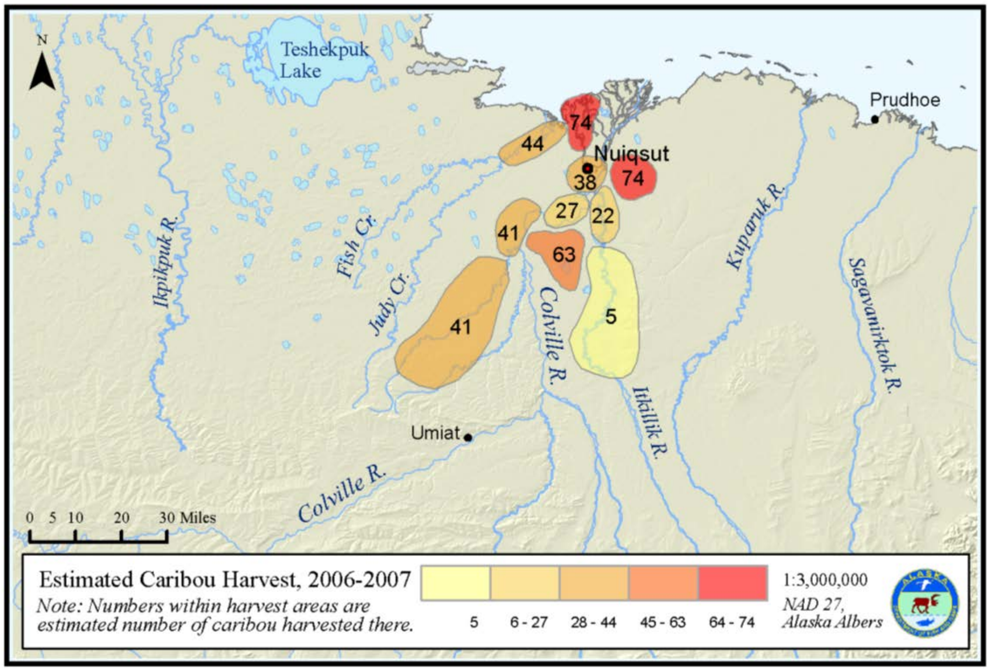
Source: Braem et al. 2011

Figure 4.4-3. Estimated Caribou Harvest, 2004-2005



Source: Braem et al. 2011

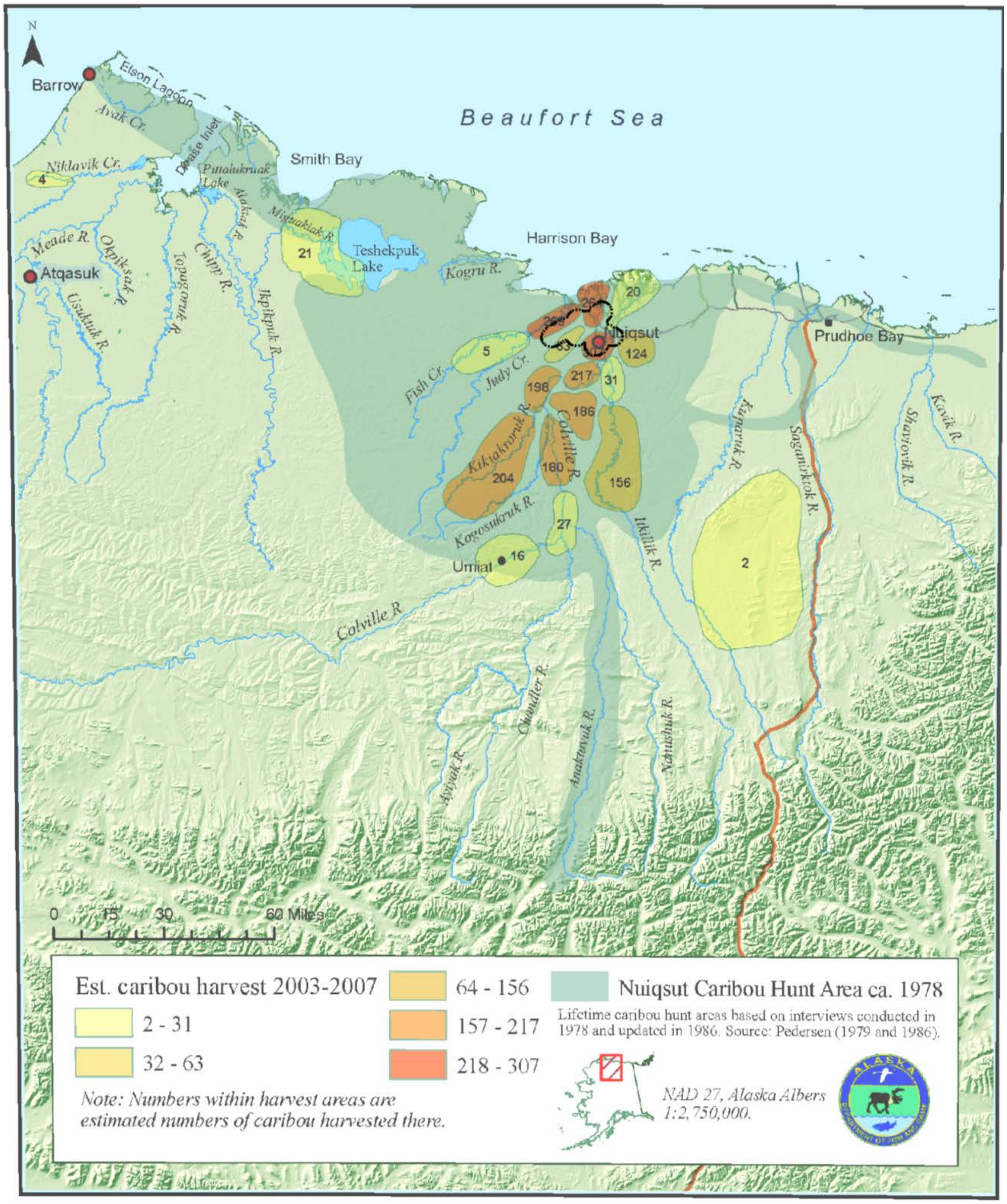
Figure 4.4-4. Estimated Caribou Harvest, 2005-2006



Source: Braem et al. 2011

Figure 4.4-5. Estimated Caribou Harvest, 2006-2007

Figure 4.4-6 shows the total of caribou harvested in each area during the period 2003-2007 with the GMT1 project study area superimposed. The four harvest areas that overlap the GMT1 project study area are Fish Creek, Nigliq, Tiŋmiaqsiġvik, and Nuiqsut. The combined harvest in these four areas during the period 2003-2007 represents 38.3 percent of all harvests during the study period.



Source: Braem et al. 2011, p. 72

Figure 4.4-6. Estimated Caribou Harvest, 2003-2007

More recent subsistence surveys and mapping conducted by SRB&A in the Nuiqsut area provide data on the average percentage of annual harvest amounts occurring in the project study area and the percentage of harvesters using the project study area. For the subsistence analysis in the recent Point Thomson Project EIS (Corps 2012), the geographic extent was defined in terms of the percentage of harvesters potentially affected rather than by the percentage of overall use areas because the size of an affected area is irrelevant if the area provides high harvest amounts, if subsistence users have a traditional or cultural connection to the use area, or if residents travel to the use area to harvest resources not available elsewhere.

Based on SRB&A's recent subsistence mapping (2010a, 2013b), data finds that the proposed project study area overlaps with areas that have been documented for multiple types of subsistence activities. This overlap of the project footprint results in the loss of traditional use areas for resources in those areas. SRB&A's recent data show that 44 percent of all Nuiqsut use areas and 31 percent of overland Nuiqsut use areas are overlapped by the project study area for 1995-2006 (Table 3.4-8). In addition, SRB&A data indicate the project overlaps with 86 percent of all 2008-2011 caribou use areas and 22 percent of overland 2008-2011 caribou use areas. In general, subsistence activities that would be particularly impacted by project activities include caribou, geese, and wolf and wolverine hunting, in addition to some overland travel to Arctic cisco and burbot fishing use areas along the Colville River (Maps 4.4-1 through 4.4-6).

A high number of overlapping caribou use areas was documented throughout the project study area during the 1995-2006 study (Map 4.4-1). More recent documented caribou use areas (Map 4.4-2) show the highest numbers of overlapping use areas within the project study area more focused along the Nigliq Channel, Fish Creek, and in overland areas west of the community toward Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek. Geese hunting areas (Map 4.4-3) show the highest numbers of overlaps in lands surrounding Nigliq Channel, Fish Creek, and the Colville River south of the community. Wolf and wolverine use areas (Map 4.4-4) show the highest numbers of overlaps in the southern and western portions of the project study area. Arctic cisco and burbot use areas in the project study area occur primarily along the Nigliq Channel north of the community (Maps 4.4-5 and 4.4-6).

Resources such as caribou and Arctic cisco contribute highly to the community's overall per capita harvest and although other resources such as geese and burbot do not contribute as much in terms of edible pounds, a high percentage of households participate in these activities and use and share these resources (Maps 3.4-1, 3.4-2, and 3.4-3). The majority of direct impacts to subsistence users in the project study area would occur during the late fall caribou hunt, winter caribou and wolf/wolverine hunting, and spring geese hunting. Direct impacts to existing summer subsistence use areas, which are focused more along river channels, would be more limited in nature. Indirect impacts from the aircraft traffic associated with the project would be highest in the summer. The project study area will likely have increased land-based subsistence activity in summer because Nuiqsut residents will be able to drive vehicles or four-wheelers along the constructed roads.

User Access

Restricted access to subsistence use areas has been experienced as a primary impact of oil and gas development and is a primary concern associated with the GMT1 Project. Testifying at a public meeting on the GMT1 Draft SEIS, Joseph Nukapigak of Nuiqsut stated:

> *"Access to the land is very important because we don't know no boundaries when we go out hunting…These are the concerns that have been brought up time and time again. Access is the most important component…"* (J. Nukapigak 2014c)

Under Alternative A, impacts on access to and through the project study area will be lessened due to the 7-foot pipeline height and permission to use and cross gravel roads associated with the project. Several Nuiqsut individuals have reported that the 7-foot pipelines still produce barriers to access in areas of high snow drifts (SRB&A 2009a, 2013b). In ongoing (2014) government-to-government consultation with the NVN on the GMT1 Draft SEIS, council members have discussed these pipeline concerns at length. Council members have requested that the pipeline be buried in sections or that ramps be constructed over the pipeline to facilitate crossing by both snowmachines and caribou, however burying pipeline in permafrost is problematic and ramps in other areas (i.e., Prudhoe Bay) are not demonstrably effective.

Use of the CD5-GMT1 gravel road under Alternatives A, B, and C could have countervailing impacts to subsistence by enabling hunters to access more areas year-round. Direct impacts to access (i.e., by introducing physical barriers or obstructions to travel) would be most likely for subsistence activities near Fish Creek that would require traveling through the proposed project area by snowmachine. These impacts may occur during winter wolf and wolverine hunting and spring geese hunting, both of which occur in the Fish Creek area. In addition, these impacts could occur for residents traveling by snowmachine in the winter to hunt caribou. The road may provide a possible benefit to access for residents who do not have snowmachine or four-wheeler transportation.

Concerns that the CD5-GMT1 gravel road would complicate access to Fish Creek and other use areas were exacerbated in May 2014, when Nuiqsut hunters headed to their camps on Fish Creek for spring geese hunting and found they were unable to cross the new, under-construction CD5 road with either snowmachine or four-wheeler because the road was too steep and high. The hunters were able to go around the road by the Nigliq Channel bridge site, but they were concerned they would not be able to cross a similarly constructed CD5-GMT1 gravel road and would have to travel much further to go around. Other hunters returning from Fish Creek on snowmachines found that with spring overflow on the river they could no longer go around the road by the bridge site and needed to travel all the way around the CD5 pad (E. Nukapigak 2014a).

If the GMT1 road is equally difficult to cross, this will present a direct impact to access in the project study area for the length of the road (7.6 miles) in addition to the 5-mile CD5 to Alpine road. Access to the area by road would be facilitated by the completion of the Kuukpik Spur Road; however, if road conditions are similar, hunters would not be able to leave the road and get back on it. Hunting directly from a road is illegal on all roads in the state; therefore hunters would be required to leave the road to hunt. Seasonally, conditions may make it very dangerous to go around the road by the bridge. There are several other hazards commonly associated with roads in the area. Ice fog exacerbated by emissions can impede visibility and white outs are frequent in the winter. Heavy industrial traffic on the road can lead to increased accidents involving residents traveling on or across the road, particularly when residents will likely be traveling in smaller passenger vehicles or on snowmachines or ATVs. Hunters traveling overland by snowmachine may not be able to see if there is traffic on the road before they gain speed to cross it. These hazards and access factors would largely negate any countervailing positive impacts to access provided by the road.

User Avoidance

While the actual footprint of the proposed project overlaps with only a small portion of Nuiqsut's highly used subsistence areas, avoidance of the area will be at a greater distance than the footprint, and therefore the loss of subsistence use areas will be larger than the direct overlap of the project with documented use areas (NRC 2003; BLM 2004a, 2014b; MMS 2007). Subsistence harvesters often avoid areas of development due to concerns about contamination and because of residents' discomfort about hunting near human or industrial activity. Concerns about shooting near traffic, infrastructure, or towards pipelines could cause residents to avoid hunting in the GMT1 area even if resources are present in those areas. Since it is likely that the road will result in increased hunting competition in the area directly around the road, other hunters may avoid the area because of that competition.

The shifting of subsistence use areas away from areas of development at a distance greater than the development footprint has already been documented for the community of Nuiqsut (IAI 1990a, Pedersen et al. 2000, RFSUNY 1984, SRB&A 2013b, MMS 2007). User avoidance will be most acute near the proposed GMT1 pad and pipeline to CD5. The BLM continues to recognize and analyzes the avoidance effect for GMT1 due to the preponderance of research indicating its significance, including the strong and continuous input BLM has received from hunters on this issue. The Kuukpik Corporation comments (on behalf of shareholders and other community institutions) to the BLM on the NPR-A Draft IAP/EIS in 2012 noted that BLM's analysis:

> *"…often dramatically understates the actual impacts of oil and gas development on Nuiqsut"* and that *"the conclusion is usually a blythe dismissal of its implications, in spite of its undisputed scope."* (I. Nukapigak 2012)
>
> *"The Avoidance effect has been documented by a number of scientists and researchers, where Native hunters harvest virtually no game within a five mile radius of oil and gas facilities, and dramatically reduced amounts of game within a sixteen mile radius. These areas are effectively eliminated from each community's available subsistence range or at least made much less valuable than they historically had been."* (I. Nukapigak 2012)

Discussing the likelihood that future standalone development in the NPR-A would most likely include roads, Kuukpik Corporation's written comments noted that the failure to adequately consider and analyze avoidance impacts from those foreseeable projects was one of the biggest defects and failures of the Draft EIS:

> *"The Avoidance effect and its extent and impact need to be incorporated into every major planning decision, not just for Nuiqsut, but for all of the affected North Slope communities."* (I. Nukapigak 2012)

With the connection provided by the new Nuiqsut Spur Road, Alternative A is not a scenario for standalone development. The countervailing impacts of this connection would likely decrease the avoidance effect.

Pedersen et al. (2000) provides the most detailed analysis of this impact, noting that harvest location information for Nuiqsut from 1993 and 1994 "*provide support for the claim of displacement from traditional hunting areas*." The report notes that 80 percent of the community's 1993 harvest came from areas more than 16 miles from any development, and a similar pattern was noted during the following year from NSB research. According to MMS (2007), oil and gas development has the potential to divert subsistence users a distance of 5 miles to greater than 25 miles from facilities (Corps 2012).

SRB&A (2009a) summarizes the results of interviews with 215 active North Slope harvesters regarding the impacts and benefits of oil and gas development. Seventy-nine percent of active harvesters in Nuiqsut cited personal experiences with difficulties in hunting related to oil and gas development, including concerns related to physical and social barriers to hunting, increased effort required, and competition. Sixty-one percent of Nuiqsut respondents volunteered concerns about the impacts of oil and gas development on their ability to hunt, and 55 percent cited personal experiences with oil and gas impacts on their ability to hunt (SRB&A 2009a). The most commonly volunteered impact was the loss of traditional hunting areas due to pipelines, roads, and other structures, followed by difficulty finding caribou due to oil and gas activities, restrictions on hunting in NPR-A areas, and loss of traditional hunting areas along the coast due to pipelines (SRB&A 2009a). The most commonly volunteered impact was the loss of traditional hunting areas due to pipelines, roads, and other structures, followed by difficulty finding caribou due to oil and gas activities, restrictions on hunting in NPR-A areas, and loss of traditional hunting areas along the coast due to pipelines (SRB&A 2009a).

Comments on the GMT1 Draft SEIS indicate that many Nuiqsut residents continue to view access and avoidance as primary impacts of development. Resident Joseph Nukapigak testified that:

> *"…[w]ith the absence of access to those lands (Kuparuk and Prudhoe Bay), we are no longer hunting over that way because of the safety, safety reasons that oil industry might have."* (Nukapigak 2014c)

While it is not possible to determine the exact extent of potential avoidance, the likelihood of avoidance would increase with the proximity to project infrastructure and activities (Corps 2012). For the GMT1 analysis, BLM considers some degree of avoidance for the project study area (all land within 2.5 miles of project components) while noting that this extent is far more conservative than the extent (5 miles of virtually no harvesting and significantly reduced within 16 miles) noted by Kuukpik (I. Nukapigak 2012) and the 5 to 25 miles noted by MMS (2007). In the case of Nuiqsut and GMT1, proximity is a factor – the entire project study area (an area that by these established standards would normally be avoided by the majority of hunters) lies within 20 miles of the community and overlaps traditional hunting areas.

Resource Availability

Impacts on resource availability related to noise, traffic, and infrastructure have been frequently observed and reported by North Slope harvesters (SRB&A 2009a). Noise, traffic, and infrastructure associated with the project could affect the availability of key resources such as caribou, waterfowl, and furbearers including wolf and wolverine. Overall project activity levels would be highest during the construction period and could heighten the impact to resource availability during the construction period. Similar to user avoidance, impacts to resource availability could also lead to increased costs, time, and effort as harvesters would have to look elsewhere or spend more time and/or money in search of resources.

According to Section 4.3.4, project components (e.g., road, pipeline, air traffic) during operation may cause local displacement of caribou in and near the project. Even localized or "limited" changes in caribou distribution resulting from displacement can affect the availability of caribou to harvesters because of residents' limited means to access caribou at different times of the year and the fact that caribou are not always available near Nuiqsut. Residents of Nuiqsut have reported observing caribou unable to cross under pipelines at 7 feet due to heavy snowdrifts. Residents are concerned that caribou will be unlikely to cross over structures they cannot see past (i.e., ramps). A high and steeply sloped road could also result in displacement. Caribou, especially cows with calves, tend to avoid areas of human activity and have been found to shift calving areas farther from developed areas (NRC 2003). Research indicates their avoidance zone may extend to 1.2 miles from the activity (NRC 2003). Drilling activities during construction may also result in reduced caribou availability. Studies show that caribou, especially females with calves, generally avoid drilling sites, and those caribou that do approach drilling sites spend less time feeding and lying down (NRC 2003). Section 3.3.4 notes that the project study area is in the peripheral eastern range of the TH and notes that, generally, caribou utilization of the area is low. However, as noted in SRB&A (2013b), because the Colville River delta is in the peripheral range of both the TH and CAH, Nuiqsut harvesters are particularly vulnerable to changes in the distribution and/or behavior of caribou in these herds. Resource displacement will also likely occur for other resources such as waterfowl and furbearers and will affect residents' success and effort in these areas (Sections 4.3.3 and 4.3.4).

Contamination or perceived contamination associated with the proposed project could result in reduced resource availability to subsistence users. The availability of subsistence resources not only depends on their abundance in traditional use areas, but on their health or quality (either actual or perceived). A major concern to North Slope subsistence users is the potential impacts of contamination and air pollution on subsistence resources related to development (SRB&A 2009a). Contamination or perceived contamination of subsistence resources could result in reduced availability of subsistence resources considered healthy enough for consumption. Subsistence resources are generally healthier than most store-bought food available in Nuiqsut; if diets switch to a higher percentage of processed store food to replace subsistence food, health impacts could occur (Furgal et al. 2005). If contamination of subsistence resources occurs, consumption of these resources by Nuiqsut subsistence users could potentially affect human health.

Air Traffic

Impacts on resource availability from noise, road traffic, and infrastructure are impacts that hunters can expect to occur at the actual site of development. These known impacts can be avoided if hunters choose to hunt elsewhere and they are impacts that resources may, to an extent, become habituated to. In contrast, impacts from aircraft traffic are significantly more difficult to foresee or avoid and can therefore cause much more acute stress and disruption to hunters. Harvesters have noted that helicopter and plane traffic tends to divert caribou or cause skittish behavior, resulting in reduced harvest opportunities (SRB&A 2009a, BLM 2014b, NPR-A SAP 2014). Disturbance from aircraft has increased in the Nuiqsut area as oil development and exploration has involved more traditional land surrounding the town, but it is not a new impact. Aircraft were depicted as an "onslaught" in the village's 1979 cultural plan (Brown 1979, p. 38). The plan's list of village concerns about the encroaching development began with: "*Too many airplanes and helicopters scare away the moose and caribou*" (Brown 1979, p. 38). The NPR-A Working Group's draft *Guiding Principles for Development of Infrastructure in Northern Alaska* states:

> *"Development projects should be designed to minimize new airstrips and aircraft flights, especially low-level flights. Traditional Knowledge tells us that aircraft pose one of the greatest potential negative impacts to the success of subsistence hunters and that such flights can also impact caribou movements over the long term."* (NPR-A WG 2014)

During interviews with Nuiqsut caribou hunters for the 2008-2011 study years, helicopter traffic was the most commonly cited impact on caribou hunting related to CD4 and other Alpine Satellite Developments, followed by plane traffic, and human-made structures (i.e., pipelines blocking caribou movement) (SRB&A 2010b, 2011a, 2012, 2013b). The issue has been the subject of several NPR-A Subsistence Advisory Meetings and land use plan hearings. Comments on the Draft GMT1 SEIS in spring 2014 continued to note aircraft as a main source of disturbance:

> *"This summer I had to travel down the creek, up the creek, Fish Creek, down river, upriver, looking for caribou and that one day, I saw five choppers roaming. …more air traffic…affected my hunting this last summer…[W]hat bugs me the most is the air traffic…I really would discourage any air traffic during hunting, late July, August and I hope you guys will listen to that, because we have to get our caribou late July, August when they're fat and that was way too much air traffic last—last fall."* (Kaigelak 2014)

Isaac Nukapigak, President of the Kuukpik Corporation, summarized the issue:

> *"The people of Nuiqsut had complained repeatedly for years and years about aircraft, fixed wing, helicopters noises that interfere our subsistence hunt trying to gather for our food security and Nuiqsut consistently opposed building any more airstrips in the traditional land of the Kuukpikmiut because of disruption of our hunt."* (Nukapigak 2014c)

Lifelong resident Dora Leavitt testified:

> *"I don't want to see any runways. [W]e have a camp about so many miles from CD-2 and Alpine, kind of north of it, and with the planes coming in and out when we are camping and doing our summer subsistence, that has a great impact on us. There's too many flights."* (Leavitt 2014b)

All the alternatives would include aircraft flights that have the potential to disturb subsistence hunters. During operations, helicopter traffic will largely be limited to summer months in support of scientific studies. BLM and CPAI have been improving systems to estimate and keep track of all take offs and landings of both helicopter and fixed-wing flights. Flight totals (baseline and estimated new flights) required for each alternative during construction and operation are described by alternative in Chapter 2. The baseline number of flights (Otter/CASA, DC-6, and helicopter) in the area is 2,997 per year, of which 1,457 occur during the peak hunting months of June, July, August, and September.

In year one of the construction phase, Alternative A would require a total of 539 new flights, including 330 new flights during the June–September season. In year two of construction, Alternative A would require a total of 504 new flights, including 320 new flights June–September. The number of new flights required would decline after construction: it is estimated that during operation Alternative A would require 115 new flights each year, of which 107 would occur during the June-September hunting season. According to these estimates, the total number of flights during routine operation (for approximately 30 years) would be 3,112 per year of which 1,564 would occur during the June-September season.

4.4.5.4 Impacts under Alternative B

Alternative B, described in detail in Section 2.6, would route the GMT1 road slightly closer to Nuiqsut and farther from Fish Creek (outside of the 3-mile Fish Creek setback). Some residents have expressed a desire to keep development as close to town as is feasible in order to leave the broader use area undisturbed, and Alternative B is designed with this purpose in mind. The same types of impacts to subsistence as described for Alternative A would be likely under this alternative, but there would be a few significant differences in when and where they would occur.

An aspect of Alternative B that has support from some residents in Nuiqsut is the reduction in the number of bridges (NVN 2014b). Alternative A would include two bridges (one over the Tiŋmiaqsiġvik [Ublutuoch] River and one over Crea Creek) and one large culvert in Barely Creek that may end up requiring a small bridge, but Alternative B would include only one bridge (over the Tiŋmiaqsiġvik [Ublutuoch] River).

User Access

There are some indications that the road for Alternative B would require more fill because it is a lower and deeper route than the one under Alternative A. If this is the case, the road under Alternative B may have higher and steeper sides than the road under Alternative A. As described above, some subsistence hunters have already reported being unable to cross the new CD5 road with either snowmachine or four-wheeler due to the height and steepness of its sides. If access across the CD5-GMT1 gravel road is an issue, Alternative B could mean that hunters are thwarted sooner when traveling in the direction of Fish Creek. If hunters use the Kuukpik Spur Road and the CD5-GMT1 gravel road to access the area from town, there could be a chance that they would not be able to get back on the road to return.

User Avoidance

Avoidance of the project study area and impacts to resource availability under Alternative B would be similar to those under Alternative A.

Resource Availability

Air Traffic

Air traffic under Alternative B would be similar to Alternative A. It is estimated in Table 2.6-4 that Alternative B would require a total of 539 new flights in year one of the construction phase. Year 1 of construction would include a total of 330 new flights during the June – September season. In Year 2 of construction, Alternatives B would require a total of 504 new flights, including 320 new flights June – September.

The number of new flights required would decline after construction: it is estimated that Alternative B during the operation phase would require 115 new flights per year, including 107 during the June-September hunting season. According to these estimates, the total number of flights during routine operation (for approximately 30 years) would be 3,112 per year of which 1,564 would occur during the June-September season.

4.4.5.5 Impacts under Alternative C

Alternative C, described in detail in Section 2.7, would make the community of Nuiqsut a hub for transportation to GMT1 and would include an industrialized Kuukpik Spur Road and an extension of the Nuiqsut Airport. The types of impacts to subsistence under this alternative would be similar to those for Alternative A; however, there would likely be additional impacts related to increased road and air traffic near Nuiqsut. These impacts would be particularly challenging for hunters who, out of choice or necessity, hunt closer to town. Several traditional spots along the Nigliq Channel would experience more intense impacts than under Alternative A due to the high amount of industrial traffic on a larger Kuukpik Spur Road. Kuukpik Corporation established a 3-mile buffer around the community within which only restricted and necessary industrial activity is allowed in large part to protect the near-town subsistence activities and generally alleviate disturbance to residents. Alternative C would not be in compliance with this buffer.

Air Traffic

Alternative C would increase air traffic near Nuiqsut. Shifting a percentage of summer aircraft traffic to Nuiqsut and away from Alpine in the Colville Delta would potentially benefit caribou hunters in the delta and along the Nigliq Channel. Increased air traffic near Nuiqsut could impact nearby subsistence activities, particularly fall caribou and waterfowl hunting west of the community.

Baseline total flights (under the existing situation) are 2,997 per year, including 1,457 during the summer hunting season of June, July, August, and September. In year one of the construction phase, Alternative C would require a total of 539 new flights, including 330 new flights during the June–September season. In Year 2 of construction, Alternative C would require a total of 504 new flights, including 320 new flights June–September. The number of new flights required would decline after construction: it is estimated that during operation Alternative A would require 115 new flights each year, of which 107 would occur during the June-September hunting season. According to these estimates, the total number of flights during routine operation (for approximately 30 years) would be 3,112 per year of which 1,564 would occur during the June-September season.

User Access

The Kuukpik Spur Road was designed to give residents of Nuiqsut access to CD5, GMT1, and Alpine its satellites within the Colville Delta. If the Kuukpik Spur Road was instead and primarily an industrial access road for the oil field, traffic and safety and security concerns could lead to issues for residential use of the road. The road would be significantly wider and likely higher, raising issues of how difficult it would be for hunters to cross the road.

User Avoidance

An industrialized Kuukpik Spur Road would likely result in diminished resource availability near town and along the Nigliq Channel due to noise and visual disturbance. The increased traffic could create additional local displacement of caribou and would create the greatest impact for caribou hunters waiting for caribou along the Nigliq Channel. These same factors, in addition to competition from local road-based hunters, would contribute to hunter avoidance of the area. As described above and documented in the NPR-A report on land use values in Nuiqsut (Hoffman et al. 1988), there are at least four traditional sites along the Nigliq Channel. The value of these sites to the families that have used them will likely be diminished by the impacts of traffic, noise, dust, and the road's potential to divert caribou away from the sites on the river.

4.4.5.6 Impacts under Alternative D1

Under Alternative D1, there would be no permanent gravel road to GMT1. An ice road would be constructed every winter from CD5 to GMT1 (approximately 8 miles). Although the types of impacts to subsistence under this roadless scenario would be similar to those under Alternative A, there would likely be significantly different intensity and timing of impacts. The impacts of permanent gravel roads would be limited to the Kuukpik Spur Road under Alternative D1. From CD5 to GMT1, annual construction of an ice road would have associated impacts including ice road crews lodged in camps in town, heavy industrial traffic during construction period, significant use of lake water, and numerous helicopter flights in early spring to clean up ice road debris.

The footprint of Alternative D1, described in detail in Section 2.8, is different and larger than the footprint of Alternative A. Because there would be no permanent road, there would be a large airstrip at GMT1, and the GMT1 pad would have to be larger to accommodate a number of facilities and equipment that would otherwise not be required. Under Alternative D1, GMT1 would require a camp to house employees whereas under Alternative A, GMT1 would be smaller with no living facilities and the numerous amenities those require. Alternative D1 would result in a significantly higher amount of emissions both from aircraft and the additional facilities on the pad.

User Access

Under Alternative D1, there would be no facilitated access to the project study area provided by a permanent gravel road, but there would also be no impacts to access from roads that are difficult to cross or that create increased hunting pressure.

User Avoidance

The continued presence of the pipeline and the larger pad and airstrip under Alternative D1 would likely contribute to hunter avoidance of the area. There may be less of a physical barrier to caribou movement due to fewer roads and less road traffic and dust in the summer, but these factors could be offset by the pipeline, the larger GMT1 pad with significantly more activities and disturbances, and increased air traffic.

Resource Availability

Air Traffic

As described in detail above, air traffic is the most frequently cited impact of development by Nuiqsut caribou hunters (SRB&A 2010b, 2011a, 2012, 2013b) and the potential impact of GMT1 that is universally opposed by residents. Alternative D1 would result in significantly higher aircraft traffic, including larger fixed-wing flights taking off and landing at GMT1. Alternative D1 would create increased impacts to caribou, waterfowl, and furbearer hunting due to the air traffic.

Alternative D1 would likely require additional helicopter flights to survey the larger pad and the airstrip before construction could begin. In Year 1 of the construction phase, there would be no runway or camp at GMT1 and construction crews would stage out of Nuiqsut and Alpine. Fixed wing flights associated with Year 1 of construction would land at Alpine and during the summer, helicopters would ferry crews back and forth daily to GMT1 from Alpine. During Year 2 of construction, crews would work from the new camp at GMT1 and ferrying would be limited to crew changes.

Baseline total flights (under existing situation) are 2,997 per year, including 1,457 during the summer hunting season of June, July, August, and September. The total new flights that Alternative D1 would require during year one of construction would be 681, including 472 new flights during the June–September season. In Year 2 of construction, Alternative D1 would require a total of 1,331 new flights, including 703 new flights June–September. The number of new flights required would decline after construction; it is estimated that during drilling operations Alternative D1 would require 1,604 new flights each year, of which 716 would occur during the June-September hunting season. According to these estimates, the total number of flights during routine operation (for approximately 30 years) would be 3,576 per year of which 1,813 would occur during the June-September season.

4.4.5.7 Impacts under Alternative D2

Subsistence Uses of the Project Area

Under Alternative D2, the layout of the GMT1 pad, airstrip, and pipeline would be the similar to the layout Alternative D1. Alternative D2 allows only seasonal drilling (during the winter ice road season). There would be no permanent gravel road to GMT1. An ice road would be constructed every winter from CD5 to GMT1 (approximately 8 miles). Unlike Alternative D1, there would not be additional drilling or well tie-in support personnel under Alternative D2. The drill rig and drilling support camp would be demobilized and transported off the GMT1 pad after each drilling season and remobilized and transported back to GMT1 once the ice roads are open. Because of the seasonal drilling, infill drilling is expected to take 24 years, with first oil anticipated in 5 years. Production operations would continue for 30 years after first oil for a project lifetime of 35 years.

Although the types of impacts to subsistence under this seasonal and roadless scenario would be similar to those under Alternatives A (and D1), there would likely be significantly different intensity and timing of impacts. The impacts of permanent gravel roads would be limited to the Kuukpik Spur Road under Alternative D2. From CD5 to GMT1, annual construction of an ice road would have associated impacts including ice road crews lodged in camps in town, heavy industrial traffic during the construction period, significant use of lake water, and numerous helicopter flights in early spring to clean up ice road debris. Most significantly, all impacts associated with Alternative D2 would occur over a longer period of time (35 years total) rather than the 30 years projected for other alternatives. This includes 24 years of infill drilling which would require a 75-person crew to be moved in and out each season and a 25-person crew that would support year-round operations and maintenance.

The footprint of Alternative D2, described in detail in Section 2.9, is different and larger than the footprint of Alternative A. Because there would be no permanent road, there would be a large airstrip at GMT1 and the GMT1 pad would have to be larger to accommodate a number of facilities and equipment that would otherwise not be required. Under Alternative D2, GMT1 would require a camp to house employees whereas under Alternative A, GMT1 would be smaller with no living facilities and the numerous amenities those require. Alternative D2 would result in a significantly higher amount of emissions both from aircraft and the additional facilities on the pad.

From CD5 to GMT1, annual construction of an ice road would occur over a longer period of time (35 years instead of 30) and would have associated impacts including ice road crews lodged in camps in town, heavy industrial traffic during construction period, significant use of lake water, and numerous helicopter flights in early spring to clean up ice road debris.

User Access

Under Alternative D2, there would be no facilitated access to the project study area provided by a permanent gravel road. Unlike Alternative A, there would be no potential issue to access posed by difficulties crossing roads on traditional travel routes or the facilitated access that may create increased local hunting pressure.

User Avoidance

The continued presence of the pipeline and the larger pad and airstrip under Alternative D2 would likely contribute to hunter avoidance of the area. There may be less of a physical barrier to caribou movement due to the roadless aspect and less road traffic and dust in the summer, but these factors could be offset by the pipeline, the larger GMT1 pad with significantly more activities and disturbances, and, most significantly, increased air traffic. Compared to Alternative D1, a decrease in user avoidance may result under Alternative D2 because there would be less activity at the GMT1 pad during peak harvesting months.

Resource Availability

Air Traffic

As described in detail above, air traffic is the most frequently cited impact of development by Nuiqsut caribou hunters (SRB&A 2010b, 2011a, 2012, 2013b) and the potential impact of GMT1 that is universally opposed by residents. Alternative D2 would result in significantly higher aircraft traffic, including larger fixed-wing flights taking off and landing at GMT1. Alternative D2 would create increased impacts to caribou, waterfowl, and furbearer hunting due to the air traffic.

Alternative D2 would require additional helicopter flights to survey the larger pad and the airstrip before construction could begin. In Year 1 of the construction phase, there would be no runway or camp at GMT1 and construction crews would stage out of Nuiqsut and Alpine. Fixed wing flights associated with Year 1 of construction would land at Alpine and during the summer, helicopters would ferry crews back and forth daily to GMT1 from Alpine. During the second year of construction, crews would work from the camp at GMT1 and ferrying would be limited to crew changes.

4.4.5.8 Impacts under Alternative E

No additional impacts to subsistence would be expected under Alternative E.

4.4.5.9 Effectiveness of Lease Stipulations and Best Management Practices

Every ROD for an NPR-A Integrated Activity Plan and/or EIS released since 1998 has established that exploration and development and production operations will be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities (BLM 1998a, 2004a, 2008a, 2013). While recognizing that oil development has had and will continue to have impacts, BLM's objectives are to protect subsistence uses and access to traditional subsistence hunting and fishing areas and minimize the impact of oil and gas activities on the air, land, water, fish, and wildlife. The magnitude of many of the impacts discussed in this section would likely be reduced through the continued application of previously established mitigation measures and the implementation of new mitigation measures.

BMPs and lease stipulations in the NPR-A seek to protect specific resources and subsistence practices with approaches that include:

- Establishing spatial buffer zones around facilities and infrastructure.
- Scheduling disruptive activities when there is the least potential for conflict with other users.
- Including community residents in project planning.
- Monitoring impacts on subsistence resources.
- Making efforts to minimize the interference of oil and gas exploration and development activities and structures with subsistence resources and users.

4.4.5.10 Effectiveness of Stipulations and Best Management Practices on Subsistence Species

Many of the protective measures established in previous Records of Decision for EISs in the NPR-A are intended to minimize the surface impacts of oil and gas activities and to otherwise ensure the continued health of wildlife and subsistence resources. For a complete description of the measures under Alternative A that are designed to mitigate impacts to fish, see Section 4.3.2. Measures designed to protect birds are described in Section 4.3.3, and measures designed to protect marine mammals are described in Section 4.3.4. Measures that are particularly relevant to subsistence species are listed below:

- A-4 minimizes the impacts of contaminants on fish, wildlife, and the environment.
- A-11 mandates the design and implementation of a study to monitor contaminants in subsistence foods for all permanent development. (Although its final design can be modified, a contaminant study for GMT1 is currently underway in Nuiqsut.)
- Measures that would minimize disruption of caribou in the GMT1 project study area include E-7, which dictates pipeline height at a minimum of 7 feet and a minimum distance of 500 feet between roads and pipelines and K-6, which establishes a buffer zone within 1 mile of the coast.
- To protect fish habitat, B-1 and B-2 regulate water withdrawals and C-2 to C-4 protect streams and prevent additional freeze down of deep-water pools.
- K-1 establishes a 3-mile setback along lower Fish Creek, a 0.5-mile setback from Judy Creek, and a 0.5-mile setback from the Tiŋmiaqsiġvik (Ublutuoch) River.
- E-10 minimizes the chances that migrating waterfowl will strike oil and gas facilities during low light conditions.
- K-2 prohibits permanent infrastructure within 0.25 mile of deep water lakes.

Effectiveness of Stipulations and Best Management Practices on Avoiding Conflict

Many protective measures are explicitly aimed at minimizing conflicts between subsistence users and oil and gas activities. Setbacks for development on subsistence rivers are important measures to protect many important traditionally used areas, and the 3-mile buffer around Fish Creek dictated the routing of the pipeline and road analyzed in Alternative B. These stipulations prohibit permanent oil and gas facilities (e.g., gravel pads, roads, airstrips, and pipelines) in the streambed and adjacent to the rivers within the buffer zone. BMP H-2 is intended to prevent unreasonable conflict between subsistence activities and seismic exploration by mandating that an applicant for seismic exploration shall notify local search and rescue operations of current and recent seismic survey locations and shall notify in writing all potentially affected cabin and camp users. BMP I-1 requires lessees to provide cultural orientation for all oil and gas workers to minimize cultural and resource conflicts with local inhabitants. Lease Stipulation K-6, mentioned above as a measure to reduce impacts to caribou, is also designed to reduce conflict by implementing a setback of a mile from the coastline and by mandating the use of previously occupied sites for industrial development whenever possible.

A measure that is particularly relevant to subsistence harvest patterns involved with the GMT1 Project is BMP E-1, which requires that all roads be designed to protect subsistence use and access to traditional hunting and fishing areas. Some subsistence users have already experienced access issues with the CD5 road currently under construction because the roadbed was too high and too steep to be able to cross it with snowmachines or ATVs. BMP E-1 is a particularly relevant measure for the GMT1 Project because the road route (in Alternatives A, B, and C) will transect several main travel routes between Nuiqsut and areas to the northwest, and subsistence access will have to be assured. One way that access would be provided under those alternatives would be via the GMT1 road itself (using the Kuukpik Spur Road to gain access to the CD5 and GMT1 roads). However, the design of the road itself will have to allow for access by subsistence users who need to cross it or need to descend from and ascend onto the road. This access could possibly be provided via ramps, however some local residents do not consider that an acceptable mitigation and have instead requested that the gravel road be constructed with a maximum height of 5 feet.

Related measures that reduce conflict over subsistence uses and access are E-2, E-3, E-6, and E-8, which maintain subsistence use and access to traditional subsistence fishing sites. E-7 mandates pipeline height (minimum of 7 feet) to provide for the safe and unimpeded passage of subsistence hunters. H-3 prohibits hunting and trapping by lessee's/permittee's employees and contractors while those individuals are on work status.

Aircraft Traffic Mitigations

As described in detail in the introduction to this social systems section and in the subsection on aircraft for Alternative A, disturbance from aircraft is one of the greatest impacts to subsistence users. The majority of local residents who support construction of a road to GMT1 do so because they believe it will reduce the amount of aircraft traffic. The numbers of flights anticipated for GMT1 show that even those alternatives that include a road will result in a greater number of flights than are currently occurring in the area. Because disturbance from aircraft will increase under all alternatives while many residents are under the impression that they will have respite from heavy aircraft traffic, BLM anticipates that stress over the inability to significantly reduce the number of flights will increase. Industry and BLM should therefore increase efforts to reduce the number of flights needed and the disturbance those flights cause.

By mandating minimum flight altitudes for industry and research, BMP F-1 mitigates the impacts the low-flying aircraft on wildlife. This is effective when practicable and when obeyed, however, enforcement is usually not feasible. Furthermore, the BLM has no authority over private aircraft or aircraft used by projects that do not require BLM permits. BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use in the project area, therefore the existing BLM mitigation only addresses a small amount of the larger problem. In the Nuiqsut area, a large percentage of flights are accounted for by CPAI but the flights are necessary to meet lease stipulations (i.e., ecological monitoring). The mitigation measures that have been implemented in the past have not been widely effective for the community of Nuiqsut, where much of the activity around the community has not been on BLM-managed land and where the development activity has consistently required more aircraft traffic.

As the GMT1 Applicant and primary oil development company in the Nuiqsut area, CPAI management has recently attempted to mitigate these impacts by coordinating helicopter-based hydrology studies with other regional oil development companies (Great Bear and Repsol), by establishing dedicated ice road cleanup crews and modifying the ice road cleanup program to reduce helicopter flights, by implementing a daily call in service that allows people to listen to updates on aircraft activity and by providing a weekly summary of helicopter activity that they share with stakeholders. CPAI managers are currently making efforts to schedule helicopter activity during early or late summer, thus avoiding peak caribou hunting season during July. For necessary flights during July, CPAI managers are attempting to schedule helicopter flights during the week so that impacts are reduced during the weekends. The effectiveness of these measures and other new aviation mitigation measures will continue to be evaluated throughout the life of the project.

In addition to the aircraft mitigations described in the paragraph above, CPAI has also designed the project in a manner that reduces impacts to subsistence, detailed in Section 4.7, and pays annual subsistence mitigation payments to the Native Village of Nuiqsut and annually funds operation of the Kuukpikmiut Subsistence Oversight Panel, which consists of representatives from the City of Nuiqsut, the Native Village of Nuiqsut, and the Kuukpik Corporation.

NPR-A Subsistence Advisory Panel

BMP H-1 established the NPR-A Subsistence Advisory Panel (SAP) in 1998 and is designed to prevent unreasonable conflicts between subsistence uses and oil and gas development by requiring that, before submitting an application to BLM, a prospective lessee/permittee consult directly with affected communities to discuss the timing, location, and methods of their proposed activities. Applicants must document consultation efforts as part of the plan of operation and must submit the plan of operations to the NPR-A SAP for review and comment. Applicants must submit these plans sufficiently early to provide time for review by SAP members and those members' tribal governments, should government-to-government consultation between BLM and the tribal government be warranted. Among other items, the operations plan must describe methods the Applicant will use to monitor the impacts of the activity on subsistence and must describe how the Applicant will keep potentially impacted individuals and communities up-to-date on the activities and locations of possible conflicts with subsistence users.

SAP meetings are public, are held in all NPR-A communities on a rotating basis, and ensure that BLM management maintains some regular communication and outreach with residents and is made aware of the wide range of concerns SAP members and the general public have regarding development. The BLM maintains a spreadsheet that lists all the recommendations that the SAP has made throughout the years and BLM responses to those recommendations. BLM has implemented nearly all the recommendations that it had the authority to implement. In 2010, the SAP expanded its purview to include reviewing science and research-based permitted projects. Since 2011, the BLM produces a spreadsheet of each permitted project in a calendar year for distribution to the SAP and interested public. The BLM produces transcripts of each meeting and a summary of the presentations and concerns. The summaries (along with notices for meetings) are distributed to a broad email list of about 250 North Slope residents. A SAP Facebook page was created in 2014 in an effort the increase communication and notification of activities. In summary, the SAP is effective at maintaining a minimum of dialogue, at assuring that at least some residents are aware of activities that are being permitted, and at familiarizing SAP representatives with the NEPA process.

The effectiveness of the SAP is limited by several factors that are shared by most similar subsistence advisory boards, which have a long and checkered history on the North Slope. Residents have a hard time keeping the numerous boards straight and tend to lump all of them (whether state, federal, or regional) together and to treat all public hearings as an opportunity to voice a wide range of concerns, whether or not they are project-specific or matters for which the agency holding the meeting is responsible (RFSUNY 1984). SAP representatives are supposed to review proposals ahead of time, discuss the proposals with their respective communities, attend the meetings, make recommendations to the Authorized Officer of the BLM on ways to improve the planned operations and/or alleviate any impacts to subsistence that may occur, maintain a repository of subsistence information for their local communities, and report back to their community (including by presenting on the SAP meeting at a public meeting in their town). However, the representatives on the Panel are unpaid volunteers who usually have full time jobs and busy lives. If these volunteers were to actually put forth the effort and time required to fulfill the roles and responsibilities of a SAP member as described, this work would constitute part-time and daunting employment. The duties are intimidating, present a significant frustration for SAP members, and discourage continued participation or new membership. Frustration is also a persistent issue because a large percentage of the long-standing recommendations and concerns that the SAP and residents have are matters that BLM has no authority to act on.

The actual effectiveness of protective measures will depend heavily on their ongoing implementation, on enforcement, and on the precise location of facilities and infrastructure. Effectiveness is also dependent on the sharing of local knowledge and on informed input from residents of Nuiqsut. As described above, several measures are designed to ensure that subsistence hunters participate in plan design. A primary issue that hinders the effectiveness of such co-management efforts is that municipal and tribal governments generally have few paid staff and members of these organizations feel overtaxed when asked to provide meaningful input to BLM on proposed or permitted activities. The general issues of sociocultural stress created by the meetings and bureaucratic process of development projects is described in detail in the sociocultural systems section. The institutional overload presented by the responsibility of reviewing GMT1 NEPA documents has been felt more intensely by some groups of people than by others. Subsistence users who are either individual residents or tribal council members and who may also have regular employment have a more difficult time reviewing and responding than those organization that have several employees and paid legal advisors or consultants (i.e., environmental non-governmental organizations, oil and gas development companies, ASRC, the NSB, or Kuukpik Corporation). Participating in the NEPA process is most difficult for subsistence users who are not compensated for their time and whose time for subsistence pursuits is reduced. In the case of the GMT1 SEIS, the NVN is participating as a cooperating agency and has therefore joined in weekly cooperating agency teleconferences as well as regular government-to-government teleconferences with the BLM Arctic Field Office and GMT1 lead planners. These regular consultation sessions continue to result in steady progress towards a more effective understanding of the NEPA process on the part of NVN council members. The BLM has also held government-to-government meetings and other discussions with Kuukpik Corporation and has convened two multi-agency teleconferences on Nuiqsut development issues with Kuukpik Corporation, NVN, NSB Planning Department and legal team, and NSB Department of Wildlife. As described in Section 4.4.2, *Sociocultural Systems*, the BLM has also established the NPR-A Working Group during the time that the GMT1 analyses were underway. The NPR-A Working Group has developed *Guiding Principles for Development of Infrastructure in Northern Alaska* (2014) that are particularly relevant for GMT1. All these efforts towards outreach and dialogue are effective at ensuring that BLM understands the range of concerns and opinions on development and they help to convince residents that agency management is earnest in its efforts to learn from locals and implement every mitigation measure that is reasonable, relevant, and within its authority.

BLM was able to effectively respond to one long-standing community request by establishing a BLM Arctic Field Office Barrow Field Station staffed by a local Iñupiaq subsistence hunter. This position (Natural Resource Specialist) is currently held by Roy Nageak. As the BLM's Arctic Field Office's Barrow employee, Nageak is able to communicate local concerns to BLM management and explain land management decisions and ongoing development permitting projects to local residents. Nageak provides translation services at BLM's North Slope meetings, has invaluable knowledge of the land and resources of the North Slope, has relations with almost all residents of the North Slope, and has served on numerous government and subsistence panels throughout his career. There have been several requests to establish a similar BLM Field Station in Nuiqsut and the BLM is currently exploring the logistical and financial feasibility of this request.

4.4.5.11 Mitigation

Suggested Mitigation Measures which BLM will not Implement for GMT1

The standard BLM must follow regarding what new potential mitigation measures must be considered and evaluated in an EIS is found in the BLM NEPA Handbook Q&A, number 19(b). This standard provides that all relevant and reasonable mitigation measures that could improve the project should be identified if they are within jurisdiction of the agency. If BLM finds that a potential mitigation measure is not within BLM's jurisdiction to implement, or should not be implemented for some other reason, the potential mitigation measure would not be adopted in the ROD that is issued after the Final SEIS. The ROD will contain a section in its Appendix for Potential Mitigation Measures Not Adopted, which will document BLM's rationale for not adopting the potential mitigation measures.

The following mitigation measures are not considered to be reasonable, relevant, or effective to address impacts identified from the GMT1 permit to drill and right-of-way grant analyzed in this SEIS, and thus are not being carried forward for further consideration:

- A mitigation measure to address the issue that seismic exploration disturbs the ground and wildlife.
    - BLM evaluated the impacts from seismic exploration in the 2012 IAP/EIS; however, this project does not propose additional seismic exploration and thus a mitigation measure for these impacts is not relevant. Impacts from future seismic activity in the area are discussed in the cumulative impacts section of this SEIS. Recently, advanced technology in both vehicles and other seismic testing equipment has allowed seismic exploration to be conducted with less impact.
- The government and industry should restrict flying until they learn how to adequately inform hunters of locations of helicopter flights and landing sites.
    - As noted above, BLM-chartered aircraft and aircraft use by BLM permittees accounts for a small percentage of the aircraft use within the NPR-A; therefore, this mitigation is not relevant to the GMT1 SEIS. Several other mitigation measures are being considered that address impacts from aircraft traffic.
- Scientific studies that require helicopters should only be allowed every three years.
    - This requirement would not be reasonable, as industry and other groups would not be able to comply with other BLM-required studies for permits.
- Pipelines in the Nuiqsut area should be buried.
    - This alternative was considered but not analyzed in detail in BLM (2004) due to safety and engineering concerns.
- Requiring the applicant to contribute funds to complete all aspects of the Colville River Access Road.
    - Notwithstanding that the access road would facilitate subsistence access along the Colville River, given that a considerable portion of the proposed action's impacts will be caused by the GMT1 road, it is somewhat ineffective to attempt to offset such impacts by constructing another road near the same community, which would itself

present similar adverse environmental impacts. As discussed in Section 4.6.2.2, the access road would involve construction of an additional 3.75 miles of road through an undeveloped area and would have a gravel footprint of approximately 21.25 acres, also located mostly or entirely within wetlands. It is BLM's determination that other potential new mitigation measures would be more effective in addressing the proposed action's impacts, including to subsistence, without resulting substantial adverse impacts to the environment.

Impacts and Concerns that cannot be Mitigated under BLM Authority

Some of the long-standing subsistence concerns that BLM has limited or no authority to act on include:

- People who have Native allotments in areas impacted by oil development should be allowed to select new allotments in other areas. (Such an action would require an Act of Congress; thus, BLM has no jurisdiction to implement such a program.)
- Animal movement is restricted and migration routes are changed. (BLM cannot quantify or mitigate this issue directly but is considering several potential mitigation measures, described below, that address similar concerns.)
- A comprehensive compensation program should be established to provide insurance for instances when damage to subsistence areas or resources occurs (i.e., the government should provide transportation to hunters to access other areas if the caribou do not migrate near Nuiqsut).

Potential Mitigation Measures

BLM is considering additional mitigation measures that may be able to further reduce the impacts associated with subsistence, including the increased aircraft activity that will result from GMT1. BLM guidance indicates that if a potential mitigation measure qualifies as being reasonable and relevant to impacts anticipated to occur from the GMT1 Project, then BLM must give it due consideration in the NEPA process. Due consideration involves evaluating how the potential mitigation measure would reduce impacts and analyzing the benefits and effects of the mitigation. BLM will determine which potential new mitigation measures to adopt in its ROD. The suggested mitigation measures discussed here have been developed from several sources, including:

- Testimony and comments of Nuiqsut residents on the GMT1 Draft SEIS (BLM 2014b)
- NPR-A SAP recommendations (NPR-A SAP 2014)
- The NPR-A Working Group's *Guiding Principles for Development of Infrastructure in Northern Alaska* (NPR-A WG 2014)
- NSB Nuiqsut Village Profile (URS Corporation 2005)
- Regular government-to-government consultation with the NVN
- Testimony and comments of Nuiqsut residents on previous NEPA actions (i.e., ASDP)

Because subsistence is not a strictly defined resource but has multiple social, environmental, and economic aspects and can be considered a way of life, several of the potential new mitigation measures described in this section also apply to other resources. When that is the case it is noted here that the measure could address biological resources or other aspects of social systems.

Potential New Mitigation Measure 1: Tiŋmiaqsiġvik (Ublutuoch) River Boat Launch

Objectives: Alleviate helicopter flights and reduce the impacts of helicopter traffic on Nuiqsut subsistence activities, alleviate disturbing oil spill prevention/response training activities and facilitate oil spill cleanup activities, and facilitate subsistence boat access to Fish Creek.

Requirement/Standard: Permittee will fund all necessary engineering design work, construction costs, compensatory mitigation expenses, and permitting leadership to facilitate and expedite construction of a boat launch and associated parking area on the Tiŋmiaqsiġvik (Ublutuoch) River adjacent to the Tiŋmiaqsiġvik (Ublutuoch) River bridge (under Alternatives A, B, and C).

Background, Potential Benefits, and Residual/Unavoidable Impacts: A Tiŋmiaqsiġvik (Ublutuoch) River boat launch would provide a new and easier way to access the Tiŋmiaqsiġvik (Ublutuoch) River and Fish Creek area during the summer months. The boat launch could potentially alleviate the high number of helicopter flights in the area, which would address a primary disturbance to subsistence activities. A portion of research, monitoring, oil spill preparation and response and other activities associated with development would be able to forego helicopter trips by using either Alpine or Nuiqsut as a hub, transporting boats to the Tiŋmiaqsiġvik (Ublutuoch) River by road, and accessing the GMT1 project study area (and possibly GMT2 and other future project study areas) by river. These types of activities are commonly conducted with Zodiacs or other shallow draft boats. In the unlikely but highly impactful event of an oil spill from the pipeline crossing the Tiŋmiaqsiġvik (Ublutuoch) River, the ability to quickly access the river by boat would be beneficial. In addition, access to the area by road could provide an important redundant route for emergency/safety transportation for hunters and industry-related workers. The mitigation could offset the fuel costs, time, and navigation hazards associated with traveling to Fish Creek via the Beaufort Sea.

Residual and unavoidable impacts include the issue that the Tiŋmiaqsiġvik (Ublutuoch) River is shallow and usually navigable only by riverboats and would thus only be a direct benefit to subsistence hunters who own that type of boat and want to use them in that area. It is not envisioned that many hunters would want to navigate upriver on the Tiŋmiaqsiġvik (Ublutuoch) River (although some would), but hunters who want to access cabins and hunting areas on Fish Creek would, with river boats (i.e., Lund-type boats) be able to do so without the extra time and risks associated with ocean travel. The mitigation could also potentially introduce new impacts for subsistence users, such as increased use of Fish Creek and competition among local harvesters in that area and would increase the amount of fill and wetlands impact of a GMT1 road. It is important to note that the boat launch would be located on Kuukpik lands, on which BLM has no jurisdiction.

Potential New Mitigation Measure 2: GMT1 Road Right of Access Agreement

Objective: Reduce impacts to subsistence in the project area by guaranteeing that residents will have the right to use the GMT1 road throughout the life of the project. Ensure that residents are aware of the policies regarding use of project-associated roads for subsistence activities; thus reducing misunderstandings and ensuring the safety of project workers and local residents.

Requirement/Standard: The permittee will produce a clear and legally binding Right of Access Agreement that will provide the community of Nuiqsut with concise policies regarding use of the roads associated with the project and hunting prohibitions, if any, along the roads and near project components. Permittee will insure that this agreement is disseminated throughout the community. The Agreement will also be provided to BLM.

Background, Potential Benefits and Residual/Unavoidable Impacts: Clear policies regarding use of project roads for subsistence activities will likely reduce misunderstandings about whether and to what extent local harvesters can use and/or hunt from the road. Residents will be more likely to use project roads if they are well-informed about company policies and security restrictions. Although the permittee has stated that this right will be in place, many residents are skeptical that the right will be guaranteed for the life of the road. No residual or unavoidable impacts are anticipated from this measure. BLM may incorporate other requirements into its right-of-way grant for the GMT1 road as appropriate.

Potential New Mitigation Measure 3: Consultation Regarding Aircraft Communication Protocols

Objective: Ensure that current communication protocols related to helicopter and fixed wing air traffic by the permittee are adequate in addressing Nuiqsut concerns about the impacts of air traffic on their hunting activities.

Requirement/Standard: In consultation with local hunters and local organizations, the permittee will continue to facilitate, improve, and expand communication protocols to inform subsistence users of daily flight patterns and identify potential conflict areas during peak hunting times. This consultation should include efforts to advertise these communication protocols within the community so that a majority of Nuiqsut subsistence harvesters are aware of them, and confirmation that existing minimum altitude requirements are adequate. The consultation results should be documented, distributed to BLM and other stakeholders, and clearly identify actions to be implemented based on the consultation.

Potential Benefits and Residual/Unavoidable Impacts: Strong communication protocols with the community of Nuiqsut regarding the timing, altitude, and location of air traffic should reduce the frequency of these impacts on subsistence users. However, such protocols will not remove impacts of air traffic altogether.

Potential New Mitigation Measure 4: Aircraft Monitoring Data Requirements

Objective: Monitor aircraft patterns and the impacts of aircraft associated with the GMT1 development on subsistence hunting activities in the project area.

Requirement/Standard: Permittee will be responsible for funding and providing data to BLM for a monitoring study of aircraft flight patterns and impacts related to aircraft traffic on subsistence activities. The permittee will provide the BLM with data from the monitoring study in a manner that facilitates meaningful analysis of activities and impacts.

- The permittee will provide BLM with clear and detailed quarterly flight reports that include the timing, flight path, and purpose of each flight in the project area.
- The reports will highlight all flights that represent deviations from BLM’s best management practices and include explanations for any deviations.
- The permittee will provide data related to altitude of flights patterns. Noise data associated with altitudes will be cross-referenced to determine minimum altitudes for flights in the project area, to reduce impacts on wildlife and subsistence activities.
- The aircraft monitoring plan will differentiate to the greatest degree practicable between the various purposes of flights (i.e., flights that are conducted for exploratory drilling operations, offshore pipeline baseline studies, and other scientific research broken down by species and researcher.

- Reports will include statistical analyses on flight patterns, including how often actual flights and patterns deviate from the flight plan that is currently required to be submitted to BLM under existing BMP F-1.
- Reports will cross-reference flight data with the latest caribou movement data.

Monitoring undertaken to provide baseline data or to monitor effectiveness of mitigation measures must meet the approval of the authorized officer. As the authorized officer deems it appropriate, the data collection process and product shall be consistent with standards established by BLM's Assessment, Inventory, and Monitoring program.

Background, Potential Benefits, and Residual/Unavoidable Impacts: Improved monitoring and analysis of flights, flight purposes, and other flight patterns will assist BLM to estimate the impacts of proposed actions or to formulate appropriate plans to reduce impacts. A monitoring study would provide a better understanding of how many aircraft are being used for different purposes, whether and how industry could reduce flights, and how aircraft and flight altitude affect subsistence activities and wildlife and in the project area. It is anticipated that such a monitoring plan will be significantly useful for the permittee and could direct the permittee to greater cost savings and efficiencies. It is anticipated that if aircraft traffic is not the reason for failed hunts, such a plan may be able to substantiate that. Data collected from this study will help BLM to adapt management decisions to changing conditions and circumstances and make better decisions for future research studies and development projects in the NPR-A.

Potential New Mitigation Measure 5: Reduce Non-essential Aircraft Traffic

Objective: To reduce the impacts of helicopter traffic on Nuiqsut subsistence activities.

Requirement/Standard: In ongoing consultation with the City of Nuiqsut, the North Slope Borough Department of Planning, Native Village of Nuiqsut, Kuukpik Corporation, and the Kuukpik Subsistence Oversight Panel, Inc., the BLM will establish a time period during peak caribou hunting when non-essential helicopter flights associated with BLM-permitted activities will be suspended near Nuiqsut. Consultation results should be documented, distributed to BLM and other stakeholders, and clearly identify actions to be implemented based on the consultation. Ongoing (multi-year, already planned) scientific /environmental studies that depend on access to study sites could continue if there is no alternative access to sites. These suspension dates can be revised every 3 years upon review of peak caribou season.

The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies shall be limited to the maximum extent possible. Trips shall be combined when possible, and studies shall be conducted by boat and foot when possible

Additionally, whenever possible, workers traveling by foot or via off-road vehicles equipped with trailers should be used in conjunction with helicopters to travel the ice road for cleanup as long as basic safety standards can be met. Exemptions for tundra travel for this purpose will be granted by BLM.

Potential Benefits and Residual/Unavoidable Impacts: Reducing helicopter traffic or limiting the geographic area affected by helicopter traffic would reduce the incidence of conflicts between BLM-permitted helicopter traffic and Nuiqsut subsistence activities. However, other operators on the North Slope may continue to fly during the suspension period.

Negative impacts of ice roads are increased by the traditional method of stick picking, which can add hundreds of flights to the permittee's overall flight numbers. In the past, the system had two workers walk along the ice road route gathering debris in bags while the helicopter leapfrogs over them every 0.25 to 1 mile to pick up the bags. This practice takes more time than is necessary and occupies the helicopter for long periods of time during a subsistence period when flying is of lower impact. It is anticipated that greater availability of the helicopter during this early-spring period would allow the permittee to conduct other required actions instead of delaying those until peak hunting season.

Potential New Mitigation Measure 6: Conservation Easement or Lease on Kuukpik-Owned Surface along Fish Creek.

Objective: To offset impacts to wildlife, habitats, and subsistence users by providing for long-term habitat conservation.

Requirement/Standard: The Permittee will fund conservation easements or leases on Kuukpik lands along Fish Creek, pursuant to the BLM Restricted Surface Occupancy (“setback”) corridor identified in the 2013 IAP-ROD and timed to coincide with the life of the impacts of GMT production. The Permittee will also fund on-going administration of the easement(s) or lease(s), accomplished through an agreement with the Native Village of Nuiqsut, North Slope Borough, and/or Kuukpik Corporation, and may include funding a cooperative agreement between BLM and the easement or lease administrator to maintain enhanced subsistence resources and opportunities on BLM-managed public lands within the Fish Creek setback.

Potential Benefits and Residual/Unavoidable Impacts: In combination with the avoidance allocations and minimization stipulations in the NPR-A Integrated Activity Plan, this easement would link conservation and development using the landscape approach. The easement or lease would create a continuous conservation corridor linking the upper drainage and tributaries on BLM-managed lands in NPR-A with the mouth of Fish Creek on corporation lands and ultimately the Beaufort Sea. This would provide local residents with protected areas in which to subsistence hunt.

Potential New Mitigation Measure 7: Reduce Flights by Utilizing Unmanned Aerial Vehicles (UAVs)

Objective: To reduce the impacts of aircraft traffic on Nuiqsut subsistence activities.

Requirement/Standard: The permittee will begin to employ UAVs to conduct monitoring activities that otherwise require helicopters (i.e., pipeline inspections, studies, and other appropriate activities). The permittee will consult with the Authorized Agency every three years to determine feasibility of this technology and appropriate monitoring activities for its use.

Background, Potential Benefits and Residual/Unavoidable Impacts: Much of the ecological monitoring that is required of lessees and permittees is supported by/requested by local residents, but there is less understanding and little support for the number of helicopter flights that are required to conduct those activities. The potential for using UAVs for baseline monitoring was discussed at the Sep. 2013 NPR-A SAP meeting when a representative of Shell Oil announced that that company was experimenting with using them. The SAP was supportive of their use to decrease impacts from helicopters. UAVs have been utilized for oil field studies at Prudhoe Bay, and have the potential for use in the NPR-A. Residents of Nuiqsut have requested that the latest technology be used for such studies as soon as and to the greatest extent possible in order to alleviate the high number of aircraft flights. BLM would not have the authority to implement this BMP on lands that are not managed by the BLM in the Nuiqsut area, where much of the disturbance from aircraft occurs.

Potential New Mitigation Measure 8: Prohibit Airboats in Key Subsistence Use Areas

Objective: To reduce noise and disturbance impacts from airboats on subsistence resources, users, and activities.

Requirement/Standard: Except in the case of emergencies, the permittee and its contractors will be prohibited from using airboats on rivers on BLM-managed lands in the Nuiqsut subsistence use area (for this measure, defined as a 50-mile-wide buffer around the community). Through consultation with local residents, the BLM may identify other key boating areas that should be avoided. The Authorized Officer and the permittee will coordinate to identify specific areas/rivers where oil spill response training and preparation activities would be permitted by BLM.

Potential Benefits and Residual/Unavoidable Impacts: Prohibiting the use of airboats in places where residents are actively traveling by boat to harvest subsistence resources will reduce potential disruptions to subsistence users and resources. The sudden and loud noise of airboats causes acute stress situations for subsistence users, particularly the elderly. Residual issues could arise if local subsistence use of airboats increased (there is currently one airboat, not in use, in Nuiqsut). BLM would not have the authority implement this measure on non-BLM-managed land and it is therefore unlikely that hunters and other subsistence users will experience respite from airboat disturbance if the measure is not adopted by the permittee for other lands.

Potential New Mitigation Measure 9: Subsistence Monitoring Studies

Objective: Monitor the impacts of GMT1 development on subsistence harvests and activities for the community of Nuiqsut.

Requirement/Standard: The permittee will monitor, through the life of the project, changes in subsistence activities in the community of Nuiqsut. The permittee will find a study to quantify changes in subsistence use and harvest levels. The study would identify changes resulting from the proposed project, and at a minimum, monitor impacts to caribou, fish, and bird harvests.

Potential Benefits and Residual/Unavoidable Impacts: A subsistence monitoring study would help identify the impacts of GMT1-related activities on Nuiqsut subsistence activities. The four years of data from the Nuiqsut subsistence caribou monitoring project (SRB&A 2010b, 2011a, 2012, 2013b) is a valuable resource for evaluating impacts. The permittee may continue the Nuiqsut Caribou Subsistence Monitoring Project (initiated in 2008 and proposed for a total length of 10 years) on an annual basis until 2018 and on a biennial basis after that. The Subsistence Fishery Monitoring on the Colville River project may be expanded to include Fish Creek and extended on a biennial basis. After 2030, the Authorized Officer and the permittee may agree on adjust the focus and duration of these subsistence monitoring studies. The results of an expanded subsistence monitoring project could be used to develop future mitigation measures aimed at lessening the impacts of GMT1 on Nuiqsut harvesters. Subsistence monitoring studies will continue throughout the life of the project, or until the Authorized Officer determines such studies are no longer necessary or prudent.

Potential New Mitigation Measure 10: Economic Study of Subsistence Impacts

Objective: To better understand the economic impacts of development on subsistence uses and activities and provide recommendations regarding how these impacts could be mitigated.

Requirement/Standard: Permittee will undertake a thorough economic study of the costs that individuals and families incur to continue subsistence activities at desired levels (or would have to incur to participate in subsistence activities if they are not able to afford them). The study will include an overview of the increased impacts to subsistence activities related to past, current, and proposed future projects, will account for the increase in cost of living. The study will also describe the adequacy of existing subsistence mitigation funds to address identified impacts.

Potential Benefits and Residual/Unavoidable Impacts: Local residents assert that costs associated with subsistence activities are steadily increasing, in large part because they must travel further, explore new and unfamiliar areas, take on increased risks, and request increased time off from regular employment. An economic study of the costs of subsistence would provide more quantifiable data on the magnitude of these impacts and will assess the efficacy of existing mitigation measures. Residual and unavoidable impacts include the difficulties of verifying the accuracy of the data in such a report and, more importantly, the larger problems that many Alaskan anthropologists and subsistence specialists have identified in attempts to quantify aspects of subsistence. These concerns, in summary, are that Euro-American conceptions of subsistence tend to be static, restrictive, and minimalist because they are tied to ideas of resource management and a definition of subsistence as the minimum resources necessary to support life. Such concepts and the studies that result from them tend to downplay the Alaska Native view of subsistence as a holistic, all-encompassing way of life. The dynamic nature and rich cultural and historical context of subsistence has arguably been undermined and constricted by an over-emphasis on Alaska’s subsistence policies which have evolved to ensure that impacts to subsistence uses are minimized within the context of economic development, rather than to enhance, protect, and conserve Alaska Native subsistence economies and cultures.

Potential New Mitigation Measure 11: Subsistence Food Safety Testing Service

Objective: Address subsistence food consumers’ concerns over oil development-related contaminants in subsistence foods.

Requirement/Standard: Permittee will expand the current contaminants in subsistence food study (established by BMP A-11) to establish a subsistence food sample testing service for residents who have concerns about harvested food. The testing service would be modeled on those in other North Slope communities that allow residents to submit samples of harvested food for contaminants testing.

Potential Benefits and Residual/Unavoidable Impacts: Many residents have long-standing concerns about the safety of subsistence foods due to pollution from natural gas flaring and blowouts at nearby oil development, knowledge about local contaminated areas such as Umiat, Oliktok, and Kogru, the 2013 fall fishery Saprolegnia (aquatic fungi) outbreak, and past tests that have indicated the presence of polychlorinated biphenyls (PCBs) in the livers of burbot from the Colville River. Subsistence hunters and fishers commonly harvest fish and game that they are not willing to consume because it appears sick or infected. There is currently no process established for them to submit samples of that fish and game to have it tested to determine whether it is safe to consume. Questionable food is commonly discarded and this contributes to needing additional time and effort for a successful harvest. Hunters want to understand the health of the animals and would like to turn in samples of questionable food for reasonable tests similar to those done at Food and Drug Administration food packing plants. Benefits would include alleviating stress related to food safety concerns and addressing the increased dependence on expensive store-bought food. Similar services are or have been in place in Barrow and in Kaktovik. Hunters appreciate the opportunity to have a role in scientific monitoring of their environment. Residual and unavoidable impacts of this mitigation measure include the risk that the service would be challenged by the complicated logistics of assuring that samples are fresh and not contaminated by other sources (during harvest and transportation).

4.4.5.12 Summary and Comparison of Alternatives

This discussion provides a description of the primary potential impacts of the proposed GMT1 Project on subsistence uses for the community of Nuiqsut. Several established methodologies, using quantitative, qualitative, or mixed data, are used to consider potential impacts to subsistence. This SEIS establishes in Section 4.1.2 a metric for determining impact levels for all resources. These criteria were based on recent NEPA analyses of oil and gas development on the North Slope and adjacent marine waters and in the Applicant's Environmental Evaluation Document for the GMT1 Project. The criteria used in this SEIS are modeled most closely after NOAA (Corps 2012, 2012a; NOAA 2013a; BLM 2004, 2012), but considered features of the others analyses. For this analysis of subsistence, impacts are evaluated by that metric in addition to the impact criteria designed specifically to evaluate subsistence that was used in the Point Thomson EIS (2013).

Under Alternatives A, B, C, D1, and D2, Nuiqsut residents would experience direct impacts to subsistence use areas, particularly those for caribou, geese, and furbearers such as wolf and wolverine. Some winter fishing activities such as Arctic cisco and burbot fishing may also be impacted. Direct impacts on subsistence use areas would be lowest during the summer months because many of the subsistence activities that occur in the project study area take place during late fall through early spring. Except for areas of high snow drifting, user access will not be restricted for residents who wish to conduct subsistence activities in the project study area because the pipeline will be elevated to 7 feet and the roads will be open to local use. User avoidance is expected to be the primary impact related to user access, as Nuiqsut residents will likely avoid the project study area GMT1 pad and pipeline corridor. Subsistence harvesters often avoid areas of development due to concerns about contamination and because of residents' discomfort with hunting near human or industrial activity.

Impacts related to resource availability will occur year-round and may extend outside the project footprint to use areas along the Colville River (including Nigliq Channel), Fish Creek, and in an area west of the community. Resource availability impacts will be greatest for caribou that migrate through the project study area, and these impacts would be most likely to occur during the peak caribou hunting season, between June and September; other resources such as waterfowl and furbearers may also experience local displacement that will affect Nuiqsut subsistence activities. Finally, for all alternatives (except Alternative E, no action), overall community participation and transmission of knowledge may be affected if residents take fewer trips due to user avoidance or reduced harvest success. Increased costs, time, and effort would also likely occur as indirect impacts related to changes in use areas, resource availability, user access, and community participation. Nuiqsut residents harvest key resources within the project study area multiple times a year, and these areas have been used for multiple generations. Impacts of the proposed project would occur in key geographic areas relative to other areas of subsistence availability and would pertain to individual subsistence users, hunting groups, and the overall pattern of Nuiqsut subsistence uses. In particular, Nuiqsut residents with limited means of transportation and limited funds would be the most impacted among subsistence users because they typically conduct subsistence activities closer to Nuiqsut and will be less able to adapt to the impacts by traveling further and/or more frequently.

In terms of overall subsistence impacts, Alternatives A and B would likely have the fewest impacts to subsistence because they require less air traffic close to the community than Alternatives C, D1, and D2, and because development-related ground traffic would be limited to the road between CD5 and GMT1. Alternative C would likely have more impacts than Alternatives A and B, because it would move development-related ground traffic closer to the community, along the road between Nuiqsut and CD5, and because the community would experience more air traffic if used as a hub, which could result in deflection of subsistence resources near the community. Alternatives D1 and D2 would likely have the greatest impact to subsistence uses and activities of all the alternatives, because they would result in increased air traffic in hunting areas west of the community and would create a new source of air traffic that did not exist before. As noted above, air traffic is the most frequently reported caribou hunting impact associated with development.

Overall the types of impacts (e.g., subsistence use areas, user access, resource availability, community participation) identified above are similar to those identified in BLM (2004) and BLM (2012). New information since these EISs including the results of CPAI's *Nuiqsut Caribou Subsistence Monitoring Project* (SRB&A 2010b, 2011a, 2012, and 2013b) and the MMS's subsistence mapping project in Nuiqsut for the 1995-2006 time period (SRB&A 2010a) provide additional context and information that indicate the intensity of these impacts and overall degree of impact are higher than previously anticipated.

Table 4.1-2 presents a summary of the current analysis of impacts of GMT1. Although there are differences between the alternatives in terms of air and ground traffic and associated impacts on subsistence, the nature and overall degree of impacts on subsistence do not vary substantially by alternative. Table 4.1-2 provides a summary of expected impacts for Alternatives A through D2. In contrast to the BLM (2004), the current analysis identifies that the intensity of potential impacts to subsistence would be high because the impacts to subsistence use areas and user avoidance would be consistently measurable or observable. This is supported by data gathered during the MMS's subsistence mapping project (SRB&A 2010a) in addition to local hunter observations and data collected during CPAI's *Nuiqsut Caribou Subsistence Monitoring Project* (SRB&A 2010b, 2011a, 2012, 2013b), which has documented shifts in subsistence activity away from Alpine-related development activities as well as reported user avoidance of development infrastructure. Results from the ongoing caribou monitoring program will provide further information regarding the magnitude of expected impacts to Nuiqsut residents' caribou subsistence uses. Furthermore, Nuiqsut residents currently have two remaining directions (west and south) in which they can conduct subsistence activities without the presence of permanent oil and gas infrastructure. This project, along with the already approved CD5 project, introduces oil and gas infrastructure into subsistence use areas west of the community, further reducing the areas in which residents can subsist without the presence of nearby oil and gas infrastructure to only the southern direction.

This high-intensity impact to subsistence would be of interim duration for construction and long-term duration during operation, and it would affect multiple generations of subsistence users. While the spatial extent of impacts during construction and certain operational impacts (e.g., direct loss of subsistence use areas) would be localized, the indirect impacts of operation (e.g., increased cost, time, effort) could extend beyond the local area and affect the whole of Nuiqsut's subsistence activities (i.e., regional) in addition to introducing disruptions to caribou availability and other resources that could extend outside of the project study area and to a broader area-wide level. Lastly, the context of subsistence is an important resource that fills a unique role in the regional sociocultural environment. Thus, by the metric established in this SEIS, the overall degree of impact to subsistence is expected to be major because it is a high-intensity impact, will have impacts of long-term duration, increase to regional extents, and is an important resource.

Impacts from the GMT1 Project can also be evaluated using a metric employed in the 2012 Corps EIS for the Point Thomson Project. That EIS considered:

> *"If a portion of a community's subsistence use area were within the project footprint, then a direct impact on subsistence use would occur. With the exception of downstream impacts, the farther a community's subsistence use area is from the project area, the less the potential exists for a direct impact on residents' subsistence uses."* (Corps 2012)

As noted above, the entirety of the GMT1 project study area is within 20 miles of Nuiqsut, overlaps several critically important use area, would locate either a pipeline and a road or just a pipeline directly across primary travel routes, would constitute the loss of traditionally used land, and would contribute significantly to the complex impacts associated with being increasingly surrounded by development.

The metric used to determine the degree of impacts to resources in the recent Point Thomson EIS (Corps 2012) and how Alternative A of the GMT1 Project would be evaluated is shown in Table 4.4-13. Evaluating impacts to subsistence under GMT1 based on the data provided in the Point Thomson EIS, the magnitude of the resource importance is major, the magnitude of the harvest amounts is moderate, the duration is long term, the potential to occur is likely, and the geographic extent is extensive. These are the most intense levels for each category except harvest amount. The harvest impact criteria are based on the assumption that the magnitude of the impact on harvest amounts is considered major if the potentially affected area provides more than 50 percent of a community's harvest for a single resource. By this metric, using data discussed in this SEIS, the GMT1 Project would have a moderate impact on harvests of caribou for Nuiqsut (38.3 percent of harvests according to Braem et al. [2011], 17 to 30 percent of respondents' [not the community's] harvest according to SRB&A, or 43.5 percent of harvest locations as reported by NSB [1998]). A caveat to this finding of a moderate impact is that it is not likely that an assessment of public food security or that residents of Nuiqsut would consider impacts of this magnitude (to approximately 32 percent of their caribou harvest) to be "moderate." Unlike the metric used for this SEIS, the Point Thomson EIS criteria did not include a category for overall degree of impact.

If substantial subsistence-focused potential new mitigation measures were to be adopted in the ROD, it is possible that the overall degree of impact of Alternatives A or B could be reduced. Upon adoption of such mitigation measures in the ROD, BLM would revisit this assessment.

Table 4.4-13. GMT1 Subsistence Impacts vis-à-vis the 2012 Point Thomson EIS – Subsistence and Traditional Land Use Impact Criteria

Impact Criteria	Intensity Type	Specific Definition for Subsistence	Nuiqsut GMT1 Alternative A
Magnitude – Resource Importance	Major	Impact affects subsistence uses of resources, contributing a high amount to either material or cultural measures	Major
	Moderate	Impact affects subsistence uses of resources, contributing a moderate amount to either material or cultural measures	
	Minor	Impact affects subsistence uses of resources, contributing to a minor amount of either material or cultural measures.	
Magnitude – Harvest Amounts	Major	Potentially affected area provides greater than 50 percent of average annual harvests for a single resource.	Moderate
	Moderate	Potentially affected area provides 25 to 50 percent of average annual harvests for a single resource.	
	Minor	Potentially affected area provides less than 25 percent of average annual harvests for a single resource.	
Duration	Major	Impact lasts greater than two years	Major Construction: 2 years Production: 30 years
	Moderate	Impact lasts one to two years	
	Minor	Impact lasts less than one year	
Potential to Occur	Probable	Impact occurs under typical operating conditions.	Probable
	Possible	Impact may occur under typical operating conditions.	
	Unlikely	Impact would be unlikely to occur.	
Geographic Extent	Extensive	More than 50 percent of harvester respondents reported use areas within the project area (i.e., affects user access and subsistence use areas).	Extensive 100 percent of Nuiqsut active hunters interviewed for 1995-2006 time period reported overland use areas crossed by the project study area. Of these, 85 percent reported hunting caribou in the project study area and 76 reported Arctic cisco and geese.
	Local	25 to 50 percent of harvester respondents reported use areas within the project area (i.e., affects user access and subsistence use areas).	
	Limited	Fewer than 25 percent of harvester respondents reported use areas within the project area (i.e., affects user access and subsistence use areas)	

4.4.6 Public Health

The following discussion of potential impact to public health is generally categorized and organized as presented in BLM (2012). Impacts to public health were not discussed in BLM (2004).

The BLM (2012, § 4.3.21) contains an extensive discussion of analysis of potential impacts on public health in the NSB based on potential future oil and gas development in the NPR-A. The following discussion of potential impacts to human health and community welfare associated with the proposed development is tiered to BLM (2012, § 4.3.21). The BLM (2012) considered all eight villages of the NSB as well as other villages of the Northwest Arctic Borough. Therefore, the focus was broader than for the proposed GMT1 Project SEIS, which focuses on the community of Nuiqsut, the closest community to the proposed project.

The BLM (2012) categorizes potential impacts into two types: impacts related to oil and gas exploration and development, and impacts that are not. This SEIS focuses on direct and indirect impacts related to oil and gas development, consistent with the proposed project.

For oil and gas exploration and development, BLM (2012, p. 343) identifies that impacts to public health could result through changes in diet and nutrition, environmental exposures, infectious disease, safety, acculturative stress, economic impacts, and capacity of local health care services. A new influx of workers may increase potential exposures to communicable disease, alcohol and drug use for the local community, as well as increasing stress and mental health issues associated with these activities.

One aspect of stress described by local residents of Nuiqsut commenting on the Draft SEIS is the uncertainty within the community of how to respond to health and safety incidents that could occur at the GMT1 development site, such as a blow-out or breach of the pipeline. In the past few years, events such as these have occurred at oil and gas developments located farther away than the proposed GMT1 development, and weigh heavy on the mind of local residents.

New data and information have not changed the discussion of impacts as presented in 2012, so the discussion in BLM (2012 p. 343-355) is still considered relevant to this proposed GMT1 Project SEIS.

As outlined in the BLM (2012, § 4.3.21.5) several potential mitigation measures were identified to minimize potential adverse health impacts associated with the considered alternatives of that plan. Mitigation measures that were implemented and therefore apply to the currently proposed GMT1 development include contaminant monitoring of subsistence species, providing air quality data to the NSB and local communities in a timely manner, and the actions to be taken to minimize the negative impacts of an oil spill on public health.

The BLM (2012 p. 358) concluded that potential contamination of food and surface water is possible, though measurable public health impacts resulting from such contamination are unlikely under normal operating conditions. However, the perception of contamination of traditional foods is already a problem in the region. Further development may worsen this perception, and could exacerbate the shift away from a subsistence diet.

Fixed production sites, particularly those in the vicinity of villages and in areas of heavy subsistence use of the land, will have an impact on public health. The avoidance of developed areas by hunters increases travel times and costs associated with subsistence activity, and as a result, will potentially decrease harvests and increase the risk of injury and accidents while on the land. Episodes of poor air quality associated with dust or emissions will pose a health hazard for at-risk populations such as those suffering from chronic obstructive pulmonary disease or asthma.

The economic impact of the GMT1 development will allow for a continuation of funding for current levels of services and maintenance of the current level of indirect employment, particularly through the NSB. Given current conditions, it is unlikely that new employment for the Iñupiat in the oil and gas sector will be significant enough to cause public health impacts. The health risks associated with economic growth and in-migration, namely increased use and access to alcohol and drugs and the spread of infectious disease and sexually transmitted diseases will be commensurate with the level of employment, road access, and the degree to which outside workers fraternize with local populations. The continued focus on the development of isolated work camps will temper these impacts.

A summary of impacts from oil and gas activities to public health resulting from the current proposed activity (i.e., a new oil and gas development located near the community of Nuiqsut) is listed below. These impacts would be common to all action alternatives.

- Localized activity will create transient impacts on subsistence by diverting hunters and animals. Nuiqsut hunters, who already avoid large areas of traditional land to the northeast of the village, could experience further limitation in their access to lands to the west of the village if intensive oil and gas development occurs there. Avoidance of productive land may reduce harvests and exacerbate dietary and nutritional outcomes independent of any direct impact on the animals themselves (BLM 2012 p. 345)
- Noise from air traffic and other sources could also create a nuisance around individuals' camps and cabins, possibly reducing their use as a base for subsistence harvests.
- Development may increase the perception that traditional foods are contaminated, exacerbating the shift away from a subsistence diet. Currently, there appears to be little contamination of traditional foods in the NPR-A (Moses et al. 2009, NOAA 2013b, Wetzel et al. 2008). At present, in the villages outside Barrow, 44 percent of Iñupiaq residents report concern that fish and animals may be unsafe to eat (Poppel et al. 2007). Residents also have distrust of regulatory bodies, believing that contaminant thresholds developed by regulatory bodies do not take into account the large volume of fish and game consumed in the region (BLM 2005). These concerns, however, do not appear to have yet resulted in persistent changes in consumption patterns or avoidance of traditional foods.
- Fixed production sites, particularly those near villages or in areas of heavy subsistence use (e.g., near rivers) will lead to avoidance by hunters. In turn, this will increase travel times and costs for subsistence activities, and could potentially decrease harvests and increase risk of injury and accidents. Existing development to the east of Nuiqsut has resulted in avoidance of a large swath of traditional land for subsistence uses. The loss of the traditional use of land close to residences and camps will increase travel time and isolation and the subsequent risk to the safety of hunters (BLM 2012 p. 351).
- The development of permanent and seasonal roads in the region also has the potential to induce travel and raise the risk of subsequent accidents and injuries. Vehicle ownership in Nuiqsut is high for an isolated indigenous community, due both to the relatively robust local economy and the ability to get vehicles in over land in the winter. As oil and gas development continues and road travel and vehicle ownership rise, so will the risk of motor vehicle accidents and injuries (Ward 2007; BLM 2012 p. 351).

- Episodes of poor air quality associated with dust or emissions can pose a health hazard for at-risk populations such as those suffering from chronic obstructive pulmonary disease (COPD) or asthma. The highest air quality pollutant concentrations are most likely to occur at and near the areas of oil and gas development. These sites are at a distance from most population centers in or near the NPR-A, and associated changes in health measurable at the population level (rather than the individual level) are unlikely to be seen. The overall impact to human health is likely to be very low.
  - The Air Quality analysis dispersion modeling was used to assess short-term acute exposure as well as long-term risk from air toxics. Short-term (1-hour) air toxics concentrations were compared to acute Reference Exposure Levels (RELs), as shown in Table 4.2-17 (for the highest concentrations off-pad) and Table 4.2-18 (concentrations predicted in Nuiqsut). RELs are defined as concentrations at or below which no adverse health impacts are expected. Tables 4.2-17 and 4.2-18 also provide the non-carcinogenic long-term exposure assessment, where annual modeled concentrations for each of the air toxics were compared directly to the Reference Concentrations for Chronic Inhalation (RfCs). An RfC is defined by EPA as the continuous inhalation exposure concentration at which no long-term adverse health impacts are expected. Modeled concentrations are far below the thresholds which would indicate risk of short-term or long-term exposure-related health impacts.
  - Long-term cancer risk was analyzed by applying EPA's unit risk factors and adjustment factors to the annual modeled concentrations for two exposure duration scenarios: a most likely exposure (MLE) scenario and one reflective of the maximally exposed individual (MEI). The cancer risk for each air toxic pollutant was summed to provide an estimate of the total inhalation risk. Table 4.2-19 shows that the total cancer risk for both the MLE and MEI scenarios are less than 1.0E-06, which represents a one-in-one-million cancer risk for residents of Nuiqsut.
- Revenue to the NSB, and village corporations will allow for the continued funding of existing health and social programs and the preservation of the current high level of indirect employment. New jobs in the oil and gas sector will continue to be created, though it is anticipated that too few will go to Iñupiaq workers to create any local health benefit based on current levels. Increases in alcohol, drug use, and sexually transmitted infections will be expected, commensurate with the level of economic growth and the degree of contact between outside workers and local populations.

Increased income for individuals or families has the potential to improve health in affected communities through increases in the standard of living, reductions in stress, and opportunities for personal growth and social relationships. Income and employment opportunities may also strengthen community and cultural ties and improve diet and nutrition by providing money to fund subsistence activities. Negative impacts of economic growth have been found to be associated with an increased prevalence of social pathologies, including substance abuse, assault, domestic violence, and unintentional and intentional injuries.

In particular, residents have expressed repeated concerns about the impacts of the GMT1 development on air quality in general, and the use of flaring specifically, in terms of the potential for local residents to have a significant increase in respiratory diseases and other chronic illnesses such as diabetes and heart disease. Local residents believe that existing oil and gas infrastructure currently resulting in health impacts to vulnerable populations:

> *"Our community is already impacted with health problems related to the air pollution, including birth defects. Children as young as three or four have been*

> *developing asthma, and newborns are having kidney problems that require treatment out of Alaska. Elders are dying of pneumonia and cancer. They are impacted by Alpine and projects by Repsol, ENI, and Pioneer."* (Margaret Pardue, NVN 2014a)

Given the high level of concern with regard to air quality impacts as expressed by community members from Nuiqsut, the discussion of these impacts on Public Health from the NPR-A IAP (2012 p. 346-347) is included:

- Oil and gas development and related activities result in airborne emissions. The primary sources of airborne emissions include construction dust, road dust, vehicle and machinery emissions, flaring and venting of gas, burning of refuse, and emissions from power generation as well as other sources.
- The air pollutants emitted by these activities include a number of Environmental Protection Agency (EPA) criteria pollutants such as nitrogen oxides (NO_X), sulfur dioxide (SO_2), particulate matter (PM, including both $PM_{2.5}$ and PM_{10}), carbon dioxide, and ozone. These substances have been linked with a range of health effects, the most notable of which are asthma, chronic bronchitis, decreased pulmonary function, cardiovascular events, increased hospital admissions, and increased mortality (EPA 2014a). Table 4.4-14 summarizes the health effects that have been linked with each of these pollutants.
- In addition, other hazardous air pollutants may also be emitted, including benzene, toluene, ethylbenzene, and xylenes. Chronic exposure to hazardous air pollutants has been associated with irritation of the skin, eyes, and lungs; the development of some cancers; neurologic effects; reproductive effects; and gastrointestinal effects (EPA 2000a, 2000b, and 2000c).

Table 4.4-14. Health Effects Linked with EPA Criteria Pollutants

Pollutant	Sources (Not Comprehensive)	Health Effects
Carbon monoxide (CO)	Motor vehicle exhaust, flaring	Headaches, reduced mental alertness, heart attack, cardiovascular diseases, impaired fetal development, death.
Sulfur dioxide (SO2)	Coal-fired power plants, petroleum refineries, flaring	Eye irritation, wheezing, chest tightness, shortness of breath, lung damage.
Nitrogen dioxide (NO2)	Motor vehicles, flaring, other industrial sources that burn fuels.	Susceptibility to respiratory infections, irritation of the lungs and respiratory symptoms (e.g., cough, chest pain, difficulty breathing).
Ozone (O3)	Vehicle exhaust and certain other fumes. Formed from other air pollutants in the presence of sunlight.	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage.
Particulate matter (PM)	Diesel engines, power plants, windblown dust	Eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, cardiovascular effects.

Source: 2012 NPR-A IAP (BLM 2012, Volume 2 p. 347)

- Both EPA and the State of Alaska have established legal limits for air pollution based on scientific evidence, known as Ambient Air Quality Standards (NAAQS), to protect public health. However, according to EPA analysis and several independent studies, substantial health impacts may accrue at even levels below NAAQS standards (Ostro et al. 2006, EPA 2006). Significantly, the populations most at risk of experiencing health impacts at levels under the NAAQS are vulnerable populations, including children, the elderly, and people with chronic illnesses.

As described in Section 4.2.3.2, *Air Quality*, flaring will not occur at the GMT1 development. However, flaring does occur at the Alpine Central Processing Facility, and the construction and operation of GMT1 may result in additional occurrences of flaring at the facility. At Alpine, flaring is a sporadic event triggered by a particular situation, with each flare resulting in varying amounts of gas being burned, for variable timeframes. Daily, continuous flaring of gas does not occur at Alpine year-round. Regardless, negative health impacts have been shown to result from flaring (Argo 2012, Ovuakporaye et al. 2012), and could result from multiple-day flare events where large amounts of gas are flared.

Comparison of Alternatives

The majority of the impacts discussed above would be relevant for all alternatives. These impacts are primarily applicable to the community of Nuiqsut, the closest community to the proposed GMT1 development. These impacts are similar to the impacts discussed in detail in the recent Point Thomson Project Final EIS, which analyzed the impacts of a development project similar to the GMT1 development (Corps 2012), which found no impacts to water and sanitation and infectious disease; low impacts to specific health issues related to accidents and injuries; food, nutrition, and subsistence; and noncommunicable chronic diseases; medium impacts as a result of exposure to hazardous materials (for example, Air Quality emissions) and social determinants of health (depression, anxiety and resulting social ills); and high positive impacts to public health as a result of increased access to health care and facilities.

The same impacts discussed for Alternative A would be likely under Alternative B with a few significant differences; only one bridge (over the Tiŋmiaqsiġvik [Ublutuoch] River) would be required. This is favorable to some Nuiqsut residents. Aircraft traffic would be similar to Alternative A. Aircraft traffic is more difficult to foresee or avoid and can cause disruption to hunters. There was concern by Nuiqsut residents in 2013 because of the number of summer flights.

Although subsistence hunters would have access and permission to cross gravel roads associated with the project, there is some concern with the road crossing through a thaw basin Under Alternative B, as it requires more fill that would make the road too steep and high, and too difficult to pass, complicating access to Fish Creek. This same issue had been experienced already by hunters trying to cross the CD5 road. It is also a cultural issue for subsistence users to be able to access this resource. The concern of subsistence resources being contaminated, or perceived to be contaminated, from spills from oil and gas development activities could affect the diet/health of subsistence users if availability of subsistence resources were reduced.

It is possible that avoidance of activities near Fish Creek under Alternative B would result in less impact to Public Health related to subsistence use. If the Fish Creek setback is avoided, this could reduce the impact on subsistence hunting areas identified as potentially leading to adverse impacts. For example, travel time and cost may not be as elevated as assumed under Alternative A because a more heavily used subsistence area would be preserved. In turn, this would likely reduce the risk of injury and accidents on the road because less time will be spent on the land. Harvests may be closer to normal since a more typical subsistence hunting range would be utilized.

The same impacts discussed above for Alternative A are also relevant for Alternative C. It is likely that this Alternative, which includes an airstrip extension at the Nuiqsut Airport and other infrastructure in and near the village, could result in greater impacts to public health for the Nuiqsut community associated with both noise from air traffic and other sources and episodes of poor air quality relative to Alternative A.

The same impacts discussed above for all alternatives are also relevant for Alternatives D1 and D2. However, the absence of gravel roads would likely reduce potential impacts associated with noise from road traffic, avoidance of fixed sites in subsistence hunting, and accidental injuries resulting from increased vehicle use on the GMT1 road. Increased air emissions anticipated under Alternatives D1 and D2, as well as the increase in number of flights to the GMT1 development and associated disturbance to subsistence use could potentially lead to increased impacts to public health.

No changes from baseline conditions would be expected under Alternative E, because no action would take place under this alternative.

Mitigation

Specific measures to protect public health are provided in BLM (2013: I-1). In particular, BMP I-1 (k) and (l) provide for training to ensure compliance with drug and alcohol policies, and training to prevent communicable diseases. Because GMT1 and its project activities will take place near and around Nuiqsut, the NSB Health Department encourages these BMPs be implemented in a region where sexually transmitted diseases are higher than the state average. Additionally, 54 percent of Nuiqsut households stated in 2010 that they often thought the health of their community had been hurt by drugs and alcohol (McAninch 2012). Developers should work with local agencies and the NSB Health Department to reduce these statistics.

Impacts to public health will be mitigated by:

- BMP I-1 (k) – Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the NSB Health Department for review and comment.
- BMP I-1 (l) – Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the NSB Health Department for review and comment.

BLM received new potential mitigation measures from the public during scoping, which would be considered for public health. BLM will determine whether to adopt the new potential mitigation measures in the ROD. The new Potential Mitigation Measures are discussed below.

Potential New Mitigation Measure 1: Public Health Monitoring (new required operating procedure)

Objective: To minimize the effects of harmful oil and gas development-related changes to population health.

Requirement/Standard: The Permittee will contribute funds to create a public health monitoring program at a regional level to track health indicators that are vulnerable to impacts from oil and gas activities. These indicators should focus on health outcomes and/or determinants of local concern that can be tied to oil and gas activity. Where possible, indicators should include threshold levels and specific actions should be developed for when thresholds are surpassed. The State may develop and implement the monitoring program; however, the State, NSB, and the Alaska Native Tribal Health Consortium should be involved in the development and implementation of the monitoring program as appropriate and assist with the identification of appropriate indicators, thresholds, and responsive actions.

Potential Benefits and Residual/Unavoidable Impacts: A public health monitoring program will expedite the detection of negative changes in population health caused by oil and gas activity. Based on results of this monitoring program, in consultation with stakeholders, the BLM may require additional measures to lessen the impacts to public health.

Potential New Mitigation Measure 2: GMT1 Disaster Response Plan for Nuiqsut

Objective: To minimize the indirect impacts of stress, and direct impacts to Public Health resulting from large-scale health and safety incidents at GMT1 or associated facilities.

Requirement/Standard: The Permittee shall fund the creation of an Emergency Contingency Plan and associated Evacuation Plan for the community of Nuiqsut to identify the appropriate response by the community to a variety of health and safety events that could concur at the GMT1 development. The Permittee will consult with the NSB, State of Alaska, City of Nuiqsut, Native Village of Nuiqsut, and Kuukpik Corporation, and ensure that these entities are directly involved in the creation of both plans. After review by the appropriate State and local agencies, the BLM will accept the completed plans.

Potential Benefits and Residual/Unavoidable Impacts: The Emergency Contingency Plan and associated Evacuation Plan will alleviate stress and will be a resource to be utilized by the community of Nuiqsut should a large-scale health and safety event occur.

Potential New Mitigation Measure 3: Minimize Undue Idling of all Vehicles

Objective: Prevent unnecessary or undue degradation of the lands and to protect health.

Requirement/Standard: To the extent practicable, engines of rolling stock (such as pick-up trucks, vans, buses, other trucks and trailers, and heavy machinery) used for oil and gas operations will be powered off when not in active use.

Potential Benefits and Residual/Unavoidable Impacts: Prohibiting unnecessary vehicle idling will reduce emissions associated with vehicle use, such as carbon monoxide and fine particulate matter and volatile organic carbon. Additionally, this measure will decrease noise impacts associated with the GMT1 Project. Emissions at Alpine are within the range of ADEC air quality regulations and are subject to DEC permitting restrictions.

Suggested Mitigation Measure which BLM will not Implement for GMT1

The standard BLM must follow regarding what new potential mitigation measures must be considered and evaluated in an EIS is found in the BLM NEPA Handbook Q&A, number 19(b). This standard provides that all relevant and reasonable mitigation measures that could improve the project should be identified if they are within jurisdiction of the agency. If BLM finds that a potential mitigation measure is not within BLM's jurisdiction to implement, or should not be implemented for some other reason, the potential mitigation measure would not be adopted in the ROD that is issued after the Final SEIS. The ROD will contain a section in its Appendix for Potential Mitigation Measures Not Adopted, which will document BLM's rationale for not adopting the potential mitigation measures.

The following mitigation measure is not considered to be reasonable, relevant, or effective to impacts identified from the GMT1 permit to drill and right-of-way grant analyzed in this SEIS, and thus is not being carried forward for further consideration:

- Install air filters in schools and other public buildings to reduce PM and VOC impacts.

- Based on the analysis of air quality impacts discussed in Section 4.2.3.2, air quality in Nuiqsut is expected to remain well within state and federal standards for particulate matter and VOCs, during all phases of construction and operations. Accordingly, installation and use of air filters in schools and other public buildings would provide only marginal benefits, and would have limited nexus to the proposed action's air quality impacts.

4.4.7 Environmental Justice

Executive Order No. 12898 (Feb. 1994), discussed in Section 3.4.4, directs federal agencies, to the greatest extent practicable and permitted by law, to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental impacts of proposed federal actions on minority and low-income populations. The community of Nuiqsut, as discussed in Section 3.3.2.4, meets the demographic characteristics to be qualified as a minority population, and requires evaluation for disproportionate impacts under environmental justice.

Federal agencies also are required to give affected communities opportunities to provide input into the environmental review process, including identification of mitigation measures. The BLM has assured meaningful community representation in the process by holding a public meeting, having a subsistence specialist spend time in the community, inviting the NVN to participate as a cooperating agency on the GMT1 SEIS, and holding regular (weekly) government-to-government consultation via teleconference with the NVN council. The BLM has also consulted with Nuiqsut's ANCSA Native Corporation, Kuukpik.

This analysis of impacts related to environmental justice considers if implementation of the proposed GMT1 alternatives would result in disproportionately high and adverse environmental impacts to the community of Nuiqsut. Following Council of Environmental Quality (CEQ) guidance on evaluating environmental justice within NEPA (CEQ 1997a), the analysis should recognize if the question of whether agency action raises environmental justice issues is highly sensitive to the history or circumstances of a particular community or population. The historical context within which environmental justice issues are considered for the Iñupiat of the North Slope is discussed in BLM (2012, § 4.4.5). Tiering from that discussion, BLM recognizes the interrelated cultural, social, occupational, historical, or economic factors that are likely to amplify the natural and physical environmental impacts of the GMT1 Project. CEQ guidance also directs the BLM to consider any multiple, or cumulative impacts, to human health and the environment even if certain impacts are not within the control or subject to the discretion of the BLM.

The BLM therefore considered the following factors in determining whether the environmental impacts of GMT1 would be disproportionately high and adverse: Whether there is or would be an impact on the natural environment that significantly and adversely impacts Native residents of Nuiqsut. Such impacts may include subsistence, ecological, cultural, human health, economic, or social impacts to tribal members when those impacts are interrelated to impacts on the natural and physical environment.

CEQ guidance spells out that if an analysis of a resource within the Social Systems category has a finding that there is likely to be a direct impact on a minority community, then there is an environmental justice issue. All evidence gathered by the BLM indicates that the vast majority of residents recognize the many benefits associated with development and support construction of GMT1, with the unqualified caveat that mitigation is adequate and their input and opinions are given priority. Those benefits, mitigating measures, and community support are recognized.

Nonetheless, the environmental justice analysis must clearly disclose whether adverse impacts have been identified in the *Affected Environment* sections. A finding of significant impact to any social resource is sufficient in itself to find that there are disproportionate high and adverse impacts to the minority community. Benefits and adverse impacts to the minority community that have been identified in the preceding sections include:

- The primary sociocultural benefits associated with GMT1 would be economic: employment opportunities, royalties to ASRC and Kuukpik Corporation, and tax revenues to the NSB.
- Negative sociocultural impacts associated with GMT1 and categorized as either minor or moderate in degree or intensity would include continuing tensions associated with the influx of non-resident workers, drug and alcohol abuse, and income and heritage disparity.
- Negative sociocultural impacts associated with GMT1 and categorized as major in degree or intensity would include continuing intra-community conflict, anxiety and social disruption related to the permitting process for development, perceived inadequacy of compensation systems, and distress associated with disruptions to the Nuiqsut cultural landscape.
- Negative impacts to subsistence that were considered in the finding of major impacts for this resource include:
    - Project footprint’s direct impact to subsistence use areas
    - Disruption to subsistence hunting activities caused by aircraft traffic
    - Reduced access to and user avoidance of traditional subsistence use areas
    - Reduced value of traditional subsistence use areas
    - Potential disruption and deflection of subsistence resources
    - Decreased community participation and transmission of knowledge

Construction

Construction crews would be housed at the APF, at commercial housing in Nuiqsut, or at a temporary camp at the drill site or on an ice pad. Construction at the site would not bisect any communities and is unlikely to adversely impact access between communities. Because the project alternatives would potentially increase the transportation options available to Nuiqsut residents, there could be a positive effect on reducing community isolation. Because of the predominance of Alaska Natives in the NSB, minority individuals form “the broader community” of the area. Construction of the proposed project would not isolate minority or low-income individuals from the broader community.

Construction of the GMT1 Project is expected to increase employment opportunities as residents take advantage of the local hire program sponsored by the Applicant and its contractors. Local residents who work at the GMT1 facility would benefit from jobs and increased income. Although the number of jobs the GMT1 Project generates for local residents would not be known until after contracts are awarded and construction begins, it likely that positions for local residents would be available. However, based on the history of past development projects on the North Slope, the construction of the GMT1 Project would likely have a minor impact on overall NSB resident employment. Nonresident workers who would leave the area between shifts will likely fill the majority of positions created by the project.

During construction, an increase in employment and in cash income from both employment and dividends to shareholders who live in the community would help local residents, especially those of working age, to stay in the area and maintain their culture and community characteristics. It is expected that residents will experience economic benefits through indirect impacts of increased tax income for the NSB government. Section 4.4.3, *Economy*, provides additional discussion of impacts to employment, income, and the NSB tax base.

Health impacts related to GMT1 construction were predominantly rated low (Section 4.4.7), and there would be limited interaction between workers at the site and the local community, thereby having minor impacts to food, nutrition, subsistence, and social determinants of health. Exposure to hazardous materials was rated as medium; however, emissions would be regulated for protection of human and environmental health. Issues associated with environmental security (fear of a blowout, lack of an evacuation plan, and air quality) are serious concerns for Nuiqsut.

Drilling and Operation

The effects of drilling and operation of the GMT1 Project on the minority community of Nuiqsut would be similar to those described above for construction, except that fewer workers would be employed to drill the wells than to construct the facility.

The 2012 NSB Baseline Community Health Analysis Report notes that a recent study examining air quality in Nuiqsut has not found evidence of [air] pollution at levels expected to have significant health effects (McAninch 2012, p. 98 and 184). That NSB Report also notes that 24 percent of Iñupiaq heads of household in Nuiqsut reported a shortage of subsistence food at some point during the year. This finding could be exacerbated if there was an adverse impact on the availability of subsistence resources due to GMT1 Project drilling and operation.

Comparison of Alternatives

The gravel access road constructed under Alternatives A, B, and C could provide increased access for Nuiqsut residents to subsistence use areas and would allow residents to commute to work at GMT1 (and potentially future pads in the GMT and Bear Tooth units). Most importantly disturbance from aircraft traffic has emerged as the most commonly reported impact on subsistence activities. In comments and testimony received on the GMT1 Draft SEIS from North Slope residents, there is universal opposition to development options that include more airstrips and thus increased air traffic. While the nature of impacts associated with aircraft traffic affects the relative intensity of other impacts (namely, roads), it does not affect the degree of intensity of other impacts. The GMT1 road and the ease of general road access to the area will likely decrease the quality of the area, increase the local hunting pressure in the area, and could decrease the success rate of those who hunted there in the past. Potential access issues have been identified for subsistence hunters attempting to cross the existing CD5 road.

BLM mitigation measures require that road design will not impede access for subsistence activities. Although significant impacts to sociocultural systems and subsistence have been identified as likely to result from either Alternative A or B, the degree of intensity of these impacts is substantial less under Alternatives A or B than it would be under Alternatives D1 or D2.

Alternative C would include improvements at the Nuiqsut Airport and upgrade of the Nuiqsut Spur Road. This alternative may provide minor economic benefits to the community but would negatively impact subsistence hunters who depend on harvesting near town and create additional local air emissions, noise, and dust impacts. Sociocultural and subsistence analyses have determined that Alternative C would have marginally higher negative impacts than Alternatives A or B but substantially lower sociocultural and subsistence impacts than either Alternative D1 or D2.

Alternatives D1 and D2, as described in Section 4.4.2, *Sociocultural Systems*, and Section 4.4.5, *Subsistence*, would involve the most substantial environmental justice issues for Nuiqsut. These alternatives would result in increased air traffic and associated noise directly over the residents' subsistence hunting areas and would include a larger footprint for the project components, including an airstrip and a permanent camp at GMT1. There would not be a road linking GMT1 to the other Alpine Satellite facilities and Nuiqsut that would allow residents' access to subsistence use areas. Although these alternatives would include none of the negative impacts of the road, they would still include a pipeline connecting GMT1 to CD5. Aircraft would be the only means of site access nine months out of the year (May through January) to access GMT1 from APF or Nuiqsut; ice roads would provide access approximately three months of the year (February through April), although five to ten flights per month are anticipated, as well. Noise impacts from aircraft operations between APF and GMT1 would disturb caribou and subsistence hunting activities. Most importantly, these alternatives do not reflect the GMT1 configuration that all members of the identified environmental justice population who have testified or submitted comments have strongly preferred due to the impacts they experience.

Alternative E, the no action alternative, would result in none of the negative impacts to subsistence that are anticipated from the action alternatives. However, the no action alternative would also result in none of the anticipated employment opportunities and other economic benefits of GMT1 development. It is anticipated that several of the sociocultural impacts of GMT1 development would be negatively impacted by the no action alternative. These impacts are expected to be, on the balance, negligible. No additional impacts to the Nuiqsut cultural landscape would occur. Understanding the impacts of Alternative E within the context of the baseline impacts that are already occurring and expected to continue around Nuiqsut with or without development of GMT1, it is anticipated that Alternative E would have different impacts but impacts equal in degree to Alternatives A and B but less than Alternatives D1 and D2.

Under all action alternatives, residents of the minority community of Nuiqsut could experience disproportionally high and adverse impacts as the result of overall negative impacts to sociocultural systems and disturbance to subsistence activities in highly valued, nearby traditional subsistence use areas. Resource availability could also be impacted in the immediate vicinity of the project.

The analyses of potential impacts to cultural resources, sociocultural systems, and subsistence described in this chapter largely confirm and corroborate Iñupiaq residents' perceptions of environmental justice issues related to development of GMT1. Residents have claimed that the overall environmental and social impacts they are experiencing in addition to the lack of power or control that they have to address those impacts or assure that their voice will have equal weight in decision-making are environmental justice issues. Perceptions of environmental injustice differ by individual. There are some areas of more general agreement: the 2005 Nuiqsut Village Profile listed a number of "community issues" that are cited here verbatim:

- There has been a loss of historic rights and land with regard to oil and gas development; traditional local rights were not protected.
- Local residents should be consulted regarding local uses. This information and Traditional Knowledge should be incorporated into study plans before they are started.
- Agencies do not listen; they make their own decisions.

- There should not be a pipeline towards Fish Creek; it is important for different types of fish in the fall, fall caribou hunting, and spring geese hunting.
- We need better coordination with industry.
- The cumulative impacts of oil and gas development need to be addressed and prioritized.
- Nuiqsut has been really impacted by petroleum development; we cannot be quiet any more (URS Corporation 2005).

NVN council member Eli Nukapigak addressed this issue in public comments on the ASDP in 2004:

> *"The socioeconomic impact statement should be strongly addressed in foreseeable development because there's a lot of studies already been done in our wildlife. What about our social impact of our human? The very people that have been impacted upon is us here in this -- here in this village."* (testimony at ASDP Draft EIS public meeting, Feb. 10, 2004, Nuiqsut)

Under NEPA, the identification of disproportionately high and adverse human health or environmental impacts does not preclude a proposed action from going forward, nor does it compel a conclusion that an action is environmentally unsatisfactory. Rather, the identification of such an impact should heighten agency attention to alternatives, mitigation strategies, monitoring needs, and preferences expressed by the affected community or population (CEQ 1997a).

Mitigation

Prior planning documents covering the proposed project study area, described in BLM (2004), BLM (2008), BLM (2012) and BLM (2013), have provided opportunities for public involvement for low-income and minority populations. BLM has carefully considered community views when developing and implementing mitigation strategies to reflect the needs and preferences of these populations, to the extent practicable. These planning documents have made some lands unavailable for oil and gas leasing, including a large portion of the eastern coastal plain within the NPR-A that is used by Nuiqsut subsistence users. See Chapter 5 for consultation activities associated with this SEIS.

These efforts also include ways to adapt management of these lands to better meet resource and use objectives, including adopting measures to protect subsistence resources, protect access to those resources, protect public health, and monitoring lessees'/permittees' activities to ensure compliance with requirements. The NPR-A SAP provides a forum for tribal representatives to propose mitigations to BLM, and the BLM conducts regular government-to-government consultation with the NVN council. In addition, the 2013 NPR-A ROD required BLM to establish the NPR-A Working Group, made up of representatives of the North Slope local government, Native corporations, and tribal entities, in order to facilitate and provide for meaningful and regular input by local communities.

In the ANILCA § 810 analysis documented in BLM (2004a) and BLM (2013), BLM concluded that the authorized developments (Alternative F and B-2, respectively, both of which include the GMT1 Project) *"includes reasonable steps to minimize adverse impacts on subsistence uses and resources."*

Potential impacts to subsistence activities and resources are mitigated by design and operational features included in Section 4.6 and the following protective measures of BLM (2013: A-4, A-5, A-6, A-7, A-11, A-12, B-1, B-2, C-3, C-4, C-5, E-1, E-2, E-6, E-7, E-19, F-1, H-1, H-3, I-I, K-1, K-2, and M-1). The effectiveness of lease stipulations and BMPs for sociocultural systems are discussed in Section 4.4.2. The discussion concludes that while measures to protect the environment and human health have proven effective, measures in effect to date do not sufficiently address the social and cultural impacts of development. A potential mitigation measure designed by the community is offered. The effectiveness of lease stipulations and BMPs for subsistence is discussed in Section 4.4.5. The discussion concludes that measures in effect to date will likely not be sufficient to adequately address the increasing impacts to subsistence from development of GMT1. Numerous potential mitigation measures, designed in collaboration with the NVN council and other community members, are proposed that will likely decrease the intensity of impacts to subsistence.

Conclusions

The analysis of impacts related to environmental justice considers if implementation of one of the proposed alternatives would result in disproportionately high and adverse environmental impacts to the minority community of Nuiqsut. The potentially affected resource in the environmental justice analysis is the community of Nuiqsut, which is characterized as unique in context.

The ANILCA § 810 analysis for this project concludes that, for all action alternatives, the impacts fall above the level of significantly restricting subsistence use for the community of Nuiqsut. Other impacts than those required to be analyzed within the ANILCA 810 evaluation are described within Section 4.4.1, *Cultural Resources*, Section 4.4.2, *Sociocultural Systems*, and Section 4.4.5, *Subsistence*. These analyses have described various potential moderate and major adverse impacts of GMT1. The duration of impacts under all the action alternatives would be long-term and of regional extent.

Overall, impacts to the minority community resulting from Alternatives A, B, and C are expected to be long term and of high intensity. In A, B, and C, the improved permanent access to subsistence use areas is expected to have a long-term, moderate beneficial effect for many residents of Nuiqsut while significantly diminishing the traditional and subsistence value of the area due to loss of land, disturbance to and possible deflection of resources attributable to the stature of the road, road traffic, the presence of the pipeline, and increased local hunting pressure. Alternatives D1 and D2 would result in increased aircraft disturbance in the project study area and would not include the mixed impacts of the road, therefore resulting in long-term, high-intensity, and significant impacts to the community, including a substantially higher degree of negative impacts to sociocultural systems. Impacts resulting from Alternative E are expected to include a lack of any of the economic benefits anticipated from GMT1 development, negligible additional negative impacts to sociocultural systems, no opportunities to enjoy facilitated access to subsistence areas, and no additional negative impacts to subsistence use areas and activities.

4.5 Impacts of Oil, Saltwater, and Hazardous Material Spills

This analysis tiers to information presented in BLM (2004) and updates that information with an analysis of the most current spill information obtained from the ADEC spills database of all spills to the Alpine Field, along with an analysis performed for the CPAI Alpine Participating Area Development Oil Discharge Prevention and Contingency Plan (ODPCP) document that addressed potential spills of more than 55 gallons, as required per ADEC regulations. BLM (2004, §§ 3.1.2 and 4.3) and BLM (2012, § 3.2.11) provide resource-specific spill-related impact assessments for the proposed GMT1 Project. Each document also provides detail on the factors affecting the fate and behavior of spilled oil.

4.5.1 Background

A complete spills analysis was conducted for BLM (2004, § 4.3). A description of the rate, behavior, and potential impacts of spills in a variety of spill scenarios was provided, along with a review of the 30-year spill history of the North Slope occurring in environments similar to the proposed GMT1 Project. The type of material or product most likely to be spilled and the primary causes and sources of spills were identified. As stated in BLM (2004), many prior documents have described the rate, risk, probability, and impacts of oil and hazardous material spills on the North Slope, and although each spill scenario is different and each document provides different details, the basic data and conclusions were found to be similar.

Basic assumptions were used in the impact assessment in both the BLM (2004) analysis and the BLM (2012) analysis, including spill size classification. The size classifications are similar to those used by ADEC when they respond to and evaluate spills of oil and hazardous materials. To describe the impacts of spills, BLM (2004) used the following spill size categories:

- Very small spills – less than 10 gallons (0.24 barrel)
- Small spills – 10 to 99.5 gallons (0.24 to 2.4 barrels)
- Medium spills – 100 to 999.5 gallons (2.4 to 23.8 barrels)
- Large spills – 1,000 to 100,000 gallons (23.8 to 2,380 barrels)
- Very large spills – greater than 100,000 gallons (greater than 2,380 barrels)

The BLM (2012) updated the data provided in the BLM (2004) analysis, including the spill size classifications that were used. The BLM (2012) analysis provides three spill-size categories:

- Small spills – less than 500 barrels
- Large spills – 500 to 120,000 barrels
- Very large spills – 120,000 barrels or more

Based on the 34 years of North Slope experience, both the 2004 and 2012 analyses found that the vast majority of spills have been less than 10 gallons or between 10 and 100 gallons, and were contained within secondary containment or on gravel pads and roads. Impacts caused by spills to natural resources of the North Slope have been limited in area, duration, and size. Large spills were determined to have low probability.

One key conclusion discussed in the BLM (2004) analysis describes a generally decreasing trend in the volume of oil and saltwater spills occurring on the North Slope over the more than 30-year oilfield operating history. The BLM (2012) updated this information, which includes a 2006 spill from a crude oil transit line at GC-2 at Prudhoe Bay. The GC-2 spill resulted in the release of over 200,000 gallons of crude oil spilled to tundra and frozen lake surface (ADEC 2008). The spill volume was large, because it was a small leak from a low-pressure line that went undetected for some time. According to BLM (2012), the same conditions that allowed it to continue undetected (snow cover and low temperatures) limited the spread of oil and environmental impact to approximately two acres. To date, this is the largest spill to occur on the North Slope, other than saltwater spills. This spill emphasized the need for visual inspection of pipelines, and the benefits of road access to the pipeline for visual inspections. Another spill that occurred on the North Slope since the Draft SEIS was published involves a spill from a three-phase flowline at the BPXA West Operating Area. The released material included natural gas and produced water containing crude oil. The spill volume is unknown and the spill is still under investigation. However, the last situation report available at the time of this writing detailed that recovered melt-water and assorted fluids totaled 1,788 barrels, which have been approved for injection disposal.

The BLM (2004) analysis determined that most spills, except those from pipelines, would occur and be contained on or immediately adjacent to the ice or gravel pads, roads, and airstrips, and would generally be cleaned up before reaching the tundra or water bodies. There is greater potential for pipeline spills to reach open water if a leak or pipeline break were to occur at a river crossing, especially during ice-free seasons.

4.5.2 Construction

Spills related to construction activities are of relatively small volume and primarily result from vehicle and construction equipment fueling and maintenance. A tanker truck accident or a fuel storage tank failure would be the most likely source of the largest construction spills, while spills from blowouts, pipelines, uncontrolled releases, or facility accidents would not occur during construction (BLM 2004).

4.5.3 Drilling and Operation

Spills that could occur during drilling and operation phases could potentially result in larger-volume spills, but these types of spills are less likely to occur. As noted in BLM (2004), "*as the spill size increases, the rate and probability of occurrence decreases*."

The Alpine ODPCP, which received renewed approval in February 2013, provides results of analyses of spills greater than 55 gallons at Alpine between facility startup in 1998 and June 2012. This information only covers spills 55 gallons and greater as required by ADEC 18 AAC 75. Results of the analysis indicated that equipment difficulties accounted for most spills at Alpine. Most spills were small events that were contained on gravel pads and rarely reached the tundra or water environment. Sources with the highest percentage of spill incidents were tanks (36 percent) and heavy equipment/mobile equipment/vehicles (23 percent), followed by pipelines (9.1 percent). The largest percentage of spill volume was from tanks (40 percent) and from heavy equipment/mobile equipment/vehicles (19 percent). Spills from pipelines made up a smaller percentage of spill volume at 5.9 percent.

Blowout Response

As required by ADEC 18 AAC 75, the blowout contingency plan establishes notification procedures, presents decision-based guidelines for managing a well control incident, and provides emergency response and source control equipment and logistics information. The blowout contingency plan is supplemental to the area Oil Discharge Prevention and Contingency Plan (C-Plan), which provides details on oil spill prevention and response for various spill scenarios, including a well blowout.

Well Capping

Well capping is effective for onshore wells; however, plans and provisions for a relief well are still incorporated into a response.

Once initial notifications are made and response objectives are established under the Incident Command System (typically within the first 24 to 48 hours of an incident), the anticipated general time frame for major actions to perform well capping is as follows:

- Mobilize heavy equipment, personnel, and materials (from North Slope locations): 1-5 days
- Mobilize well control contractor personnel and specialized equipment: 1-5 days
- Situation and site assessment; establish Safety Plan and Well Capping Plan: 2-5 days
- Equipment staging, determine approach paths, prepare heavy equipment with heat shielding, rig up Athey wagons and fire pumps, test equipment, apply fire suppression, begin debris removal, continually assess situation, (initiate relief well planning): 6-10 days
- Cut off BOP stack with abrasive jet cutter, excavate at wellhead, prepare casing for new wellhead or capping stack, install new wellhead (if required), prepare and deploy capping stack, activate rams and/or place on divert, kill well: 10-15 days

Due to the unpredictable nature of well blowouts, and environmental conditions which can limit the effectiveness of personnel and equipment, this timeline is intended for illustration and planning, and represents the best-case scenario (DeGeorge 2014c).

Relief Well Drilling

Well capping is typically effective for well source control; however, in the event of an uncontrolled well emergency, plans and operations for drilling a relief well would be made simultaneous with those for well capping. Drilling a relief well in support of a well control response at GMT1 during summer months (generally May through October) primarily would require construction of a gravel pad and mobilization of a drill rig and related facilities (e.g., mud and cement plants). A gravel pad sized at a minimum of 300 feet by 380 feet would be required to support the rig and drilling operations; gravel would be scavenged from nearby gravel pads and roads or possibly mined from local gravel resources. Approximately 600,000 cubic feet of gravel would be needed to construct the gravel pad. Alternatively, a well pad could be constructed using rig mats placed on leveled tundra surface; approximately 1,800 rig mats, double layered for stability, would be required. Siting of the relief well pad would be made at the time of the incident, taking into consideration current wind and weather conditions, blowout severity, and distance from the heel of the blowout wellbore, as well as other environmental or regulatory factors such as mandatory setbacks. Proximity to the gravel road structure would allow unrestricted access and reduce tundra damage; however, it is assumed tundra travel would be approved by governing agencies as an element of the response (DeGeorge 2014c). The timing and capability for response with a relief rig to a catastrophic blowout varies by alternative, and are described further in Section 4.5.4.

4.5.3.1 Spill Scenario Modeling

CPAI will amend its Alpine ODPCP to include the GMT1 Project if development proceeds as proposed. A hypothetical spill of an uncontrolled well blowout is described in the current Alpine ODPCP. The Response Planning Standard (RPS) for the spill scenario is 30,000 barrels, or 2,000 barrels of oil per day for a duration of 15 days.

ADEC regulations governing the ODPCP (18 AAC 75) require modeling to show where dispersed oil would be most likely to fall within the environment (trajectory analysis). This involves consideration of prevailing wind direction (wind direction is taken from the nearest available wind monitoring station). For the proposed GMT1 Project the nearest wind monitoring station is in Nuiqsut. The RPS scenario in the Alpine ODPCP describes a hypothetical well blowout at CPAI's CD2 pad. The plume dispersion model is from SL Ross, which projects that the oil takes the form of an aerial plume extending from the well in the direction of predominant winds. Using wind data derived from the Nuiqsut Air Quality Monitoring Program, the predominant winds are from the NE, ENE, and E. Therefore; the hypothetical blowout would discharge 30,000 barrels to the W, WSW, and SW of the CD2 pad. For this scenario, the model predicts the following plume dimensions:

- Approximately 80 percent of the discharged oil falls within 600 feet downwind of the well. At that distance, each fallout plume is about 119 feet wide.
- Approximately 90 percent of the discharged oil falls within 4,175 feet (0.8 mile) downwind of the well. At that distance, each fallout plume is about 684 feet wide.
- According to the SL Ross model, 10 percent of discharged oil is in the form of droplets so small (50 micrometers or less) that they do not fall to the ground. As a conservative measure for response planning purposes, the volume of oil that is predicted to stay aloft is proportionately distributed between the two modeled fallout zones. Consequently, the conservative scenario addresses the full RPS volume of 30,000 barrels.

For this scenario, approximately 80 percent (23,333 barrels) of the discharged oil falls on the pad, while approximately 6,667 barrels of oil falls beyond the pad. The average thickness of the oil deposited off pad is 0.7 inch. This would be considered a very large spill (under size classification of the BLM (2004); however this type of release is considered to be highly unlikely.

Between 1998 and 2013, the largest reportable spills from Alpine Field were a seawater spill in 2002 of 4,998 gallons, and a produced water spill in 2013 of 1,560 gallons. The largest oil spill reported by CPAI was 840 gallons of diesel at CD1 pad in 2008. The cause was a tank overflow resulting from a fitting connection not being fully closed. Most of this spill occurred to secondary containment, with only 0.5 gallon reaching outside of containment. There was one spill of Extremely Hazardous Substance (EHS) that occurred at the Alpine Field during this analysis. One gallon of Sulfuric Acid leaked from a battery in the Mechanic's Shop and was cleaned up on site.

4.5.3.2 Waste Disposal

Drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil and natural gas are solid wastes that are not hazardous waste in accordance with 40 CFR §261.4(b)(5). Any other hazardous waste generated at the facility is subject to the hazardous waste regulations under Sections 3001 through 3019 of the Resource Conservation and Recovery Act (RCRA) (42 USC 3251 et seq.).

In the event of an oil spill there may be a need for temporary storage of oil, oily waste, and debris recovered during a spill cleanup. The spill location or other logistical concerns, in the event of a roadless alternative, may require the use of small, portable containers that can be mobilized via truck or aircraft to the nearest disposal facility.

Numerous options are available at North Slope facilities for the recycling of recovered hydrocarbons. Injection well disposal of Class I fluids is available at the Alpine Development and at Pad 3 in the Prudhoe Bay Unit, and would be included in the Alternatives D1 and D2 infrastructure. Injection well disposal of Class II solids is available at the Grind and Inject Facility in Prudhoe Bay Unit, and Class II wells for liquids disposal in Alpine and Kuparuk. If materials need to be transported off the North Slope, truck, and/or air transportation would be arranged.

4.5.4 Comparison of Alternatives

Alternative A

For the proposed GMT1 Project (Alternative A), the largest pipeline river crossing would occur at the Tiŋmiaqsiġvik (Ublutuoch) River, where a 350-foot-long bridge is proposed. The Tiŋmiaqsiġvik (Ublutuoch) River is the only perennial stream that would be crossed by the GMT1 access road and is a tributary to Fish Creek. A potential spill to the river would have to reach the Fish Creek delta and offshore at Harrison Bay to impact marine mammals. The Tiŋmiaqsiġvik (Ublutuoch) River is a slow moving, meandering river, with many oxbows, allowing for opportunities to intersect the majority of oil before it could travel to Fish Creek, or farther to the Fish Creek delta. Seals do not occupy the Tiŋmiaqsiġvik (Ublutuoch) River, but spotted seals may occur in the Fish Creek delta (see Section 3.3.4).

Marine mammals are not expected to occur either in the project study area, or north of the project study area along the coastline of Harrison Bay. The water along the coast is too shallow for most species to utilize during the limited migrations through the area. The exceptions are polar bear, spotted seal, and beluga whale. The impacts to these species are discussed in Section 4.3.4.2. Bearded seals, walruses, and gray whales mostly occur offshore in the Beaufort Sea. An oil spill resulting from development would be unlikely to occur in the marine environment, or to reach typical bowhead whale migration habitat from onshore locations (BLM 2012). Any large spill would be expected to disperse before it reached migration routes and offshore habitats of these species. Polar bears would be most vulnerable to an oil spill that reached coastal habitats of Harrison Bay, but the potential for this occurrence from the GMT1 Project is extremely low.

In terms of pipeline access for the purposes of surveillance monitoring and repair, most of the pipeline under Alternative A follows the proposed GMT1 access road, allowing easy year-round access. Over the more than 30-year history of oil industry operations on the North Slope, operators have been more likely to inspect pipelines more frequently if they are easily accessible (Corps 2011). The small portion (less than a mile) of pipeline that does not closely follow the proposed road system would not be easily accessed. Surveillance for this portion of the pipeline could be done with snowmachine or ATV, if mobilization of a helicopter was not feasible.

There is potential for pipeline spills where the pipeline crosses under the road, due to corrosion of the underground portion of the pipe. The likelihood of corrosion occurring is reduced through pipeline design and monitoring. CPAI maintains corrosion control and inspection programs. These programs are more fully described in the Alpine ODPCP.

To be as effective as possible, elevated pipelines should be separated at or beyond the recommended minimum distances of 500 feet from roads (Cronin et al. 1994). Likewise, if the pipeline is greater than 1,000 feet from the road, the benefits of co-locating the pipeline with the road are reduced. Approximately 1.5 miles of pipeline is more than 1,000 feet from the road.

A resource-specific impact assessment on oil spills is discussed in BLM (2004 § 4.3.3). CPAI maintains a robust suite of dedicated, full service medical, fire, and spill response personnel, facilities, and equipment at APF. In order to ensure these resources can be reliably made available for a timely and effective incident response is with a gravel road that would allow year-round transport and mobilization.

Under Alternative A, it is not clear how quickly a relief well drill rig could be transported to the GMT1 site if a blowout were to occur during the summer months, though timing would be expected to be similar to the timeline provided for Alternative D1, below. Gravel roads now exist between the existing Alpine CPF and CD5, and would be authorized from CD5 to GMT1 under Alternative A. However, three of the bridges between Alpine CPF and CD5 are not rig-capable, including the bridge across the Nigliq Channel. Due to these rig access complications, a drill rig would need to be broken down in order to be transported to GMT1. The bridges are adequate for bearing trucks carrying the parts of specialized well control equipment, including a "Hercable" rig, prior to reassembly. The trucking is not expected to cause any significant delay to the preparations for drilling a relief well.

It is possible that there may be no rig at CD5 or any other CRU drill site while GMT1 wells are being drilled. In that case, if a loss of well control at GMT1 were to occur when the ice road between Alpine and Kuparuk is in place, then a rig could be mobilized from Kuparuk, Prudhoe, or elsewhere on the road system and come across ice bridges (some of which would need to be constructed) to drill a relief well. More likely, however, a Hercable rig would be transported to Deadhorse in pieces, then transported in smaller loads on a Hercules to Alpine CPF. Once there, the rig pieces would be transported by truck to GMT1 or nearby via the gravel road and bridges. The fact that not all bridges are capable of supporting the weight of an assembled drilling rig poses no restriction to transportation of the pieces of a rig than can be flown in a Hercules and transported with a truck.

Alternative B

This alternative is similar to Alternative A, except that the road and pipeline would be located to the south, avoiding the Fish Creek setback. It increases the footprint by increasing the distance of the access road in order to remain outside the setbacks established for Fish Creek, and water bodies on federal land in the NPR-A. Under this alternative, the pipeline closely follows the access road from GMT1, south of lakes L9820 and L9819, to the western valve pad at the Tiŋmiaqsiġvik (Ublutuoch) River crossing, then follows the preferred alternative route, keeping the route entirely out of the Fish Creek buffer zone. Similar to Alternative A, this option places the road next to the pipeline allowing for easier access by operators for pipeline surveillance, monitoring, repair, and emergency response, and thereby potentially increasing the frequency of inspections by operators. The response capability and timing to stage a relief rig and drill a relief well under Alternative B would be very similar to Alternative A.

Alternative C

Similar to Alternative A, this option places the road next to the pipeline allowing for easier access by operators for pipeline surveillance, monitoring, repair, and emergency response, and thereby potentially increasing the frequency of inspections by operators.

Additional road access and connection to facilities by gravel road under the Nuiqsut Alternative Access would increase the options to move resources from APF or Nuiqsut in the event of a spill response. Under Alternative C, CPAI would be able to stage their response with a relief rig as described for Alternatives A and B. Additionally, the Nuiqsut Airport would have a Hercules-capable airstrip, and thus a relief rig could be mobilized and flown in as described in Alternatives D1 and D2.

Alternative D1

Under Alternative D1, transportation to GMT1 from the existing APF would be via aircraft approximately nine months of the year (May through January, and via ice road approximately three months of the year: February through April). The ice road would roughly parallel the pipeline for easy access. The pipeline route would run from GMT1 to CD5, with a portion of the pipeline crossing into the Fish Creek setback. A portion of the pipeline would also cross through the Tiŋmiaqsiġvik (Ublutuoch) River setback.

Ice roads would be required annually to access GMT1 during winter. Additionally, a 5,000-foot airstrip with apron and access road to the pad would be constructed at GMT1.

This alternative would require a larger footprint in part because of additional storage, including fuel storage at the GMT1 pad and possibly the new airstrip, and to accommodate additional infrastructure. This alternative would also require the addition of a 2-inch diesel pipeline added to the production pipelines along the same route to GMT1. The additional pipeline could increase the opportunity for spills to occur by adding another product line as more volume of oil passes through the cable trays.

There are two types of pipeline access needed by an operator; one for daily operations (for activities such as inspection, monitoring, repairs and modifications, testing, pigging, and construction), the other for emergency response (for response to a spill, security, leak mitigation, emergency repairs, emergency access to equipment or valves, and fire fighting). Quick access can mitigate environmental impact from all of these (Corps 2011).

The lack of road access under Alternative D1 would complicate spill response. Tundra travel can be difficult during winter and more difficult during summer, and must be done by low ground pressure vehicles. Without a road to follow the pipeline for easy access, aircraft would be required for pipeline monitoring and surveillance.

Limitations associated with aircraft and ice-road only access to the GMT1 pad will affect response capability for emergency health and safety measures. Dedicated response resources are available at Alpine CPF including full service medical, fire, and spill response personnel, facilities, and equipment. As stated above, based on historic restrictions in air traffic due to weather in this area, aircraft access may be restricted 13 to 22 percent of the year (CPAI 2014a). This could result in delayed response in the event of a spill, or any worker health or safety event on site.

Spill response equipment would be stored at the GMT1 pad and at the proposed airstrip to be used in the event of an emergency response. An approved Class 1 disposal well and injection pump module would be located at the GMT1 pad.

If GMT1 were developed without gravel road access, a relief well drill rig would have to be mobilized by aircraft during the summer. Currently, one rig that could be mobilized by Hercules C-130 is located on the North Slope, the Nabors drill rig 14E. Nabors 14E would be capable of drilling the length of well likely required to intercept a blowout well at GMT1. Alternatively, heliportable bootstrap rigs typically operating in Canada could be utilized; however use is restricted to shorter range wells and requires use of specialized heavy lift helicopters. The best-case scenario time frame for major actions to perform relief well drilling under Alternative D1 is as follows (DeGeorge 2014c).

- Mobilize heavy equipment, personnel, and materials (from North Slope locations): 1-25 days

- Mobilize well control contractor personnel and specialized equipment: 1-5 days
- Situation and site assessment; establish Safety Plan, obtain emergency permits or authorizations for relief pad and road (if required): 2-5 days
- Construct relief well pad and access road (requires gravel scavenge and placement): 1-25 days
- Disband Nabors 14E, transport by Hercules aircraft to GMT1 airstrip (approx. 150 loads): 1-25 days
- Transport rig to relief pad, rig up: 26-55 days
- Develop relief well plan: 1-55 days
- Drill relief well to total depth for interception (approx. 28 days): 56-84

Alternative D2

The impact from and response to oil spills under Alternative D2 would be the same as under Alternative D1, except as described below.

A complete loss of well control may be less environmentally damaging under Alternative D2. Drilling during winter when the ground is frozen may reduce the blowout risks to open water in wetlands, floodplains, and the Fish Creek watershed. Under Alternative D2, CPAI could stage its relief rig via aircraft, as described for Alternative D1. Alternatively, CPAI could use ice roads and its rig-capable ice bridges connecting GMT1 to Alpine CPF to transport a relief rig, which would likely be the fastest option.

4.5.5 Mitigation

The likelihood of an onshore spill reaching marine waters is greatly reduced through several mitigation measures included in Stipulations K-1 through K-6, which require contingency planning, include set-back requirements, and deal with the handling of fuel and other pollutants (BLM 2012).

Several BMPs were developed to minimize impacts of the proposed project from contaminants. The BLM (2013) provides BMP A-3, which has the objective of minimizing pollution through effective hazardous-materials contingency planning prior to transportation, storage, or use of fuel or hazardous substances. BLM (2013) also provides BMP A-4, which has the objective to 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. This requirement includes the development of a comprehensive spill prevention and response contingency plan, which shall include items such as on-site cleanup materials, storage containers with secondary containment, container identification and labeling, liner materials, fueling stations, and reporting spills. BMP A-5 has the objective to minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment. This requirement includes setbacks for refueling of equipment and fuel storage near water bodies (BLM 2013).

Facilities that must have an ADEC-approved ODPCP must also meet oil discharge prevention requirements. Required prevention measures include training programs, operating procedures, monitoring, inspections, and equipment/facility specifications such as leak detection systems. Design specifications are also required under these state approved plans. For example, pipelines are designed to ASME Codes B31.4 (oil and water) and B31.8 (gas).

CPAI North Slope operations employ several measures to minimize and mitigate the occurrence of spills. A "Root Cause Failure Analysis" investigation process occurs for significant spills and corrective actions are taken based on the analysis by the review team. Lessons learned are then shared with supervisors and workgroups. CPAI promotes spill prevention by encouraging proactive involvement and knowledge sharing though spill prevention programs and awareness training or communications.

CPAI provides new-employee orientation on health, safety, and environmental issues, annual environmental training seminars, and appropriate certification classes for specific activities, including spill prevention and response, as noted above. All North Slope employees and contractors are required to complete an eight-hour unescorted training program. All trainees in that program receive a Field Environmental Handbook and an Alaska Safety Handbook. Project-specific training is provided for all personnel working in the NPR-A. A key objective of this program is to increase awareness of the environmental, social, and cultural issues that relate to the NPR-A. This training emphasizes protection of archaeological and biological resources, avoiding conflicts with subsistence activities, relevant health and safety measures, and project mitigation commitments.

In the event of a pipeline failure, CPAI Operations personnel isolate the damaged section by closing the necessary valves to prevent further discharge from production or backflow potential. Manual isolation valves, to be located on each side of the Tiŋmiaqsiġvik (Ublutuoch) River, will minimize potential spill impacts in the event of a leak or break by isolating the production pipeline across the bridge. One manual valve will be located on a gravel pad adjacent to the gravel road, approximately 1,700 feet west of the Tiŋmiaqsiġvik (Ublutuoch) River bridge. A similar second valve will be located approximately 700 feet east of the Tiŋmiaqsiġvik (Ublutuoch) River bridge. These valves comply with mitigation adopted in BLM (2004, p. 23). Additionally, automatic valves, which would be immediately shut in the event of a spill, will be located at GMT1 and CD5.

Reaction time to isolate pipeline sections varies and is a factor in predicting spill volume potential. Continuous production from drill sites is stopped when low pressure is sensed as a result of the failure. It is unlikely an entire pipeline volume would be drained, due to the frequent elevation changes associated with routing of pipelines, as well as the planned installation of manual valves at GMT1 and the CD5 tie-in, and on either side of the Tiŋmiaqsiġvik (Ublutuoch) River.

The general spill prevention and response for the Alpine area includes several sites for boom pre-deployment. CPAI's primary response action contractor, ACS, has pre-staged equipment in containers by the Nigliq Channel crossing. ACS would deploy diversionary and exclusion boom immediately downstream of pipeline crossings over rivers. This line of defense could also be implemented for the proposed GMT1 Project, along with the BLM stipulations and BMPs for spill prevention.

Due to seasonal changes of the river channels and weather conditions causing fluctuating river currents, specific boom configurations and exact lengths of boom pre-deployed at each site may vary. At each pre-deployment site, sufficient boom sections and anchors are utilized to traverse the water body in a manner that optimizes its intended use for containment, diversion, exclusion, and/or recovery.

Oil spill responders would be able to reach the production pad by road or by air (depending on weather). Primary spill responders would come from CD1 and from ACS, with additional resources available from Kuparuk Oilfield, the Nuiqsut Village Response Team, and mutual aid providers. As stated in other sections of the SEIS, spill response capabilities are most easily accomplished via road access.

Additional information on spill response resources is provided in BLM (2004, § 2.3.4.2).

BLM received new potential mitigation measures from the public during scoping, which would be considered in addition to the mitigation, prevention and response measures described above. BLM will determine whether to adopt new potential mitigation measures in the ROD. These new Potential Mitigation Measures would update BMPs A-4 and A-3, and include:

Potential New Mitigation Measure 1: Fuel Storage (new subparagraph to BMP A-4)

Objective: 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.

Requirement/Standard: Fuel and hazardous material storage containers with a capacity greater than 660 gallons must use impermeable lining and diking capable of containing 110 percent of the containers' capacity. Vinyl liners, with foam dikes and a capacity of 25 gallons, must be placed under all valves or connections to fuel tanks when located outside of secondary containment.

Potential Benefits and Residual/Unavoidable Impacts: Potential benefits of these added measures above current protections include additional protection for vegetation, wetlands, and other surface resources by locating potential spill sources away from the edges of the pad, and using liners for protection outside of secondary containment.

Potential New Mitigation Measure 2: Oil Spill Response Equipment (new subparagraph to BMP A-3)

Objective: Minimize pollution through effective hazardous-materials contingency planning.

Requirement/Standard: Oil spill response equipment for use in winter conditions must meet the following standards:

- Equipment must be designed to be effective in arctic conditions.
- Mechanisms must be available to prevent the freezing of response equipment (including the equipment used for storing, transferring, and treating recovered fluids) and/or to de-ice it.

Potential Benefits and Residual/Unavoidable Impacts: Potential benefits of these added measures above current protections include additional protection for vegetation, wetlands, and other surface resources by ensuring response equipment is operational under extreme weather conditions and other limiting factors such as ice and snow conditions.

Potential New Mitigation Measure 3: Facility Equipment and Design Criteria (new subparagraph to BMP A-3)

Objective: Minimize pollution by ensuring adequate facility design criteria and system integrity.

Requirement/Standard: Equipment used to develop hydrocarbons must meet the following standards:

- Equipment must be designed in accordance with standard arctic engineering practices for use in arctic conditions;

- Design criteria must be based on conservative estimates (as determined by the authorizing officer).

Potential Benefits and Residual/Unavoidable Impacts: System integrity is essential for spill prevention, but not all integrity requirements are within the scope of Oil Spill Contingency Planning. Potential benefits of these added measures above current protections include additional protection for vegetation, wetlands, and other surface resources by ensuring facility design and system integrity are suitable to harsh arctic environmental conditions.

Potential New Mitigation Measure 4: Spill Prevention and Response Plan

Objective: Under the requirements of 43 CFR 3162.5-1(c) and (d), develop a contingency plan for blowouts, spills, and other undesirable events that addresses equipment and communication with affected residents. Minimize pollution by ensuring effective hazardous-materials contingency planning. Establish BLM's role in an actual response scenario on unitized lands and in the ROW corridor.

Requirement/Standard: To the extent practicable, the Permittee will develop a spill prevention and response plan that adopts the *Alpine Development Participant Area Oil Discharge Prevention and Contingency Plan* (Alpine C-Plan).

The Response Plan will include the following requirements:

a. The appropriate BLM office must be notified of any spills or releases that occur on unitized lands. Thresholds are established under BLM's NTL-2007-01-Alaskafor incidents that require immediate notification (e.g., any blowout that occurs; any spill, regardless of volume, to water, tundra, or undisturbed lands; and spills to land greater than 1 barrel for oil).

b. As part of BLM's approval of the initial Plan, CPAI will provide a detailed, probabilistic risk assessment for spills, a most likely trajectory for various environmental conditions related to a catastrophic spill, and an assessment which includes pre-staging equipment across the Nigliq Channel. The BLM may require updated assessments in the event new factors are discovered indicating potentially significant risks not previously analyzed.

c. BLM will be provided with up-to-date copies of the Alpine C-Plan and all amendments to the plan, which BLM will review and approve (with respect to GMT1) on a five-year basis or as otherwise required by the BLM authorized officer.

d. BLM will require submission of ACS Technical Manual and any updates. (This describes all the tactics used to control, contain, and clean up a spill.)

e. If the Unified Plan is enacted, the Federal On-Scene Coordinator (FOSC) is responsible for directing the emergency spill response. On unitized and Federal lands, necessary measures to control and remove pollutants and to extinguish fires are subject to the approval of the BLM authorized officer.

f. If there is a spill due to system failure which necessitates an emergency shut-down of equipment, require BLM approval prior to system restart. This will ensure that repair was appropriately and correctly done, and that appropriate investigations into the root cause of the spill will occur.

g. BLM will require that specific tactics (e.g., boom locations, access locations, staging areas, etc.) be described for drainages (Crea Creek, Barkley Creek and Tiŋmiaqsiġvik

[Ublutuoch] River) in the GMT1 area, while recognizing that actual spill response would be based on conditions of the time of the spill.

h. BLM will require that the Alpine C-Plan be amended with specific facility descriptions for GMT1, including (Section 3.10) specific environmental features and sensitive areas.

i. An emergency countermeasure plan must include well capping if technically feasible.

Preparedness Plan includes the following requirements:

a. BLM will observe and evaluate responder training and response exercises to ascertain response readiness. The Applicant will accommodate BLM's training efforts.

b. If satellite fields developed in NPR-A become a significant portion of the Alpine Development Area, BLM be will periodically check the availability of immediate incident responders and to monitor training records (Alpine C-Plan p. 3-49).

c. If any pre-deployed boom is identified for the GMT1 area, BLM requires amendment of Alpine C-Plan to show its location.

Prevention Plan includes the following recommendations:

a. BLM will require submission of the corrosion control programs applied to all lines connected with GMT1, and periodic (annual, biennial, or triennial) reports of corrosion monitoring.

b. The spill prevention section should contain: all spill prevention programs in place to inspect, maintain, and repair all equipment; a description of the age and condition of equipment; spill prevention methods and operating restrictions for periods when response is not possible; and policies protecting whistleblowers.

Potential Benefits and Residual/Unavoidable Impacts: By default BLM would be represented by DOI Regional Environmental Officer on the Alaska Regional Response Team (ARRT) in support of the FOSC. ARRT is a group of representatives from federal agencies and the ADEC responsible for providing advice and input to the FOSC in the event of a spill response and for maintaining and updating the *Alaska Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharges and Releases* (Unified Plan) and all of the sub-area plans in Alaska. Combined with existing regulations, these measures ensure BLM's involvement in spill prevention, planning, and response, and ensure coordination with affected residents.

Many of the requirements are within the scope of oil spill contingency planning, but not specifically required under current regulations. System integrity will help prevent spills from occurring, while planning for organized and adequate response equipment and personnel will help ensure fast and proper cleanup. Potential benefits of these added measures above current protections include additional protection for vegetation, wetlands, and other surface resources by ensuring effective prevention of a spill, as well as planning for proper controls in the event of a spill or blowout.

The BLM will work to enter into MOU with EPA, ADEC, and other necessary federal and state agencies to clarify roles and responsibilities as they pertain to Unified Plan spill response at GMT1.

Potential New Mitigation Measure 5: Leak Detection Criteria (new subparagraph to BMP E-4)

Objective: Implement leak detection systems for GMT1 facilities.

Requirement/Standard: To the extent practicable, the Permittee will provide a specific description of the leak detections systems installed on all lines described in the development plan. The descriptions could be an addendum to the Alpine C-Plan or a stand-alone document. Monitoring would be via remote continual monitoring (e.g., camera or FLIR) of water crossings, or daily on-site visual inspections. The spill prevention section of the Alpine C-Plan must contain criteria to prevent and detect slow leaks.

Potential Benefits and Residual/Unavoidable Impacts: Automated and visual on-site leak inspections would reduce the extent of spills.

Potential New Mitigation Measure 6: Spill Minimization Measures at the Tiŋmiaqsiġvik (Ublutuoch) River Bridge

Objective: 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 into waterways.

Requirement/Standard: The Permittee will install increased spill minimization measures at the Tiŋmiaqsiġvik (Ublutuoch) River Bridge, which may include use of a thicker wall diameter pipeline spanning the bridge or automated valves on either side of the bridge.

Potential Benefits and Residual/Unavoidable Impacts: Potential benefits of these added measures above current protections include additional protection for water resources, fish, and public health. In the event of a guillotine break in the pipeline crossing over the Tiŋmiaqsiġvik (Ublutuoch) River, CPAI's current manual valve design could release up to 15,234 barrels of fluids (oil, water, gas) into the Tiŋmiaqsiġvik (Ublutuoch) River. The flow of water from the Tiŋmiaqsiġvik (Ublutuoch) River eventually meets the Beaufort Sea, and thus release contaminants could potentially reach the Beaufort Sea and impact marine mammals. The use of automated valves causes this projected number to drop significantly to 626 barrels of fluid. Altering the type of valve should not make a difference in the gravel footprint for the valve pad, given that BLM analyzed a gravel footprint for manual valves, and there is a power source running the length of the road and pipeline which could power the automated valves. Thus, BLM does not anticipate that additional space would be needed for batteries or power generation. In the alternative, BLM and the permittee may consider the use of other measures to achieve similar spill minimization, such as use of a thicker wall diameter pipeline spanning the Tiŋmiaqsiġvik (Ublutuoch) River Bridge.

4.5.6 Conclusions

The direct impacts of oil spills under each of the potential action alternatives are similar, with the greatest impacts resulting from spills to water. The spill history for the Alpine Unit shows the primary type of spill was from equipment failure. Most of these spills have occurred to a pad area or containment and resulted in minor impacts with low intensity, short duration, and limited extent. A spill that reached water could have major impacts if subsistence resources were affected. However, the likelihood of this is very low with the many prevention measures that would be in place.

Alternatives D1 and D2 would have the greatest potential risk of a spill or leak reaching fish bearing or marine waters before detection or before response teams could be mobilized to the spill site, given its lack of access via gravel road.

Localized impact may occur from oil or hazardous material spills. The potential impacts may be greater if oil is sprayed under high pressure into the air creating plumes to land and/or water.

The BLM (2004) analysis determined that large spills that directly or indirectly enter flowing water of the rivers or creeks that discharge to Harrison Bay, the Colville River delta (including the Nigliq Channel), and Kogru River mouth could have limited impacts on some marine mammals. Likewise, the BLM 2012 analysis found that chances were higher for oil to reach the marine environment if a spill occurred near a major river drainage or near coastal areas.

A pipeline spill from the CD5 to GMT1 pipeline has the potential of spilling oil into the Fish Creek wetlands. If oil were to enter Fish Creek and make it to the mudflats associated with Fish Creek, this could negatively impact important bird habitat. A conservation easement is in place for the Fish Creek delta. Fish Creek contains numerous meandering bends, which would allow many opportunities for booming and containing spilled oil. The probability of oil reaching the Fish Creek delta is very low.

There is potential for pipeline spills where the pipeline crosses under the road, due to corrosion of the underground portion of the pipe. The likelihood of corrosion occurring is reduced through pipeline design and monitoring. CPAI maintains corrosion control and inspection programs. These programs are more fully described in the Alpine ODPCP.

Oil spilled on land could also enter lakes or ponds and could be contained by the banks of those water bodies. Because cold water increases the viscosity of oil in water, this could restrict oil spreading on the water surface. If a spill were to enter moving water such as rivers and streams, spreading of oil would be dependent on the velocity or surface currents of the moving water (BLM 2012).

Fate and behavior of spills, and how spills would act during different seasonal conditions is described in BLM (2004, § 4.3.2.3). Potential Pipeline Spill Volumes are detailed in BLM (2004, Table 4.3.3-1).

The greatest defense against large impacts from oil spills is prevention and countermeasures. Table 4.7-1 lists mitigation measures associated with the GMT1 development project. These include BLM management prescriptions, as well as spill prevention, design measures, regular inspections, preventative maintenance, training and root cause analysis, and pre-staging of equipment which will be carried out by CPAI to reduce the likelihood of oil spills and minimize the impacts should an oil spill occur.

4.6 Cumulative Impacts

As defined by Council on Environmental Quality (CEQ) regulations (40 CFR 1508.7 and 1508.25[a][2]), a cumulative impact is:

> *"…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."*

The purpose of this cumulative impacts analysis is to determine if the impacts of the actions considered in this SEIS, together with other past, present, and reasonably foreseeable future actions, have the potential to interact or accumulate over time and space, either through repetition or combined with other impacts, and under what circumstances and to what degree they might accumulate.

4.6.1 Background

The ASDP Final EIS (BLM 2004) evaluated a proposal by CPAI to develop 5 satellite oil accumulations in the northeast corner of the NPR-A and the Colville Delta. The EIS considered direct, indirect, and cumulative impacts that could occur with implementation of the ASDP. The BLM (2004a) determined the ASDP was an environmentally responsible development of the oil resources discovered on federal lease tracts and that gravel drilling/production pads described as CD6 and CD7, roads, and pipelines were compatible with BLM's management plans for the NPR-A. The BLM Record of Decision (2004a):

> *"...documents the Department of the Interior's decision to approve rights-of-way and permits to drill on public lands in response to an application by ConocoPhillips Alaska, Inc...The authorizations will allow development of federal oil leases on BLM-managed land in the National Petroleum Reserve-Alaska. These authorizations will adopt the Preferred Alternative, with minor modifications... in the...ASDP FEIS."* (BLM 2004a, p. 1)

Pursuant to BLM (2004a), CPAI developed CD3 and CD4, and is currently constructing CD5. The other two satellites, GMT1 and GMT2, were considered Reasonably Foreseeable Future (RFF) actions by BLM (2008, § 4.7; 2012, § 4.8), and also by the Corps (2012, § 4.2). It is noted that a GMT2 Project is not currently pending authorization, modification, or rejection as part of this SEIS, and that CPAI has not indicated when, or if, an application for the GMT2 development, as conceptually depicted, may be filed. BLM has determined that the conceptual GMT2 Development Project is appropriate for analysis in the cumulative impacts because it is reasonably foreseeable (BLM 2008c, H-1790-1, p.45).

The cumulative impacts analyses described in BLM (2004, § 4.G, pp. 1233-1333), BLM (2008, § 4.7, pp. 4-631 - 4-929), BLM (2012, § 4.8, pp. 1-296), and Point Thomson EIS (Corps 2012, § 4.2 p. 4-2) provide a broad cumulative impacts analysis of existing and potential oil and gas-related activities on the North Slope.

The cumulative impacts analyses for this SEIS begins by reviewing the cumulative impacts summary and conclusions in BLM (2004) and BLM (2012), followed by an identification and evaluation of changes (e.g., new actions, new data) relevant to analysis of cumulative impacts of developing the proposed GMT1 and GMT2 projects. Table 4.6-1 summarizes the parameters bounding the cumulative impacts analyses performed by BLM (2004; 2012).

Table 4.6-1. Parameters of Cumulative Impacts Analyses in the 2004 ASDP EIS and the 2012 NPR-A IAP/EIS

Parameter	2004 ASDP EIS	2012 NPR-A IAP/EIS
Period of Analysis	20 years in the future (2024)	Through the year 2100
Total Past, Present, and Reasonably Foreseeable Direct Disturbance in NPR-A between NPR-A and the Colville River and Canning River, and in Near Shore Estuarine/Marine Waters	21,402 acres. Gravel mines = 7,435 acres with 5,202 acres of gravel mining in rivers used primarily for construction of the Dalton Hwy and TAPS. Natural gas production was considered speculative due to lack of commercial gas pipeline system before 2024.	55,895 acres (non oil and gas = 4,300 acres). Gravel mines = 10,950 acres including 3,050 acres in NPR-A). Includes a commercial gas pipeline and deletes road connection to Umiat and Nuiqsut. Commercial gas pipeline and production in the Beaufort Sea OCS and Chukchi Sea OCS with onshore support and pipelines included.
Plan Area for Reasonably Foreseeable Future (RFF) Actions	NPR-A, land between Colville and Canning Rivers, near shore estuarine and marine waters (all federal, state, and Alaska Native ownerships on the 57-million-acre North Slope not closed to oil and gas activity and adjoining near shore estuarine and marine shallow waters).	NPR-A, land between Colville and Canning Rivers, near shore estuarine and marine waters, Beaufort Sea OCS and Chukchi Sea OCS (all federal, state, and Alaska Native ownerships on the 57-million-acre North Slope not closed to oil and gas activity and adjoining near shore estuarine and marine waters extending northward into deeper OCS marine waters).
102-mile-long gravel road with an estimated footprint of 505 acres, to provide access to Umiat and to Nuiqsut	Yes	Road only between Umiat and Dalton Highway (includes potential pipeline system between Umiat and TAPS).
Number of Discovered Oil Wells	33 producing with an additional 14 discoveries producing in the next 20 years.	38 past and current producing in 2010 with production from the Beaufort Sea OCS = 1.1 BBO/5.75 TCF Gas and Chukchi Sea OCS = 6.23 BBO/24.75 TCF Gas and continued onshore production of 3.91 BBO/50.69 TCF Gas for the period 2012 - 2100.
Tiŋmiaqsiġvik (Ublutuoch) River Setback Designated	No.	Yes.
Enforceable Land Use Controls	1998 Northeast NPR-A IAP/EIS ROD, NSB Land Use Plan, ACMP, and agreements between Kuukpik/ASRC and CPAI.	2013 NPR-A IAP/EIS ROD, NSB Land Use Plan, and agreements between Kuukpik/ASRC and CPAI. ACMP program terminated.
Enforceable Requirements on Federal Oil and Gas Leases in the project area	1998 Northeast NPR-A IAP/EIS ROD Stipulations.	2008 Northeast NPR-A Final Supplemental IAP/EIS ROD Stipulations (in effect prior to 2013 NPR-A IAP/EIS ROD).
Threatened and Endangered Species	Polar bear not listed. The Pacific walrus and ribbon seal were candidate species. Threatened and endangered species included bowhead whale, spectacled eiders, and Steller's eiders.	Polar bear listed as threatened in 2008. Bearded and ringed seal designated as threatened in 2012. NMFS rejected the ribbon seal for listing in July 2013. USFWS must make a decision on listing the Pacific walrus by October 2017 and a decision on listing the yellow-billed loon by October 2014.

4.6.2 Methodology

This cumulative impacts analysis tiers to these two previous analyses, although the overall scope of the analysis and project area are narrower. The analysis of cumulative impacts follows guidance provided in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997b). The SEIS will identify and describe actions—past, present, and future—that may impact the elements of the environment, including people, that may be impacted by the proposed project. These include not only the proposed project, but also actions undertaken by others within and outside the project study area. The SEIS also provides the geographic and temporal scope of the analysis and addresses additive, synergistic, and countervailing impacts among the cumulative impacts.

This analysis involves the following steps:

- Define the time frame and geographic scope for each resource/issue analyzed in this SEIS.
- Identify past present and future actions within the geographic area.
- Characterize response to changes and evaluate cause and effect relationships.
- Determine the magnitude of cumulative impacts from current conditions and if any thresholds of significance would be exceeded.

In this SEIS, both the time period and geographic scope of the cumulative impacts analysis vary according to the resource/activity under consideration. Generally, the appropriate timeframe for cumulative impacts analysis spans from the 1970s through 2050 (through the duration of the proposed project). Geographic scope generally encompasses the Harrison Bay and Lower Colville River watersheds. Specific timeframe and geographic scope restrictions are located in Section 4.6.2.

- Time Frame for Relevant Past and RFF Actions: While relevant past projects date back to the 1940s, the general timeframe used in this cumulative impacts analysis reflects more recent oil and gas activities. Unless otherwise specified, the general timeframe ranges from the 1970s through the duration of the proposed project until roughly 2050. Projections of projects beyond this time frame (or 30 to 35 years) become speculative. Resource-specific time frames are presented in Table 4.6.2.
- Geographic Area of Relevant Past and RFF Actions:
  - In order to consider the cumulative impacts of GMT1 and GMT2, these project study areas are considered together in a combined GMT1-GMT2 Project study area of approximately 109,600 acres.
  - Unless otherwise specified, the geographic extent for the cumulative impacts analysis is limited to the Harrison Bay and the Lower Colville River watersheds (see Map 4.6-1.).
  - Resource-specific geographic areas are presented in Sections 4.6.4, 4.6.9, and 4.6.10.
- Impact Evaluation: Unless specified otherwise, the impact criteria for magnitude (intensity), duration, context, and geographic extent described in Sections 4.2, 4.3, and 4.4 are used for determining the cumulative impact analysis of each respective resource/activity (e.g., impact criteria and conclusions for vegetation and wetlands [Table 4.3-1] have been used in the cumulative impacts evaluation). The analysis also considers the interaction among the impacts of the proposed action with the impacts of various past, present, and RFF actions as described below:

  - Additive - the impacts of actions add together to make up the cumulative impact.
  - Countervailing - the impacts balance or mitigate the impacts of other actions.
  - Synergistic - the impacts of the actions together is greater than the sum of their individual impacts.

  Impacts from past, present, and RFF actions within these timeframes and geographic areas were combined with those from GMT1 to determine if a threshold of significance would be exceeded. BLM considers mitigation and monitoring requirements to determine if these supplemental protective measures would avoid or minimize impacts.

The cumulative impact analysis considers impacts of a proposed action and its alternatives that may not be consequential when considered individually, but when combined with impacts of other actions, may be consequential (CEQ 1997b).

Facilities with very small footprints such as the USGS Fish Creek meteorological station located approximately 2.3 miles northwest of the GMT1 pad are expected to have a negligible contribution to cumulative impacts and are not included in the cumulative impacts analysis. Likewise, activities that have the potential to adversely impact paleontological and cultural resources are required to have professional inventories and reports filed with the appropriate agencies prior to starting the proposed action, including potential gravel sources, cross-country winter travel routes, ice road and ice pad locations, and temporary summer camps. These requirements provide assurances that adverse impacts to paleontological and cultural resources will be minimized, if not eliminated. Accordingly, paleontological and cultural resources are not discussed further.

4.6.2.1 Assumptions

Key assumptions used for the cumulative impacts analysis in this SEIS are:

- Development of the oil and gas resources of the GMTU is consistent with the Secretary of the Interior's most recent decisions to offer federal oil and gas leases in the NPR-A (BLM 2013).

- As a stand-alone production facility in the GMTU, cumulative impacts from GMT1, including abandonment and final reclamation, would extend 30 to 50 years, or longer in a case where Alternative D2 is selected. Production at GMT2, which requires GMT1 to be operational, would extend the period of some cumulative impacts at GMT1 for an additional period to coincide with abandonment and final reclamation at the conceptual GMT2.

- BLM has approved a substantial number of winter exploration wells in the area now known as the GMTU, with CPAI having drilled two wells (Rendezvous No. 3 and Flat Top No. 1) in the GMTU during the 2013-14 winter season. Newly-identified and economically recoverable oil resources resulting from these or other future drilling projects in the GMTU may further extend the cumulative impacts of GMT1 and/or GMT2 based on BLM policy to minimize the number of permanent facilities such as gravel roads and elevated pipeline systems to the maximum extent practicable.

- The GMT2 Project is directly linked to development of GMT1. However, GMT1 is not dependent upon production of oil from conceptual GMT2 facilities.

- Production of oil at GMT2 would likely result in the transfer of federal land and management of federal oil and gas leases in existing valid selections to Kuukpik and ASRC, respectively.

- Alternatives A, B, C, D1, or D2 would meet the purpose and need identified in Section 1.3.

- Alternative E would not meet the purposes and need identified in Section 1.3.

- Alternative E would deny the production of economically viable oil resources in the GMTU that are 8 to 16 miles from existing oil production and transportation facilities connected to the TAPS in the Prudhoe Bay area. Prohibiting a project in the GMTU that otherwise appears to meet the requirements contained in federal oil and gas leases, as amended in 2008, and the requirements of BLM (2013), may result in industry uncertainty and concern that proposed developments meeting the requirements of the lease and land use plans would be denied. This uncertainty could reduce industry interest in development on federal lands in the NPR-A.

- The Deepwater Horizon spill in the Gulf of Mexico has caused re-examination of the technology and environmental protections for offshore drilling in the Beaufort and Chukchi Seas OCS. This technical review is not expected to cause abandonment of existing federal leases in either of these two areas of the Alaska North Slope.

4.6.2.2 Past, Present, and Future Actions

Table 4.6-2 summarizes factors to be considered in the cumulative impacts analysis within the project study area, within the Harrison Bay and Lower Colville River watersheds, and the larger area of the North Slope and adjacent estuarine and marine and OCS marine waters for a period extending to about the year 2050. Additional discussion on these factors follows the table.

Table 4.6-2. Major Cumulative Impacts Factors

Impact	Time Frame	Geographic Scope	Development Footprint (If Applicable)	Reference
Climate Change	1950s through 2050	North Slope	NA	BLM 2012, § 4.8.7 and Appendix B
Community Footprint (non-oil and gas)	1970s to though 2050	Nuiqsut (including landfill)	Existing: 341 acres (plus landfill). Colville River Access Road: 21.25 acres. Nuiqsut Spur Road: 51 acres	BLM 2012, §§ 4.8.2.1, Table 4-33, p. 7 and 4.8.7.3, p. 87. Corps 2014
Military Development	1940s to 2030 (or when these sites are cleaned up/reclaimed)	Kogru, Oliktok, and Point Lonely	Kogru: 50 acres. Oliktok: 59.7 acres. Point Lonely: 60.5 acres. Total: 170 acres	USAF 2013
Legacy Wells	1940s to 2030 (or when these sites are cleaned up/ reclaimed)	24 sites in the Harrison Bay and Lower Colville River watersheds [a]	12 to 48 acres (based on estimated 0.5 to 2 acres per site).	BLM 2012 Map 3.2.11-1 3.2.11; BLM Report 127 2013
Gravel Footprint including gravel mines (oil and gas)	1970s to 2050 (duration of proposed project) Within oil and gas development areas (Umiat to Point Lonely to Prudhoe Bay)	Includes Units in Harrison Bay and Lower Colville River watersheds [b]	GMT (1 and 2): 145 acres [c]. Alpine: 205 acres. Kuparuk: 1,400 acres. CD5: 58.5 acres. Umiat: 1,450 acres. Umiat Road between Dalton Hwy and Umiat: 1,215 acres [d]. Total: 4,473.5 acres	BLM 2012, § 4.8.3.5, Table 4-40
Winter Access (oil and gas and non-oil and gas ice roads, ice pads, ice bridges, snow trails, and seismic data collection.)	1970s to 2050 (duration of proposed project)	Harrison Bay and Lower Colville River watersheds	Seismic activity could have a long-term impact to between 1,490 to 2,658 acres within the NPR-A	BLM 2012, Tables 2.5-4, 2.6-3, 2.7-3, 2.8-4, 2.9-3, 2.5-5, 2.6-4, 2.7-4, 2.8-5, 2.9-4, and § 4.8

[a] Inigok, North Inigok, South Harrison, Umiat 1-11, West Fish Creek (and Gubik 1 and 2 on Native land outside NPR-A near Umiat).

[b] Includes the following Units: Bear Tooth, Colville River, Greater Mooses Tooth, Gubik, and Umiat.

[c] Estimated acreage value based on Alternatives A of 72.7 acres including an access road of approximately 7.6 miles and 12-acre pad at GMT2.

[d] Only a portion of the Umiat road is in the southern part of the Colville River watershed. Total footprint regardless of location is included.

Climate Change. As described above, climate change momentum has developed in the Arctic environmental system due to the effects of a persistent warming trend that began more than 30 years ago. See Section 3.2.4 for a more detailed description of climate change on the North Slope.

Community Footprint. Nuiqsut is one of the six communities considered in the cumulative impacts evaluations described by BLM (2012). The community encompasses approximately 5,760 acres (BLM 2012, § 4.8, Table 4-33, p. 5) and the footprint for infrastructure is 341 acres (BLM 2014a). See Section 3.4 of this SEIS for a description of the infrastructure of Nuiqsut. The current population of Nuiqsut, based on the 2010 U.S. Census, is 402 people, up from 128 in 1973 when it was founded (BLM 2012, § 3.4.11.1, p. 476).

Military Development. Former military sites are located at 13 locations scattered along the coast of the North Slope (BLM 2012, Table 4-35, § 4.8, p. 8). One former military site, Kogru, and one active military site, Oliktok, are located within the Harrison Bay and Lower Colville

River watersheds. These sites, along with former military site Point Lonely, which is not in these watersheds, are included in the cumulative impacts evaluation.

Other Activities Not Associated with NPR-A Oil and Gas. The NPR-A IAP/EIS describes several additional types of impacts in the NPR-A, not associated with oil and gas exploration and development (BLM 2012 § 4.2.1.1). Types of activities include aircraft use for transport and research or monitoring; watercraft use for summer transportation; excavation and collection for archaeological, paleontological, geologic and soil resources; ground activities and camps for scientific or recreational expeditions; winter-time overland moves; solid and hazardous waste removal and remediation; recreation permits and film permits; and research or monitoring for offshore development. Table 4.6-3 summarizes the frequency and season of these types of activities in the NPR-A.

Table 4.6-3. Summary of Annual Selected Non-Oil and Gas-Related Management Activities

Activity	Frequency	Season
Aircraft use [a]		
Point-to-point	Up to daily	Mostly summer
Wildlife aerial surveys	Up to daily	Mostly summer
Other aerial surveys	Several 1- to 3-week periods	Spring, summer, fall
Watercraft use		
River trips [b]	Intermittent	Summer, fall
Excavation and collection		
Research/archeological	Up to 4 to 6 acres disturbed per year	Mostly summer
Ground activities and camps [c]		
Large camps [d]	3 to 4 camps/up to 12 weeks	Winter and summer
Small camps	20 or 30 small camps a few days to 12 weeks	Mostly summer
Overland moves	4 to 60 trips per year	Winter
Waste removal and remediation [e]		
Non-oil and gas	Intermittent	Winter and summer
Recreation and film permits		
Permits [f] issued	Typically 6 to 12 permits	Spring, summer, fall

Source: BLM 2012, Volume 2, p. 6

[a] This does not include use that is associated directly with oil and gas development within NPR-A. It also assumes that fixed-wing aircraft and helicopters are used and that use occurs almost exclusively during spring, summer, and fall.

[b] Summer transportation and supply.

[c] Camps in this category are not associated directly with oil and gas development.

[d] Large camps are at least 15 persons and may have 5,000 gallons of fuel.

[e] Non-oil and gas operations include site evaluation and cleanup at former defense sites. This type of activity would probably decrease in frequency as these sites are cleaned up in the future.

[f] Average of four to six persons per party.

Legacy Wells. From 1944 to 1982 the U.S. Navy and U.S. Geological Survey developed exploratory oil wells in the NPR-A (BLM 2013a). Of the original 136 wells in the NPR-A, five areas ranging from a single well to the 11 at Umiat, are within or adjacent to the Harrison Bay and Lower Colville River watersheds that could be affected cumulatively in relation to the proposed GMT1 Project. Among these wells, Inigok No. 1, and Umiat No. 3 and No. 4 will require surface cleanup; Fish Creek No. 1, Umiat No. 1, and Umiat No. 11 will require surface cleanup and plugging; Gubik Test No. 1 and Gubik No. 2, which have been transferred to ASRC, will require remediation (BLM 2013a).

Existing Oil and Gas Infrastructure. All existing oil and gas infrastructure in the evaluation area is located in the Lower Colville River delta. The Alpine production facilities (except CD5, which is under construction) are connected by pipeline and ice roads to the Kuparuk field. Winter only ice roads provide seasonal access to Alpine for resupply activities. The Kuparuk field was established in the early 1980s; it includes 141 miles of access roads (524 acres) and 873 acres for facility pads. Oil and gas infrastructure including gravel roads and pipelines continue eastward to the main production facilities at Prudhoe Bay, the Dalton Highway, and TAPS. The primary public airport is at Prudhoe Bay with smaller airfields at Nuiqsut and Umiat. Private industry owned airfields, associated with operations within the several fields, are also present between Prudhoe Bay and Nuiqsut. Marine docks are located at Prudhoe Bay. Surface travel to the Lower Colville River Unit from the Kuparuk field is by gravel road. Ice roads are used for going westward into NPR-A; there is also ice road access from the Dalton Highway to the Umiat area. See Section 3.4.4.1 for additional discussion of transportation.

Since 2000, industry has drilled 29 wells on federal leases in the NPR-A, including discovery wells at both GMT1 and GMT2 (BLM 2012, § 3.2.6.2, p. 176). Regular oil production from the Alpine Field began in November 2000. Existing oil production facilities include pads at CD1, CD2 (located approximately 3 miles west of CD1), CD3 (north of CD1), and CD4 (located south of CD1). CD1 is connected to CD2 and CD4 via gravel roads. CD3 is accessible only by seasonal ice road or by air, and production drilling at that site occurs seasonally. These facilities are supported by APF (CD1), which includes processing facilities, camp facilities, a drilling mud plant, an airstrip, a maintenance complex, warehouse facilities, disposal wells, an emergency response center, communications and power generation, and various mobile equipment. The estimated footprint of the Alpine field includes 163 acres of roads and pads and 42 acres of gravel extraction (total of 205 acres). Gravel used for construction of Colville Delta roads, pads, and airstrips was obtained from the ASRC Mine site. All of these facilities are located on non-federal surface and subsurface ownerships.

Umiat was developed by the U.S. Navy in the 1940s and 1950s, and 11 test wells (now Legacy wells) were drilled. Currently there is an airstrip and some year-round support and research facilities there. The airstrip encompasses 1,450 acres. The area includes a road from the airstrip to Seabee pad, approximately 1 mile away.

Winter Access. Current technology, permitting requirements, and BMPs eliminate long-term direct and cumulative impacts to vegetation, wetlands, and soils from ice roads. Seismic activity could, however, have a long-term impact to between 1,490 to 2,658 acres of vegetation and wetlands within the NPR-A during the timeframe of cumulative impacts analysis.

Proposed and Current Activities

Within the evaluation area, there are some activities currently being implemented and others that have been sufficiently advanced to be considered likely (e.g., are currently undergoing permitting; have been permitted, but not constructed; or have been funded for construction). These include the CD5 Development Project (construction activity underway), the Nuiqsut Spur Road (construction activity underway) and Colville River Access Road (CRAR) (federal funding; permitting underway), and current/proposed winter exploration in the general area of the GMT1 and GMT2 (i.e., in the Bear Tooth, GMT, and Tofkat Units). A recently proposed gravel road would provide access between the Dalton Highway and the Umiat area. Only part of this road would be located in the Lower Colville River watershed, but is considered in its entirety as a RFF project that would be a connected action for future development of petroleum resources in the Gubik and Umiat fields as well as other resources to the west of Umiat (state funding; permit applications submitted; EIS initiated, but currently on hold). Table 4.6-4 outlines the activities and their corresponding footprints. These activities are further described below for the cumulative impacts analysis.

Table 4.6-4. Summary of Proposed and Current Activities

Activity	Footprint (acres)
CD5 Development Project	58.5
Nuiqsut Spur Road	51
Colville River Access Road	21.25
Umiat Road	up to 1,215
Winter Oil and Gas Exploration	varies from year to year
Offshore Oil and Gas Exploration	varies from year to year
ASRC Mine Site Expansion	conceptual
GMT2 (RFF)	86.6 to 93.4

CD5 Development Project. The CD5 Development Project includes the CD5 drill site, an access road, pipelines, a bridge across the Nigliq Channel of the Colville River, three additional smaller bridges, and communication equipment, including messenger cables for oil and gas production. The CD5 Development Project would result in the placement of 595,700 cubic yards of fill on 58.5 acres (Corps 2011). The proposed CD5 drill site will be located in the Colville River Unit approximately 6 miles west-southwest of the existing APF. The Kuukpik Corporation holds surface ownership of the CD5 project area with the exception of the bed of the Nigliq Channel, which is owned by the State of Alaska; ASRC owns subsurface rights for the entire CD5 project area. Oil, gas, and water produced from the CD5 facility will be transported via pipeline to APF for processing. The proposed drill site will be operated and maintained by Alpine personnel supported by the existing Alpine infrastructure and APF. This project is a connected action, and development of GMT1 depends on the construction and development of CD5.

Nuiqsut Spur Road. Kuukpik Corporation is currently constructing a 5.8-mile-long, 24-foot-wide gravel road from the community of Nuiqsut to connect to the CD5 access road to increase user access to subsistence resources, to enhance the ability of Nuiqsut residents to obtain training and employment, to provide year-round access to the Alpine field, and to support Kuukpik Corporation business activities. This project includes a new 11.0-acre gravel storage pad near the intersection of the Nuiqsut Spur Road and CD5 access road and an upgrade of the existing 0.8 mile long Nuiqsut dump road. The project footprint impacts approximately 51 acres and require 455,000 cubic yards of gravel. The project is located on lands owned by Kuukpik Corporation. The Nuiqsut Spur Road permit was issued on March 12, 2014 (Corps 2013b) and construction began during the 2013-14 winter season.

Colville River Access Road. The NVN filed an application on June 27, 2013 with the Corps to construct the “Colville River Access Road” to provide road access needed to facilitate subsistence-related activities along the Colville River. BLM previously granted a ROW grant for BLM-managed land that would be crossed. This project would extend the existing 1.3-mile gravel road to the water supply lake by an additional 3.75 miles to the west bank of the Colville River approximately 5.5 miles upstream from the community. The road footprint would directly impact about 21.25 acres of tundra wetlands and stream crossings. An estimated 152,000 cubic yards of fill material would come from the existing ASRC mine site. The application also identifies an alternative undeveloped gravel source about 4 miles west of the landfill that may be used.

Umiat Road. For this cumulative analysis, BLM assumes a road between the Dalton Highway and Umiat would be built to facilitate production of known reserves in the Gubik and Umiat fields and to enhance economic development such as at Wolf Creek to the west of Umiat. Depending on the final design, this road could extend to Nuiqsut. In this case, the road would be approximately 102 miles long, with a footprint for the road and ancillary facilities estimated at 850 acres; with an additional 175 acres for gravel extraction (BLM 2012, § 4.8.3.2, p. 103). An elevated oil pipeline is possible but its inclusion is considered speculative, therefore the analysis will not include pipeline. In total the road could have a total footprint of about 1,025 acres. Most of the road is outside of the Lower Colville River watershed. The primary geographic area of effect has been adjusted to consider this proposed road because improved access would likely cause increased interest in developing the Umiat/Gubik fields which are both in the Lower Colville River watershed.

Depending on which route is selected for the Umiat road, different potential oil and gas resources may be accessed. The Umiat road could lead to increased access and development of oil and gas in or adjacent to the Lower Colville River watershed. However, with the Meltwater Corridor alternative "*a road would be constructed from Umiat to the Tarn road at Meltwater, and on to Deadhorse via the Spine Road. This alternative would potentially limit public access into the Foothills Province*." (AK DOT 2012: http://www.foothillswesteis.com/system/assets/7/original/newsletter1_04_2012_single_page.pdf?1334014330)

Winter Oil and Gas Exploration. BLM and the State routinely receive applications to conduct winter oil and gas exploration activities. Map 4.6-2 shows current pending exploration activity in the project area. Map 4.6-2 shows activities relevant to the proposed GMT1 Project include exploratory drilling in the Bear Tooth Unit, GMTU, Umiat Area, and the Tofkat Unit east of Nuiqsut. These exploration activities took place in winter (2013-2014) in the Harrison Bay and Lower Colville River watersheds as described below.

- Bear Tooth Exploration Activities – CPAI has conducted exploration drilling activities in the Bear Tooth Unit in the NPR-A in the winter of 2012-2013. Exploration activities included two exploration wells, Cassin No.1 and Cassin No. 6, were supported by 88 miles of ice roads and ice pads. CPAI is currently evaluating the results of that exploration activity.

- GMTU Exploration Activities – CPAI drilled at two exploration wells during the 2013-2014 winter season. The two sites (Rendezvous No. 3 and Flat Top No. 1) are about 14 miles southwest and about 5 miles southeast, respectively, from the proposed GMT1 pad. Project elements include two ice pads, 41 miles of ice road, three ice laydown pads, and three staging ice pads. Water for the ice structures primarily was drawn from lakes that have existing approvals from ADNR and ADF&G for winter water withdrawal.

- Tofkat Prospect – Brooks Range Petroleum Corporation applied in 2013 to the State to conduct winter exploratory drilling under a State oil and gas lease on State land in the Tofkat Unit, at a site about 2.5 miles northeast of Nuiqsut. The proposed drilling operation would utilize ice roads and an ice pad for drilling.

- Qugruk Prospect – Repsol E&P USA Inc. has been conducting winter exploration drilling under State oil and gas leases in the Colville River delta, west of the Oooguruk and Kuparuk River Units and east of the Colville River Unit. Repsol began exploration drilling in the winter of 2012-2013 through 2013-2014, and proposes to continue them in 2014-2015. These exploration activities would utilize ice road and pad for drilling.

- Umiat Exploration Activities – Linc Energy Operations, Inc. conducted exploratory drilling on a federal oil and gas lease at Umiat during the 2012-2013 winter season (Umiat No. 18) and during the 2013-2014 winter season (Umiat No. 23H). BLM has approved exploratory drilling at the Umiat No. 25 well site. Linc Energy Operations, Inc. commenced a drilling program in 2012-2013 including construction of a 101-mile snow road from the Dalton Highway, mobilization of a drill rig, and drilling Well #18. The second winter of the exploration drilling program in 2013-2014 resulted in drilling the first horizontal well at Umiat, #23H. Unlike the previous winter season, the 2013-2014 drilling was not dependent upon a snow road, because the drill rig was stored on site at Umiat during summer (Linc Energy Operations, Inc. 2014). To date, Linc Energy Operations, Inc. has relied on snow and ice roads and ice pads; no permanent infrastructure has been constructed.

The activities described above are typical of winter exploration drilling programs across the North Slope. The number and location of exploration sites in a given year is variable. BLM and the State have previously determined that this type of activity has short-term site-specific impacts because no permanent facilities are typically allowed. Winter exploration is preceded by summer activity in the area to collect site-specific data for drill sites, ice road routes, lake surveys, steam crossings, wildlife habitat, and cultural resources. Knowledgeable local residents are often requested to identify subsistence activities. Both drill sites in what is now the Bear Tooth Unit, and the two sites in the GMTU were included in areas evaluated by BLM for exploration activity, and were subsequently approved.

Offshore Oil and Gas Exploration. It is recognized that oil and gas seismic and exploration activities in the OCS are, and will, continue to occur during the cumulative impacts timeframe considered for the GMT1 Project. There is no known direct or indirect relationship between the proposed development of GMT1 and OCS offshore exploration activity.

ASRC Mine Site Expansion. The ASRC Mine site currently has an estimated 2 million cubic yards of gravel available and permitted. The total estimated gravel requirement for CD5, Nuiqsut Spur Road, GMT1, and possibly the CRAR is more than 1.95 million cubic yards of gravel. The BLM (2012) and the Corps (2012) considered that the GMT1 Project and the GMT2 Project would be developed, and the ASRC Mine site would continue to be used. The use of these gravel sources depend on the development of discovered oil and gas fields or discovery and extraction of yet undiscovered oil and gas in areas within existing oil leases.

Reasonably Foreseeable Future Actions

Two proposed future actions in the area of the cumulative impacts analysis are the development of the GMT2 Project and the development of onshore infrastructure or activity (e.g., seismic exploration) associated with offshore oil and gas development. These are described below.

GMT2 Project. As described above, development of GMT2 hydrocarbon resources is a reasonably foreseeable action, although the exact location and parameters of development are still under study. For the purpose of this SEIS, a conceptual GMT2 development project is used for analysis, based on descriptions from BLM (2004) and BLM (2012). The GMT2 Project would be located approximately 22 miles west of Nuiqsut and approximately 8 miles southwest of the proposed GMT1 pad (BLM 2004, Figure 1.1.1-2). The project design elements are predicted to be generally similar to those described for GMT1 (see Section 2.2). Table 4.6-5 provides a summary of the major elements of the GMT2 development that would be connected to GMT1 under the action alternatives described in Section 2.5. Under Alternative E, the GMT2 drill site would not be constructed because it is dependent on construction of GMT1.

It is assumed that if GMT1 is developed with a gravel road between CD5 and GMT1 (i.e., CD5-GMT1 gravel road), GMT2 would be developed with a gravel road between GMT1 and GMT2 (i.e., GMT1-GMT2 road). Conversely, if GMT1 is developed without the CD5-GMT1 road, GMT2 would be developed without a GMT1-GMT2 road. The proposed GMT2 development under the GMT1 Alternatives A, B, and C would include construction of an 8.7-mile GMT1-GMT2 road, a 13.0-acre pad, and a 9.1-mile pipeline. The proposed GMT2 development under the GMT1 Alternatives D1 and D2 would not include the 8.7-mile GMT1-GMT2 road, and would instead include construction of a 13.0-acre pad, a 9.1-mile pipeline, a 0.7 mile access road, a 17.5-acre occupied structure pad, and a 31.9-acre airstrip with apron.

Table 4.6-5. Major Project Elements Required to Construct and Connect the GMT2 development to GMT1[a] under the Action Alternatives

Element	GMT1 Alternatives A, B, and C	GMT1 Alternatives D1 and D2
GMT2 pad	Footprint: 13.0 acres	Footprint: 30.0 acres
GMT1 to GMT2 gravel road	Footprint: 66.7 acres Length: 8.7 miles	None
Ancillary access facilities, including road between GMT1 pad and airstrip/apron	None	Footprint: 54.7 acres
Total fill required and associated gravel source footprint	625,500 cubic yards	689,296 cubic yards/16.4 acres
Elevated Pipeline System (from GMT1)	9.1 miles Pipelines on VSMs: 6-in gas, 6-in miscible injectant, 20-in crude, 14-in injection water, messenger cables (power and fiber optic) with space for a future 24-inch pipeline [b]	9.1 miles Pipelines on VSMs: Same as Alternatives A, B, and C plus a 2-in diesel pipeline and a water pipeline
Ice Road (from GMT1)	8.7 miles for two winter seasons	8.7 miles each winter season
Permanent Stream Crossings	Currently undetermined	Currently undetermined
Total Permanent Footprint (gravel fill plus mined pit area)	86.6 acres	93.4 acres

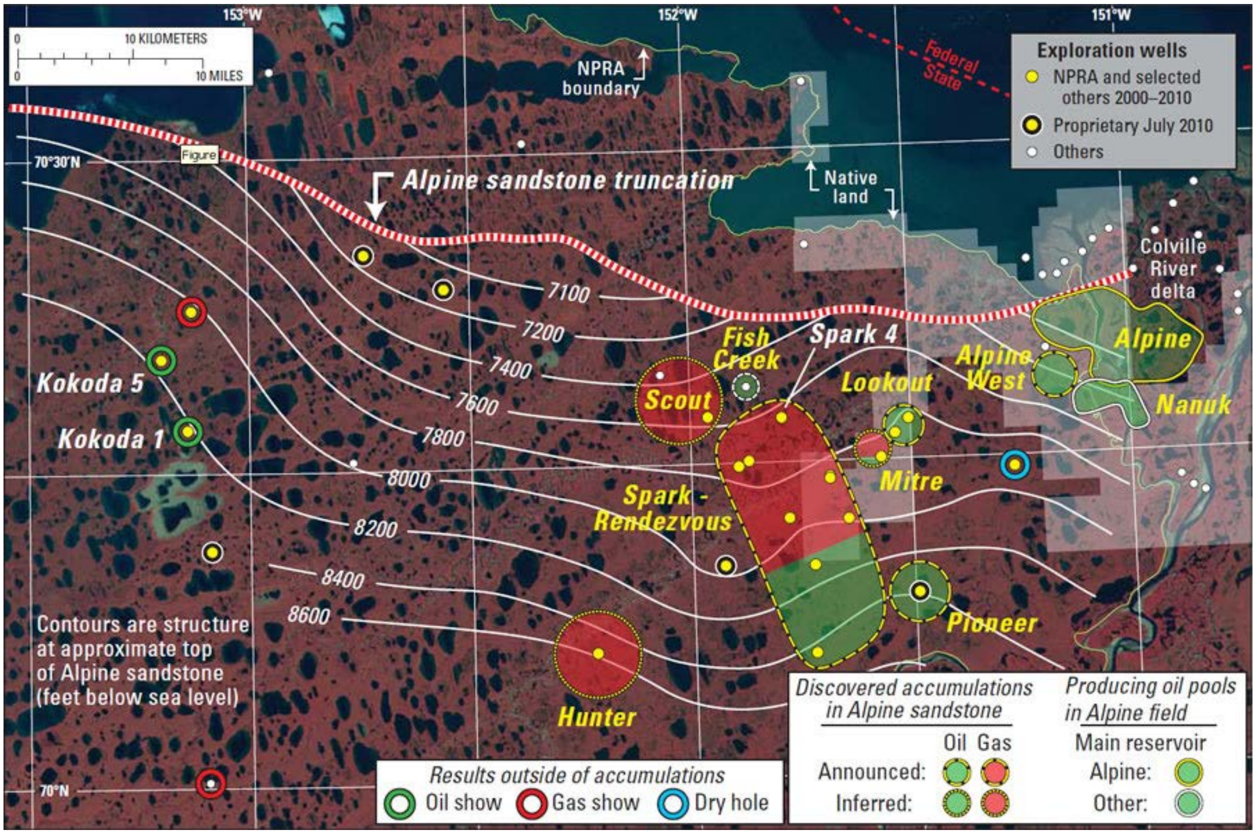
[a] No Application for developing the GMT2 site is currently filed with BLM or other permitting entities. All miles, acres, and cubic yards of fill are estimates for comparison purposes only. See Sections 2.5, 2.6, 2.7, 2.8, and 2.9 for descriptions of the GMT1 development Alternatives A, B, C, D1, and D2.

[b] Minimal footprint associated with VSM installation not included in total.

<u>Development of Discovered Oil and Gas within the Greater Mooses Tooth and Bear Tooth Units beyond GMT2.</u> Lookout (GMT1), Pioneer, and Spark-Rendezvous (GMT2) comprise three, potentially commercial-size oil and gas discoveries located in the northeast NPR-A. These discoveries were not included in the 2010 USGS assessment of undiscovered technically recoverable oil and gas resources of the NPR-A (Figure 4.6-1). Lookout and Pioneer are oil accumulations with little or no associated gas. The Spark-Rendezvous accumulation is a large reservoir system that includes gas plus condensate at shallower depths in the north and oil at greater depths in the south (Houseknecht et al. 2010). The USGS estimates that 120 to 200 million barrels of oil (including oil and condensate) and 1.9 to 3.0 trillion cubic feet of gas may be technically recoverable from these accumulations, from the Alpine West discovery on private

lands directly to the east, and from inferred discoveries (i.e., an NPR-A accumulation not announced as a discovery by Industry) at Mitre, Scout, and Hunter. With the exception of Alpine West (CD5), all of these discoveries are located in the Greater Mooses Tooth or Bear Tooth units. For this analysis, the two units are projected to be developed as satellites to the Alpine oil field. The BLM is assuming that up to 120 million barrels of oil and 1.5 trillion cubic feet of gas would be economical to produce from the discoveries in the Greater Mooses Tooth and Bear Tooth units.

Similar to the existing Alpine satellites, the NPR-A discoveries, including inferred discoveries, would be developed from remote pads approximately 12 acres in size. The surface disturbance footprint from gravel pads and pipelines would be similar to CD5 and GMT1. To maximize development efficiencies, NPR-A satellites would be developed in sequence with equipment and materials moving in a stepwise manner from completed activities at one satellite to the next. Some associated gas production may occur, but its infrastructure would be included with oil development scenarios. Any associated gas usage likely would be used to facilitate oil recovery and not for commercial use.



Source: Houseknecht et al. 2010

Figure 4.6-1. Oil and Gas Accumulations in or Near the Northeastern NPR-A

Projected development would include three-phase pipelines for oil development and two-phase pipelines for non-associated gas development, vertical support members up to 40 miles in length, and gravel roads of equal length connecting the satellites to the Alpine facilities. The number of production, injector (oil production only), and disposal wells on each pad would depend on the discovered recoverable resource volume. ConocoPhillips, for example anticipates 29, 75, and 33 wells will ultimately be drilled on satellite pads CD3, CD4, and planned CD5

(DeGeorge 2012). Barring unforeseen geotechnical difficulties, extended reach drilling, multi-lateral completions, and horizontal bores through the reservoir would be utilized to minimize surface disturbances in the NPR-A. Fracture stimulation would likely to be used to initiate or enhance commercial production. With the Alpine field and its current satellites in the decline phase of production there should be adequate capacity to add additional satellites from the NPR-A as they are developed.

Initial exploration drilling has occurred in the Bear Tooth, and additional exploration drilling has taken place in the Greater Mooses Tooth Unit, as required by exploratory unit agreements with the BLM. In the next ten years, it is projected that additional delineation/confirmation wells would be drilled to define the limits and productivity of these reservoirs before there is a commitment to full project development

The number and location of future development sites provides for consideration of potential impacts and portrays one of an infinite number of potential future development scenarios. The descriptions or their consideration do not imply that development will or will not occur at any of the locations or on this scale. Additional information on projected future development in the region is contained in BLM (2012).

Any future proposal for development would be subject to additional NEPA analysis. Such future analysis of impacts and potential mitigating measures will occur before issuance of any permits or approvals for future oil and/or gas development in the NPR-A. The actual location of production pads and non-associated gas processing facilities are not known.

CPAI projects that its leases could support two additional oil production developments and one non-associated gas accumulation development. Infrastructure required for each scenario would be similar to that described in BLM (2012) and the GMT1 SEIS.

Table 4.6-6 shows the estimated area of surface disturbance and amount of gravel required for projected satellite oil development facilities of these discoveries in the NPR-A.

Exploration seismic data acquisition would continue to occur in these Units, using more advanced 4D seismic data collection.

Table 4.6-6. Estimated Area of Surface Disturbance and Amount of Gravel Required for Projected Satellite Development Facilities of Discoveries in the Greater Mooses Tooth and Bear Tooth Units

Facility/Disturbance	Number of Facilities/ Miles/Acres	Total Amount of Impact
Satellite production pads (10 acres each)	3	36 (12 X 3) acres
Wells	Approximately 33 wells per development pad	
Connecting roads to satellite fields (7.5 acres per mile) [a]	24 miles	180 acres
Vertical support members (150 per mile)[b]	12 miles	<3 acres
Two-phase gas pipeline (6.06 acres/mile)	only one gas facility at 16 acres plus VSM footprint	16 acres
Total acres		235 acres
Gravel consumption for basic development		
Central production facility (10,000 cubic yards per acre)	16 acres	160,000 cubic yards
Production pads (10,000 cubic yards per acre)	36 acres	360,000 cubic yards
Roads (41,000 cubic yards per mile)	24 miles	984,000 million cubic yards
Total gravel consumption		1.5 million cubic yards
Estimated borrow gravel pits [c]	1	47 acres

Source: BLM 2012

[a] Assumes there are 8 miles between each satellite production pad.

[b] The number and distance between vertical support members varies as their use (http://www.alyeska-pipe.com/PipelineFacts/pipelineengineering.html)

Distance between: Anchor supports — 800 feet to 1,800 feet; Standard supports — 60 feet approx.

[c] Assumes 1 acre disturbed for a gravel pit to meet the gravel needs for five acres of gravel pad, road, airstrip, or other development.

Natural Gas Pipeline. In the spring of 2014, the Alaska Legislature approved a bill that would give the state a 25 percent ownership for a pipeline to ship natural gas from the North Slope to Port Mackenzie and potentially with a spur to Fairbanks and Canada. The main pipeline would originate from Prudhoe Bay, but potential for gas exploration and development within the geographic range of the GMT1 or GMT2 projects could occur if such a pipeline is made. Construction could begin as early as 2020.

Offshore Development and Onshore Support Infrastructure. The BOEM uses a range of low and high oil and gas prices and resource estimates in their 2012-2017 Outer Continental Shelf Oil and Gas Leasing Program Final Programmatic EIS (BOEM 2012, p. 4-658). The estimates are for the entire Chukchi Sea program area and are not tract- or lease sale-specific. For the Chukchi Sea Program Area, the BOEM projects that assuming an oil price of $160 per barrel and a gas price of $11.39, up to 6.23 billion barrels of oil and 24.75 trillion cubic feet of gas could eventually be produced from federal waters in the Chukchi Sea. This production would occur over a period of 40 to 50 years.

If Chukchi Sea development results in pipelines and possibly other infrastructure in the NPR-A, oil and gas exploration within the NPR-A could be encouraged and marginal discoveries could be developed. The oil and gas leases in the Chukchi Sea are more than 55 miles offshore from the NPR-A coastline and at least 130 miles from Barrow. If a Chukchi Sea pipeline came ashore on the North Slope west of the NPR-A it could similarly encourage exploration and potentially discovery and production from lands far west of the project area. Increased future development west of the project area would have synergistic effects within the project area. As of 2014, no leaseholder has drilled an exploration well to a hydrocarbon zone in the Chukchi Sea.

The BOEM projected that up to 1.10 billion barrels of oil and 7 trillion cubic feet of gas could eventually be produced from federal waters in the Beaufort Sea (BOEM 2012). This production would likely occur over 40 years. There could be up to 40 exploration and delineation wells, 310 platform production wells, and 25 subsea production wells. The BOEM assumed that to transport the oil and gas would require 423 miles of offshore pipelines and 290 miles of onshore pipelines. The wells would require 30 service vessel and 30 helicopter trips/week. The BOEM also projected 4 new natural gas processing facilities and 4 docks or causeways.

Development in the eastern Beaufort Sea, in the area in which Shell currently plans to explore, could have synergistic effects on the environment. New pipelines from the eastern Beaufort OCS that are at a distance of 12 to 25 miles from onshore infrastructure at Point Thomson, and could connect to the Point Thomson pipeline, which ultimately connects to Prudhoe Bay and TAPS. New pipelines from the western Beaufort OCS connecting to existing infrastructure near Prudhoe Bay could make currently uneconomic oil and gas fields in the northern NPR-A viable to produce. Development in the Beaufort Sea could increase development in northern NPR-A east of Barrow. Development of oil and gas resources in the Chukchi Sea OCS could have similar impacts.

4.6.2.3 Speculative Development

The previous discussion on RFF actions does not include small discoveries and undiscovered resources that are very unlikely to be developed in the next 20 years. With respect to undiscovered resources, it is not reasonable to estimate new infrastructure or predict the impacts of development for prospects that have not been located or leased to industry for exploration. Accurate predictions of the location, size, or development schedules are not possible at this time; thus analyzing such development is not within the scope of this SEIS.

The North Slope Science Initiative (NSSI), in partnership with the University of Alaska Fairbanks and GeoAdaptive, LLC, is conducting a scenario planning effort for future development on Alaska's North Slope and the waters of the Beaufort and Chukchi Seas. The intent is to engage a broad stakeholder network including state and federal agencies, local communities, industry, university scientists, and non-governmental organizations to develop plausible energy and resource development scenarios through the year 2040. A range of issues that will affect future development on the North Slope include energy demand and alternative sources; new oil and gas discoveries; local needs and food security; global commodities; social priorities; climate change; and national and international politics. NSSI targets completion of its Scenario Plan in 2016. Consideration of speculative future developments on the North Slope, although outside the scope of this SEIS, will be fully analyzed in this Scenario Plan. The 2013 NPR-A IAP ROD approved slightly more than half (52 percent) of federally owned NPR-A lands for development.

4.6.3 Cumulative Impacts Analysis

The following cumulative impacts discussions use the same impact criteria discussed in Sections 4.2, 4.3, 4.4, and 4.5 of this SEIS. Each resource discussion includes:

- A summary of the cumulative impact conclusions for all alternatives, derived from Sections 4.2, 4.3, and 4.4 of this SEIS, with addition of the conceptual GMT2 Project.
- A summary of the cumulative impact conclusions from BLM (2004) with projected future impacts to the North Slope and adjacent marine waters for 20 years.
- A summary of the cumulative impact conclusions from BLM (2012) with projected impacts to the North Slope and adjacent marine waters to the year 2100.
- A summary of the cumulative impact conclusions from this SEIS that includes the conceptual GMT2 Project and other RFF actions with projected impacts to the North Slope and adjacent marine waters to the year 2100.

Table 4.6-7 describes the time frame, geographic scope, and direct and indirect impacts of the proposed development.

Table 4.6-7. Summary of Resource/Issues Time Frame, Geographic Scope

Resource or Issue	Time Frame	Geographic Scope
Terrestrial Environment	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Aquatic Environment	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Soil Resources	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Atmospheric Environment	1970s through 2050 (through duration of proposed project)	Nuiqsut area to North Slope
Noise	Intermittent from 1970s through 2050 (through duration of proposed project)	Note that the range of impact from noise is usually very limited, to within a mile or two of the source; so the cumulative area should be relatively small, from where activity occurs.
Climate Change	1970s through 2050 (through duration of proposed project)	North Slope including Beaufort Sea OCS and Chukchi Sea OCS
Vegetation and Wetlands	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Fish and Fish Habitat	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Birds	1970s through 2050 (through duration of proposed project)	Species dependent, but would include distribution area of birds being analyzed
Terrestrial Mammals (caribou)	1970s through 2050 (through duration of proposed project)	Species dependent, but would include distribution area of animals being analyzed
Marine Mammals	1970s through 2050 (through duration of proposed project)	Beaufort Sea from Cape Halkett to Milne Point
Threatened and Endangered Species	1970s through 2050 (through duration of proposed project)	Species dependent, but would include distribution area of animals being analyzed
Sociocultural Systems	1970s through 2050 (through duration of proposed project)	North Slope communities, particularly Nuiqsut
Public Health	1970s through 2050 (through duration of proposed project)	North Slope communities, particularly Nuiqsut
Economy	1970s through 2050 (through duration of proposed project)	NSB and Arctic Slope Regional Corporation
Subsistence	1970s through 2050 (through duration of proposed project)	Primarily the Nuiqsut Subsistence Use Area
Environmental Justice	1970s through 2050 (through duration of proposed project)	Nuiqsut
Land Use and Ownership	2013 through 2050 (2013 IAP/EIS is base year)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Recreation	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds
Visual Resources	1970s through 2050 (through duration of proposed project)	View shed near development area
Transportation Systems	1970s through 2050 (through duration of proposed project)	Harrison Bay and Lower Colville River (from Umiat north) watersheds and Umiat Road between Dalton Hwy and Umiat
Oil, Saltwater and Hazardous Materials Spills	1940s through 2100	Harrison Bay and Lower Colville River (from Umiat north) watersheds, and coastal regions

Table 4.6-8. Summary of Direct and Indirect Impacts

Resource or Issue	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2	Alternative E
Terrestrial Environment	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	Physiography: Minor Geology: Minor Petroleum (depletion): Major Soils: Minor Sand/Gravel: Minor	None
Aquatic Environment	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	Water Resources: Minor Surface Water Quality: Minor	None
Soil Resources	Minor	Minor	Minor	Minor	Minor	None
Atmospheric Environment	Climate and Meteorology: Negligible Air Quality: Moderate Noise: Minor	Climate and Meteorology: Negligible Air Quality: Moderate Noise: Minor	Climate and Meteorology: Negligible Air Quality: Moderate Noise: Minor	Climate and Meteorology: Negligible Air Quality: Moderate Noise: Minor	Climate and Meteorology: Negligible Air Quality: Moderate Noise: Minor	None
Climate Change	Negligible	Negligible	Negligible	Negligible	Negligible	None
Vegetation and Wetlands		Minor	Moderate	Minor	Minor	None
Fish and Fish Habitat	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	Fish: Minor Fish Habitat: Minor	None
Birds	Minor	Minor	Minor	Minor	Minor	None
Terrestrial Mammals (caribou)	Caribou: Minor (Alternatives A, B, C); Moderate (Alternatives D1 and D2) Other species: Minor	Caribou: Minor Other species: Minor	Caribou: Minor Other species: Minor	Caribou: Moderate Other species: Minor	Caribou: Moderate Other species: Minor	None
Marine Mammals	Negligible	Negligible	Negligible	Negligible	Negligible	None
Threatened and Endangered Species	Spectacled Eider: Minor Steller's Eider: Negligible Yellow-Billed Loon: Minor Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Yellow-Billed Loon: Minor Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Yellow-Billed Loon: Minor Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Yellow-Billed Loon: Minor Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	Spectacled Eider: Minor Steller's Eider: Negligible Yellow-Billed Loon: Minor Polar Bear: Minor for some individuals; negligible at population level. Bowhead Whale: Negligible Ringed Seals: Negligible	None
Sociocultural Systems	Major	Major	Major	Major	Major	Major

Table 4.6-8. Summary of Direct and Indirect Impacts (Continued)

Resource or Issue	Alternative A	Alternative B	Alternative C	Alternative D1	Alternative D2	Alternative E
Public Health	Minor	Minor	Minor	Minor	Minor	None
Economy	Minor (Positive)	Minor (Positive)	Minor (Positive)	Minor (Positive)	Minor (Positive)	None
Subsistence	Major	Major	Major	Major	Major	None
Environmental Justice	Major	Major	Major	Major	Major	None
Land Use and Ownership	Moderate	Moderate	Moderate	Moderate	Moderate	None
Recreation	Recreation: Negligible Wild-Scenic Rivers: None Wilderness Values: None	Recreation: Negligible Wild-Scenic Rivers: None Wilderness Values: None	Recreation: Negligible Wild-Scenic Rivers: None Wilderness Values: None	Recreation: Negligible Wild-Scenic Rivers: None Wilderness Values: None	Recreation: Negligible Wild-Scenic Rivers: None Wilderness Values: None	None
Visual Resources	Minor	Minor	Minor	Minor	Minor	None
Transportation Systems	Minor	Minor	Minor	Minor	Minor	None
Oil, Saltwater and Hazardous Materials Spills	(No Impacts; Risks Discussed)	No Impacts; Risks Discussed	No Impacts; Risks Discussed	No Impacts; Risks Discussed	No Impacts; Risks Discussed	None

4.6.4 Terrestrial Environment

Physiography, Soils, Permafrost, Geology, and Petroleum Resources

As noted in Section 4.6.2, impacts to paleontological resources are not expected to occur and as a result are not discussed further.

Overall, the direct and indirect impacts to physiography, soil, permafrost, and geology, other than petroleum and gravel resources, are predicted to be of moderate intensity and long-term in duration, but of local extent. Because the resources are common as defined in the impact criteria, the overall direct and indirect impacts are characterized as minor for all action alternatives. The cumulative effect of Alternative E, would incur no incremental impacts to gravel or other geologic resources. Cumulative impacts to the terrestrial environment are discussed more fully in BLM 2004, § 4G.5.1 through § 4G.5.5, and BLM 2012, § 4.8.7.2 and § 4.8.7.3.

Past and Present Impacts and Their Accumulation

Additive cumulative impacts have occurred from some 40 years of construction activity in the area (including the City of Nuiqsut); maintenance and abandonment of military sites along the coast; development, use, and abandonment of Legacy Wells in the NPR-A; and oil and gas development at Kuparuk, Alpine, and Umiat (including gravel footprint from extraction and construction and winter exploration activity).

Cumulatively (including the City of Nuiqsut, Military Development, Legacy Wells, Kuparuk, Alpine, Umiat, and the Umiat road), the footprint is approximately 5,065 acres (based on estimates of 48 acres of surface area for Legacy Wells). The expected impact represents approximately 0.12 percent of the geographic extent of this analysis. Since most of these impacts are associated with ongoing non-oil and gas residential and commercial development, and oil and gas activities, these impacts to soil are additive to future impacts and would be likely to persist for several decades or more. However, the rate at which soil is disturbed by development has slowed substantially in recent years due to advances in technology and a slowing of oil field development on the North Slope.

Future Impacts and Their Accumulation

RFF development would increase the direct footprint of gravel fill and gravel mining for all projects (oil and gas and non- oil and gas); these impacts would likely be concentrated along the coast between the Canning River and westward into the NPR-A.

The GMT1 and conceptual GMT2 projects, in combination with existing gravel footprints and footprints of developments in permitting review total approximately 23,000 acres, which represents 0.5 percent of the geographic extent of this analysis. The potential for future impact to the existing physiography, soil, permafrost regimes and to petroleum resources are recognized and cannot be quantified at this time; therefore, analysis of potential future impacts are not included for the approximately 23,000 acres as shown in Table 4.6-4.

Activities Not Associated With Oil and Gas Exploration and Development

The potential remediation/reclamation of former Military Sites would have a countervailing impact. The extent or timing of reclamation is unknown at this time, due to uncertainty of federal funding availability and the relative priority and timing of site cleanup, when compared to similar sites across the North Slope and Alaska. It is anticipated that villages will continue to grow in the future due to population growth and to provide services and infrastructure to support new oil and gas development on the North Slope. The amount of area that would be disturbed by new development is projected to increase by 2 percent annually for the next 40 years or so and then level off. Assuming community infrastructure and footprint grow at roughly the same pace as population, there would be approximately 3,600 acres of community footprint by the time population may level off in the 2040s (BLM 2012, § 4.8.7.3). This estimate is for the entire NPR-A. Specific proposals in the Nuiqsut area include the proposed CRAR, described in Section 4.4.5, *Subsistence*.

GMT 2 Development

The cumulative impacts from the proposed project and the conceptual GMT2 to the physiography, soil, and permafrost of the area would be directly related to the construction materials needed for production of oil from the GMT1 and the conceptual GMT2 sites. Gravel would be mined from one or both of the existing ASRC Mine site. The ASRC Mine site is already permitted, so there would be no incremental cumulative impact so long as this site was not expanded to meet other gravel demands in the Lower Colville River watershed.

The proposed GMT2 Project would add 86 to 93 (estimated at this time) acres to the overall footprint, depending on whether or not the GMT2 is constructed with a GMT1-GMT2 road. A road to GMT2 would necessarily require the GMT1 road to remain in place until reclamation of GMT2. The continued existence of the CD5-GMT1 road would mean that impacts from gravel spray and deposition would exist until the end of the GMT2 project life.

Oil and Gas Exploration and Development Activities

The north-south Dalton Highway and TAPS also supports oil and gas development on the North Slope by providing direct access to the rest of Alaska and other markets. A natural gas pipeline system would be located in the vicinity of both the Dalton Highway and TAPS. Overall impacts to the landscape would be minor, site-specific, and long-lasting depending on the relationship of a RFF development for projects near existing or proposed new access (such as the Umiat road).

The potential remediation/reclamation of Legacy Wells would have a countervailing impact due to uncertainty of federal funding availability and the relative priority and timing of site cleanup, when compared to similar sites across the North Slope and Alaska.

Additional development and production may also occur east of the NPR-A, including the possible construction of a natural gas pipeline to deliver North Slope gas to markets. However, production would likely use a combination of existing infrastructure and new infrastructure resembling the Alpine field. Although the footprint would be relatively small compared with the total area, some additional areas of long-term disturbance to soils would be required for gravel staging areas, gravel roads, gravel pads, and other semi-permanent infrastructure.

While impacts to soils from exploratory drilling would occur over a small area, relative to the ACP, these impacts would be unavoidable and permanent. Development activities, such as the construction of permanent gravel roads and pads, could cause damage or loss of soil over the area affected. Offshore development associated with leases in the Beaufort Sea could impact small areas along the coast for staging and storage of materials, but is unlikely to impact large areas of soil. Construction of any oil and gas pipelines or the use of a gravel mine site would also permanently disturb or destroy soil in the immediate vicinity of the project. If a crude or refined oil spill occurred, the resultant impact to soils could extend beyond the immediate work area. However, lease stipulations and required operating procedures/best management practices would reduce the majority of effects. Some soil would be restored as sites are abandoned and reclaimed. Removal of gravel pads and roads may damage soils and leave remaining areas vulnerable to thermokarst since the insulating vegetation has been removed. However, due to the harsh Arctic climate, it could take several hundred years for soil productivity to reach pre-disturbance levels on abandoned pads and roads (BLM 2012, § 4.9.3).

Contribution of the Alternatives to Cumulative Impacts

Impacts to gravel resources under all the action alternatives are expected to be of high intensity (e.g., gravel extraction) and long-term in duration. Under Alternatives A, B, and C, gravel road construction would be more likely to continue as part of future westward development within the GMT1 Unit; however, this does not necessarily mean a road would be needed to connect to any future developments at Bear Tooth. Infrastructure-related factors, including road dust and roadside flooding are contributing to more extensive thermokarst in areas adjacent to roads and gravel pads (Raynolds et al. 2014).

For all action alternatives, the duration of the impacts is temporary (one to several years) if the vegetation is disturbed and up to several decades if the soils are damaged. Incremental impacts of the proposed GMT1 Project would be small (approximately 2 to 3 percent) when compared to past, present, and future development. While soils and permafrost impacts are additive, the total and incremental amount of disturbed area is small compared to the total resource within the North Slope region and is not considered to be cumulatively significant (BLM 2004, § 4G.5.3). The temporary impacts are expected to diminish after a few years, with the long-term impact estimated to be about three percent of the original footprint regardless of the alternative (BLM 2012, § 4.8.7.3). The long-term impact resulting from the gravel spray and dust deposition that roads and pads may contribute to the increased rate of permafrost degradation, which may adversely affect the stability of the gravel fill over time. Impacts would be local, long-term, and potentially major. More gravel and reconstruction may be necessary over the life of project. The decrease in albedo may cause higher temperatures and increase thaw rates.

Impacts to petroleum geology under all the action alternatives are expected to be major because GMT1 will result in the irreversible and irretrievable commitment of petroleum hydrocarbon resources of the GMTU; however, this is the Applicant's stated purpose for the project. Under the no action alternative (Alternative E) there would be no impacts to petroleum geology.

Conclusion

Cumulative impacts to petroleum resources would be major due to depletion, although primarily limited to the GMTU. Alternative E would cause no impacts physiography, soil, permafrost, and geology.

If global climate change persists, the cumulative impacts to soil from oil and gas development, and non-oil and gas development, on the North Slope could be greater than predicted. If the climate warms, the permafrost will thaw to an increased depth each season, which will cause varying degrees of impacts on subsidence, soil moisture, and vegetation. Since there is great depth of the permafrost on the North Slope it would take several decades of warming at the predicted rate before it would transition into discontinuous permafrost. However, if the permafrost continues to warm, its ability to support structures would diminish, which could affect development on the North Slope. Historical infrastructure changes for the Alaska North Slope oilfields for ten dates from the initial oil discovery in 1968–2011. By 2010, over 34 percent of the intensively mapped area was affected by oil development. In addition, between 1990 and 2001, coincident with strong atmospheric warming during the 1990s, 19 percent of the remaining natural landscapes (excluding areas covered by infrastructure, lakes and river floodplains) exhibited expansion of thermokarst features resulting in more abundant small ponds, greater microrelief, more active lakeshore erosion and increased landscape and habitat heterogeneity (Raynolds et al. 2014). Thicker gravel may be needed to support structures, and abandoned work pads and roads could become unusable as they are cut up by deep polygonal troughs over thawing ice wedges, or by other thermokarst degradation (BLM 2012, § 4.8.7.3).

The proposed action is consistent with the provisions of the federal oil and gas leases in the project area, and the land use plan approved in BLM (2013). Overall, the direct and indirect impacts to physiography, soil, permafrost, and geology, other than petroleum and gravel resources, are predicted to be of moderate intensity and long-term in duration, but of local extent. Because the resources are common as defined in the impact criteria, the overall direct and indirect impacts are characterized as minor for all action alternatives. The cumulative effect of Alternative E, would incur no incremental impacts to gravel or other geologic resources.

4.6.5 Water Resources

Cumulative impacts to water resources and water quality from oil and gas exploration, development, and production in the NPR-A and across the North Slope would result from: (1) thermokarst from damaged vegetation and streambanks; water withdrawals from lakes, (2) disruption of natural flows by roads, pads, and river crossing structures; (3) water withdrawals from lakes, (4) gravel mining; and (5) spills. Cumulative impacts to water resources in the project area are discussed more fully in BLM 2004, § 4G.5.6 and § 4G.5.7, and BLM 2012, § 4.8.7.4.

Past and Present Impacts and Their Accumulation

Approximately 2,500 acres of direct land surface disturbance from non-oil and gas activities have impacted water bodies and drainage patterns (BLM 2012 4.7.8.4). Scientific excavations, temporary tent camps, overland moves by transport vehicles, aircraft landings and use of gravel strips, boats, use of off-highway vehicles such as four-wheel vehicles, snowmachines, hazardous material or debris removal, legacy well plugging, and small fuel spills, all have the potential to impact water resources and quality. These impacts are usually localized and result in short-term impacts for up to a few years. Large amounts of debris were left on the North Slope from exploration and military activities from 1940 to 1970 that impacted water quality, but cleanup efforts since the 1970s have removed some of the remaining debris.

Through 2011, oil and gas activities have caused approximately 18,400 acres of direct impacts to lands on the North Slope, and indirect impacts to water resources may have occurred on another 18,400 acres. These impacts to water resources are likely to persist for several decades or more. Water withdrawals are required for all oil field operations. Permit regulations have maintained water quality and quantity in lakes as natural recharge processes have been sufficient to recharge the lakes each year.

Through 2011, over 9,500 acres of gravel pads and roads were constructed in association with oil-field development on the North Slope. Inadequate design and placement of structures, culverts, or bridges have caused impoundments, streambank erosion, scour, and sedimentation at stream crossings. This has altered natural sediment transport and deposition, creating scour holes or channel bars. Several spills have occurred on the North Slope, but their impacts have been minor and have likely not accumulated. Effects of discharges from offshore facilities and subsurface injection of drilling wastes are largely unknown, but likely have had little cumulative effect on water quality on the North Slope.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The BLM (2004; 2012) both concluded non-oil and gas activities such as construction of roads and pads at villages could impact water bodies and drainage patterns but would be minor due to the slow growth (two percent annually) of the communities. Water demand for construction of the Nuiqsut Spur Road and CRAR, and the Umiat road are expected to be available where and when needed. Water to support the cleanup of abandoned Military sites and Legacy Wells would likely come from the same lakes used originally. None of these water supply lakes are associated with the construction and operations of the GMT1 or conceptual GMT2 Project or with other reasonably foreseeable demand for water in the Nuiqsut area.

A large amount of debris was left on the North Slope from Legacy Well exploration and military activities from 1940 to 1970 that impacted water quality, but on-going cleanup efforts since the 1970s have removed some of the remaining debris. BLM has assessed the condition of the USGS Legacy Wells and embarked on a program to plug and abandon those wells that pose risks. Since 2002, BLM has plugged 18 of 19 wells identified to pose a potential risk to the environment. Assessment for the Legacy Wells can be found in the BLM *National Petroleum Reserve in Alaska: 2013 Legacy Wells Summary Report* (BLM 2013a). These and other remediation and reclamation projects in the Harrison Bay and Lower Colville River watersheds would have a cumulative, long-term, countervailing, and local impact to water quality.

GMT 2 Development

The reasonably foreseeable GMT2 Project would have similar, though potentially fewer impacts, than GMT1, which would be additive. As currently conceptualized, the conceptual GMT2 Project would add another 13.0 acres for the pad, and 66.7 acres of roadway to construct the 8.7-mile GMT1-GMT2 road under GMT1 Alternatives A, B, and C (Table 4.6-5).

The predicted road corridor linking GMT1 with a conceptual GMT2 site, under GMT1 Alternatives A, B, and C, would not require major river crossings such as the CD5-GMT1 gravel road crossing of the Tiŋmiaqsiġvik (Ublutuoch) River, although at least one relatively small fish-bearing stream would be crossed (tributary to Blackfish Creek west of GMT1). Lakes along the route would be potential water sources for ice road construction. In general, there are fewer streams and lakes in the vicinity of GMT2 compared to GMT1. Under a development scenario without the CD5-GMT1 gravel road (i.e., GMT1 Alternatives D1 and D2) no road would be built connecting GMT2 to GMT1, and both GMT1 and GMT2 would require annual ice road construction, which would require more water withdrawal over the life of the proposed GMT1 Project and the conceptual GMT2 Project.

The BLM (2004) analyzed the potential cumulative impacts of the project to water resources and water quality (BLM 2004, §§ 4G.5.6 – 4G.5.7). It predicted that no cumulative impact to North Slope water supplies from withdrawal of water for construction and operation would occur because the annual yield (runoff and refill of lakes) is many times greater than the amount withdrawn. Further, water use peaks during construction except for Alternatives D1 and D2, which is a temporary, not-permanent activity and is generally not consumptive, so a continuous minimal increase in water use was not expected. The BLM (2004) found that localized and temporary impacts may occur at those lakes used for water supply, and that the project was not expected to contribute to cumulative impacts to marine and estuarine water quality.

Overall, it is expected that the combination of lakes in the vicinity of the NVN will continue to meet demand for existing and RFF demand for water to construct ice roads and pads, exploration drilling and for GMT1 and the conceptual GMT2, as well as for a potable water supply. Further, it is expected that existing mitigation requirements (e.g., BMPs and Stipulations) will avoid and minimize impacts to fish and fish habitat.

Oil and Gas Exploration and Development Activities

The BLM (2012) analyzed potential cumulative impacts on water resources and water quality from oil and gas development in the Chukchi and Beaufort sea offshore leases, construction of a road between Umiat and the Dalton Highway, and construction of a commercial gas pipeline and unconventional oil and gas development east of the NPR-A. Large discoveries of oil in the Chukchi or Beaufort seas offshore could make additional developments in the northern NPR-A more economically feasible, resulting synergistically in even more impacts in the NPR-A.

In general, all action alternatives and RFF projects have the potential for long-term cumulative impacts to local water resources resulting from the placement of new infrastructure. During most winters, ice roads are constructed between staging areas in the Kuparuk River Unit to locations within the NPR-A as far as the Barrow area. Water needed for construction of CD5 was available and has been permitted.

Improper siting of gravel mine sites could result in changes to the configuration of stream channels, stream flow hydraulics or lake dynamics, erosion and sedimentation. Gravel removal for roads and pads has resulted in over 6,400 acres of surface impacts through 2011 (BLM 2012, § 4.8.7.4, p. 95), with 4,550 acres rehabilitated by conversion into functional habitat for plants and animals and possible fish habitat. The Clover site and others may be required as development moves west and greater distances from the ASRC Mine site near Nuiqsut. Gravel mining for oil and gas development is projected to account for a total of 10,950 acres by the year 2100 (Table 4.6-6).

The BLM (2012) determined that some lakes were being pumped annually along primary transportation routes until development commenced. If lakes do not fully recharge or have water quality changes, future withdrawals may be conditional upon permit stipulations. It is possible that if water is drawn from a majority of lakes in a concentrated area, this could affect the surface flow regime of an area (BLM 2012, § 4.8.7.4, p. 94).

Seismic and overland travel (including non-oil and gas activities) could result in thermokarst erosion with associated increases in turbidity of adjacent water bodies. The BLM (2004) determined that construction of gravel roads and pads, road crossing structures and removal of gravel from riverine pools could affect water flow and result in subsequent melting of permafrost (thermokarst) and induce changes to stream morphology (BLM 2004, § 4G.5.6). Dust deposition along roads can increase turbidity of adjacent water bodies. Snowdrifts along gravel and building structures can increase wintertime soil surface temperatures and result in increased thaw depths, contributing to thermokarsting (BLM 2012, § 4.8.7.4, p. 91). These impacts would be considered additive, but local, long-term, and minor in effect.

Inadequate design and placement of structures, culverts, or bridges and unbreached or slotted ice bridges could cause impoundments, streambank erosion, and scour and sedimentation at stream crossings, thereby altering natural sediment transport and deposition, and creating scour holes or channel bars. Up to 1,106 miles of roadways are projected for maximum development within BLM (2012). A total of 55,895 acres of direct impacts are projected to occur through 2100 (Table 4.6-6). To date, very little abandonment (except for single exploration or development wells) has occurred anywhere on the North Slope. However, abandonment of gravel pads and roads, as well as pipelines, would most likely only have a temporary impact on local aquatic habitats. Removal of problematic stream crossing structures would contribute to positive cumulative impacts on water resources by allowing for a return to the previous hydrological regime.

Spills from GMT1 and other oil and gas developments on marine or estuarine waters or along streams draining into such water bodies could impact those waters (Section 4.5). The extent of such contamination would be related to the size and timing of the oil spill. Because spill frequency and volume are expected to be low, the cumulative impact from oil spills is not considered to be an additive cumulative impact. If a large (500- to 900-barrels) spill were to occur during the ice-covered season, the impacts would be minor. If it were to happen during the open-water or broken-ice seasons, hydrocarbons dispersed in the shallow estuarine water column could exceed acute-toxic criteria during the initial spill period, but would be short-term and localized (BLM 2004, § 4G.5.7). Spills have occurred on the North Slope, but their impacts have been minor and have not accumulated.

Contribution of the Alternatives to Cumulative Impacts

Cumulative impacts to water resources tend to be proportional to the amount of area impacted by infrastructure, with modifications due to specific activities and locations. Cumulative impacts to water resources from gravel roads and pads and gravel mines would generally be proportional to the number of acres developed in a nature that disrupts the hydrologic regime. On a watershed level, cumulative water resource impacts are related to alterations in the drainage pattern, and to a lesser degree stream flow. Alternative B would cause incrementally greater cumulative impacts to drainage patterns than Alternatives A and C due to a slightly longer routing to avoid the Fish Creek setback. Overall, Alternatives A, B, and C have a greater potential for cumulative impacts to drainage patterns due to long linear gravel access road installations.

Erosion, sedimentation, and stream flow are impacts to water quality that may be sustained to a lesser extent, as a result of road construction, stream crossings, and culverts. With the increase of roads and airport infrastructure under Alternative C, there is a higher likelihood of erosion and sedimentation than with Alternatives A and B. Sustained periods of these impacts are not expected to have significant cumulative impacts on a watershed level under any of the action alternatives. These impacts would be additive to other reasonably foreseeable future projects impacts that may be developed.

The primary change in project components of Alternatives D1 and D2 with potential to alter the degree of cumulative hydrological impacts is the reduction in the total length of new roads, and the construction of an airstrip. Despite the elimination of the CD5-GMT1 access road which parallels the pipeline, the new gravel foot print is larger than Alternative A due to the addition of the airstrip and increase in pad size to support a remote, self-sufficient camp and drilling operation. The gravel footprint of the 5,000-foot airstrip under Alternatives D1 and D2, and would have minor impacts to the localized drainage pattern.

The 5,000-foot airstrip and associated GMT1 pad and occupied structure pad under Alternatives D1 and D2 would not cross any major drainages or streams. To minimize surface water ponding adjacent to the gravel embankments, the gravel surface may need to be contoured to direct surface water runoff (from precipitation and snow melt) to the down-gradient edges of the pad. The width of the pads and airstrip are too large to traverse with culvert. If ponds develop, runoff may need to be routed along the edges of the airstrip and pads. Over the compacted gravel surface there will be less infiltration of precipitation which may reduce the recharge of shallow groundwater in the immediate area. However, this impact will be localized and of low intensity.

Water withdrawal from lakes to support construction of ice roads and activities would be temporary under Alternatives A, B, and C and are not expected to sustain cumulative impact to water resources. Naturally occurring seasonal water recharge occurs at a rate sufficient to offset withdrawal volumes if BMPs and state permit requirements are adhered to as directed. Cumulative impacts to water withdrawal sources and recharge functions are not expected.

Alternative D1 would require significantly more water withdrawal from local lakes to support year-round drilling during the non-winter months when ice road access to APF would not be possible. Under Alternatives D1 and D2 there are more ice road miles during the construction phase, and also a need for annual ice roads during the operation phase (production). Therefore, any impacts of ice roads under Alternatives D1 and D2 would be greater and of longer duration compared to the other action alternatives. If reasonably foreseeable future roadless projects were developed, similar impacts would be additive. The impacts to rivers and drainage basins under Alternatives D1 and D2 would be less than those for the other action alternatives.

In comparison to the other action alternatives during the operation period, Alternatives D1 and D2 could result in higher spill risk due to increased activity with aircraft operations and year-round living accommodations.

Conclusion

Impacts to water resources and water quality would be additive to past, present, and reasonably foreseeable future impacts on the North Slope. The majority of the impacts would result from oil and gas development activities, with construction of roads, permanent pads, stream-crossing structures, and water use from lakes during the winter months being the major contributors. These impacts tend to be proportional to the amount of area impacted by infrastructure, with modifications due to specific activities and locations. All of these activities involve construction of infrastructure that would affect water quality through dust, impoundments, changes in natural drainage patterns, snow drifting, and oil, seawater or produced water spills. These impacts would be long-term and would accumulate. Because of the abundance of water resources on the North Slope, the overall cumulative impact to water resources on the North Slope and in the NPR-A would probably be small in magnitude and most impacts would be local in nature.

BLM (2012, § 4.8.7) concluded that climate change may increase particulate matter to the extent shallow lakes and ponds dry up or become smaller, watersheds would experience a change to drier soils, and thermokarsting may increase as ice-rich permafrost becomes unstable with increases in ambient surface temperatures.

4.6.6 Air Quality

Cumulative impacts to the atmospheric environment would be negligible due to the relatively low quantity of emissions and short duration through the construction phase compared to existing North Slope infrastructure. Cumulative impacts to air quality are discussed more fully in BLM (2004, § 4G.5.8), and BLM (2012, § 4.8.7.1).

The BLM (2004) found that the cumulative impacts of all projects affecting the Alaska's North Slope in the past and occurring by 2004 caused generally little deterioration in air quality, which achieves national standards. Production levels for the foreseeable future were not anticipated to be higher than the 1996 level. Thus, while reasonably foreseeable North Slope projects are additive, they were not expected to have synergistic cumulative impacts on air quality (BLM 2004, § 4G.5.8).

The BLM (2012, § 4.8.7.1) analyzed potential cumulative impacts to air quality across the North Slope. The cumulative impacts of all projects affecting the North Slope of Alaska in the past have caused some deterioration in and contributed to increases in criteria pollutants, hazardous air pollutants, hydrocarbons, and greenhouse gases. Improvements in air-pollution-control technology would help reduce emissions from historic levels which may be offset somewhat by increasing production. Arctic haze will continue to be of concern on the North Slope, due primarily to air pollutant emissions originating in northern Europe and Asia.

A cumulative impacts analysis utilizes air quality modeling similar to that used for the direct and indirect impacts to air quality. The cumulative impacts of the proposed GMT1 Project to air quality are within the range considered in BLM (2012), which projected that regional air pollutant emissions generated by North Slope facilities would remain near current levels.

The magnitude and extent of potential cumulative impacts to air quality would depend on the timing, extent, and design of activities. Cumulative impacts are the result of past, present, and RFD actions by federal, state, and local governments, private individuals, and entities in or near the project area. Cumulative impacts could result from individually minor but collectively significant actions that take place over time.

Impacts may result from collective emissions from fuel-burning equipment at oil production facilities and from vehicle usage. Fugitive dust emissions from road usage and construction activities may also be expected, but are limited to summer months; during winter months the ground is snow-covered reducing fugitive dust emissions. Impacts are regionally additive (e.g., concentrations from multiple facilities can contribute), however the project area has relatively pristine air quality, and existing and proposed facilities are expected to meet ambient air quality standards.

For the far-field cumulative impact analysis, emissions from each of the modeled alternatives were added to the emissions predicted for reasonable future development (RFD). Impacts to air quality and AQRV were predicted for the three areas of special concern identified in Section 3.2.3.2 for Gates of the Arctic National Park, Arctic National Wildlife Refuge, and the community of Nuiqsut.

Under the Air Quality MOU, emissions from RFD must also be included in the air quality analysis. Consequently, the far-field analysis was performed for the modeled alternative project emissions as well as for emissions from all RFD sources. Emissions from the following RFD sources were modeled in addition to the GMT1 Project sources. The predicted impacts from the GMT1 Project and RFD sources were added together to assess the cumulative impacts.

- Shell Discoverer Camden Bay
- Eni Nikaitchuq Development
- TDX Deadhorse Power Plant
- Pioneer Oooguruk Development

- Brooks Range Petroleum North Shore
- ConocoPhillips Alpine CD5
- ExxonMobil Point Thomson Facility
- ConocoPhillips GMT2
- Brooks Range Petroleum Mustang
- BPXA Liberty

For the Draft SEIS, far field modeling included project point and volume source emissions while RFD sources were characterized strictly as volume sources with permitted potential to emit annual emission rates. Because of the close proximity of some of the RFD sources to modeled receptors, and their dominant influence on cumulative impacts, this change in characterization could result in an increase in cumulative results.

Past and Present Impacts and Their Accumulation

Emissions from sources have contributed to increases in criteria pollutants, hazardous air pollutants, hydrocarbons, and greenhouse gases. It may be difficult to discern whether global climate change is already affecting resources within and adjacent to the planning area. Projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change that could affect air quality, visibility, and atmospheric deposition may not be measurable within the reasonably foreseeable future. Existing climate prediction models are global or continental in scale. There are no tools available to estimate potential impacts of a single greenhouse gas emission source on global climate change (BLM 2008; 2012, § 4.8.7.1).

Climate change will impact regions differently and warming will not be equally distributed. Both observations and computer model predictions indicate that increases in temperature are likely to be greater at higher latitudes, where the temperature increase may be more than double the global average (IPCC 2013).

The World Resources Institute's (WRI's) Climate Analysis Indicators Tool (WRI 2013) provides data on GHG emissions from 186 countries and all 50 states. In 2010, which represents the most recent complete year of data, total global GHG emissions were 44,543 million metric tons of CO_2 equivalent (Mt CO_2 eq). From 1990 to 2010, global GHG emissions increased at an annual rate of 1.9 percent. Electricity generation, manufacturing/construction, and transportation account for roughly 31 percent, 14 percent, and 13 percent of total global GHG emissions, respectively.

The EPA publishes the national GHG emissions inventory on an annual basis (EPA 2014b). In order to be consistent with global GHG emissions from 2010 provided above, 2010, total United States GHG emissions in 2010 were 6,821.8 Mt CO_2 eq. From 1990 to 2010, United States emissions increased at an annual rate of 0.5 percent. The GHG emissions associated with the GMT1 alternatives represent an even smaller fraction.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Emissions on the North Slope as a whole may decrease as the result of technological advances, which decrease air emissions; therefore, air quality impacts from local existing sources may be reduced (BLM 2012, § 4.8.7.1).

GMT 2 Development

The development of the GMT2 Project would have similar impacts to air quality relative to GMT1. Additionally, the GMT2 Project may enable the expansion oil and gas development activities to the west and south of current development. If the GMT2 development were connected via roadway to existing facilities at APF or to the community of Nuiqsut, the expanded access and facilities may increase the future development in the NPR-A as projects that are currently not economically feasible, may become more feasible. Development of GMT2 would also extend the existence of the GMT1 facilities which would be required to support development at production at GMT2; this extension of operating duration would also increase the duration of air quality impacts associated with the GTM1 project. And although GMT1 and the RFF GMT2 Project would involve staggered construction, simultaneous operations would occur for a moderate duration until production activities at both sites cease.

Oil and Gas Exploration and Development Activities

The types and relative amounts of air pollutants generated by oil and gas operations vary according to the phase of activity (i.e., exploration, development, or production). During the exploration phase, air pollutant emissions from combustion processes consist primarily of nitrogen oxides, with lesser amounts of carbon monoxide, particulate matter, and sulfur dioxide. During the development phase, emissions are similar to exploration, but with lesser amounts of carbon monoxide, particulate matter, and sulfur dioxide. During the production phase, emissions consist primarily of nitrogen oxides, with smaller amounts of carbon monoxide and particulate matter. In addition to these criteria pollutants, certain hazardous air pollutants may also be emitted. Benzene, toluene, ethylbenzene, and xylenes are common hazardous air pollutants associated with volatilization of oil and gas resources, as is formaldehyde from compressor engines. Depending on conditions, hydrogen sulfide may also be found in oil (BLM 2012, § 4.8.7.1).

Abandonment and rehabilitation activities would have impacts similar to those of construction since similar equipment and vehicles would be used. Because abandonment would occur at single locations for a short length of time, air quality impacts would be short term. Impacts could be less than those associated with construction if gravel fill was left in place, due to less use of vehicles and machinery. Particulate matter emissions would also be reduced at sites that are revegetated. Greater reliance on technologies and mitigation measures that reduce the need for permanent roads and pads, and reduce the size of the facility footprint, would specifically reduce particulate matter emissions (BLM 2012, § 4.8.7.1).

The impacts of offshore oil and gas development in the Chukchi and Beaufort seas and construction of roads to support the development would result in increased emissions of criteria pollutants, hazardous air pollutants, hydrocarbons, and greenhouse gases. The extent of the impacts would depend on the size of operation, duration of activities, distance offshore, and mitigation measures imposed by the regulatory agency. Potential oil and gas development to the east (upwind) of the NPR-A would likely result in increases in air pollution depending on the magnitude of the production operation and distance from the NPR-A. Should the State of Alaska construct a road to Umiat the quantity of particulates and gaseous air pollutants in the

NPR-A and in the vicinity of Umiat would increase. The magnitude of the impact would depend on the amount of traffic, time of day, season, and meteorological conditions (BLM 2012, § 4.8.7.1).

Potential impacts from future oil and gas activities would be scattered over a large regional area. Emissions associated with routine program activities would increase, although all applicable standards would continue to be met. Maximum concentrations of air pollutants will occur close to facility boundaries, and dissipate rapidly as distance from the facility increases. Thus, it is unlikely cumulative interaction between developments would occur. However, until air pollution emissions in Asia and Europe decline, Arctic haze is likely to persist or get worse. In addition, worldwide emissions of carbon dioxide and other greenhouse gases are anticipated to persist and accumulate in the atmosphere (BLM 2008, BLM 2012, § 4.8.7.1).

Contribution of the Alternatives to Cumulative Impacts

Alternative A

The analysis of air quality impacts from NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at the Arctic National Wildlife Refuge, Gates of the Arctic National Park, and the community of Nuiqsut indicated that total maximum ambient concentrations will be below the NAAQS/AAAQS for all pollutants examined for Alternative A combined with RFD sources as shown in Tables 4.6-9 through 4.6-16.

Table 4.6-9. Cumulative Alternative A Air Quality Impacts at Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m3)	Ambient Background (µg/m3)	Total Impact (µg/m3)	NAAQS/ AAAQS (µg/m3)	Percent of NAAQS/ AAAQS
NO_2	1-hour [a]	40.79	38	79	188	42
	Period [a, b]	0.14	2.9	3.0	100	3
SO_2	1-hour [a]	0.76	7.7	8.5	196	4
	3-hour [a]	0.54	18	18.5	1,300	1
	24-hour [a]	0.17	6.8	7.0	365	2
	Period [a, b]	0.01	0.34	0.35	80	0.4
PM_{10}	24-hour [a]	2.68	48	51	150	34
$PM_{2.5}$	24-hour [a]	0.45	7.1	7.6	35	22
	Period [a, b]	0.02	2.2	2.2	12	19

[a] The maximum impacts are reported for all averaging periods.

[b] Due to two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore, the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Table 4.6-10. Cumulative Alternative A Air Quality Impacts at Gates of the Arctic National Park

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m3)	Ambient Background (µg/m3)	Total Impact (µg/m3)	NAAQS/ AAAQS (µg/m3)	Percent of NAAQS/ AAAQS
NO_2	1-hour [a]	0.44	38	38	188	20
	Period [a,b2]	0.002	2.9	2.9	100	3
SO_2	1-hour [a]	0.05	7.7	7.8	196	4
	3-hour [a]	0.04	18	18	1,300	1
	24-hour [a]	0.02	6.8	6.8	365	2
	Period [a, b]	0.001	0.34	0.34	80	0.4
PM_{10}	24-hour [a]	0.33	48	48	150	32
$PM_{2.5}$	24-hour [a]	0.04	7.1	7.1	35	20
	Period [a, b]	0.003	2.2	2.2	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore, the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Table 4.6-11. Cumulative Alternative A Air Quality Impacts at the Community of Nuiqsut

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m3)	Ambient Background (µg/m3)	Total Impact (µg/m3)	NAAQS/ AAAQS (µg/m3)	Percent of NAAQS/ AAAQS
NO_2	1-hour [a]	2.71	38	41	188	22
	Period [a, b]	0.15	2.9	3.1	100	3.0
SO_2	1-hour [a]	0.71	7.7	8.4	196	4.0
	3-hour [a]	0.60	18	19	1,300	1.0
	24-hour [a]	0.31	6.8	7.1	365	2.0
	Period [a, b]	0.02	0.34	0.36	80	0.45
PM_{10}	24-hour [a]	1.35	48	49	150	33
$PM_{2.5}$	24-hour [a]	0.12	7.1	7.2	35	21
	Period [a, b]	0.03	2.2	2.2	12	19

[a] The maximum impacts are reported for all averaging periods.

[b] Due to two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore, the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8,760 hours and conservatively represent an annual average.

Visibility conditions calculated for cumulative impacts using the FLAG method were evaluated at each Class II area of concern to determine if the 98th percentile change in light extinction exceeds the 10 percent change in light extinction thresholds (equivalent to 1.0 dv). The cumulative visibility impacts, however, exceed both the 0.5 and 1.0 ddv thresholds at both Sensitive Class II areas for Alternative A. The cumulative impacts are likely controlled by the nearby offshore and onshore sources and their proximity to the Arctic National Wildlife Refuge. Additional model runs with refined GMT1 source data would be expected to show reduced cumulative impacts on visibility.

Table 4.6-12. Cumulative Alternative A Number of Days Greater Than 0.5 ddv

Area	Number of Days Greater Than 0.5 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	80	103	91
Gates of the Arctic National Park	8	11	18

Table 4.6-13. Cumulative Alternative A Number of Days Greater Than 1 ddv

Area	Number of Days Greater Than 1 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	49	58	48
Gates of the Arctic National Park	1	1	2

Table 4.6-14. Cumulative Alternative A Maximum ddv Impact

Area	Maximum ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	9.016	8.628	7.772
Gates of the Arctic National Park	1.242	1.039	1.154

Table 4.6-15. Cumulative Alternative A 98th Percentile ddv Impact

Area	98th Percentile ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	3.614	4.267	4.502
Gates of the Arctic National Park	0.521	0.558	0.684

When proposed GMT1 Project emissions are combined with RFD emissions, the cumulative deposition impacts exceed the DAT at the Arctic National Wildlife Refuge for nitrogen, but are below the DAT for the Arctic National Wildlife Refuge for sulfur and for both pollutants at Gates of the Arctic National Park for Alternative A. As with the predicted cumulative visibility impacts, deposition is likely affected by the nearby offshore and onshore sources.

Table 4.6-16. Cumulative Deposition Impacts for Alternative A

Area	Pollutant	Averaging Period	Maximum Impact (kg/ha/yr)	DAT (kg/ha/yr)	Percent of DAT
Arctic National Wildlife Refuge	Nitrogen	Annual [a]	2.33E-02	0.005	466
Gates of the Arctic National Park	Nitrogen	Period [b]	4.54E-03	0.005	91
Arctic National Wildlife Refuge	Sulfur	Annual [a]	3.90E-03	0.005	78
Gates of the Arctic National Park	Sulfur	Period [b]	7.85E-04	0.005	16

[a] Maximum cumulative deposition impacts occur in year 2008, thus represent a true annual impact.

[b] Maximum cumulative impacts occur in the second portion of year 2009 (7,230 hours), thus do not represent a true annual impact. The conversion from g/m2/s to kg/ha/yr assumes 8,784 hours, therefore; reported impacts are conservatively high.

Alternatives B and C

Far-field cumulative impacts from Alternatives B and C were not modeled but it is expected that the Alternative A analysis of cumulative impacts adequately represents potential impacts from Alternatives B and C. Infill drilling was the scenario selected for far-field modeling as the project-related activity with the highest amount of fuel use and the greatest potential for far-field impacts. Infill drilling activities would use the same equipment and have the same duration under Alternatives A, B, and C.

Based on Alternative A results, the analysis of air quality impacts from NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at the Arctic National Wildlife Refuge, Gates of the Arctic National Park, and the community of Nuiqsut indicate that total maximum ambient concentrations will be below the NAAQS/AAAQS for all pollutants examined for Alternatives B and C combined with RFD sources.

The cumulative visibility impacts exceeded both the 0.5 and 1.0 ddv thresholds at both Sensitive Class II areas for the Alternative A analysis. The cumulative impacts are likely controlled by the nearby offshore and onshore sources and their proximity to the Arctic National Wildlife Refuge. Additional model runs with refined GMT1 source data would be expected to show reduced cumulative impacts on visibility. These results are also assumed to be representative of Alternatives B and C.

Alternatives D1 and D2

An additional turbine would potentially be installed at APF under Alternatives D1 and D2 due to power requirements for roadless GMT1 and GMT2 pads. The GMT1 well site is anticipated to increase power demand on APF by 1 to 2 megawatts electrical (MWe), depending on the season, due to required lighting, heat trace on piping, and heating modules. If Alternatives D1 or D2 were to be constructed, the GMT2 pad would also be roadless with an additional 2.5 MWe electrical demand placed on Alpine generators. Electrical demand on the Alpine facilities fluctuates between a peak of 30 MWe winter demand and 20 MWe summer demand. The current permitted electrical capacity at Alpine is 37.6 MWe (International Organization for Standardization [ISO]), plus an additional 11 MWe (ISO) backup power generation. This electrical power is provided by stationary combustion turbines. The installation of one 15 MWe (ISO) stationary combustion turbine would be expected to meet the total additional demand of 10 MWe (with a sufficient safety margin) for roadless GMT1 and GMT2 pads. Turbine installation would require permitting prior to construction. The additional turbine emissions which would result at APF were not included in the Alternatives D1 or D2 emission inventories.

The analysis of air quality impacts from NO_2, SO_2, PM_{10}, and $PM_{2.5}$ at the Arctic National Wildlife Refuge, Gates of the Arctic National Park, and the community of Nuiqsut indicated that total maximum ambient concentrations will be below the NAAQS/AAAQS for all pollutants examined for Alternative D1 combined with RFD sources, as shown for Alternative D1 in Tables 4.6-17 through 4.6-24.

Table 4.6-17. Cumulative Alternative D1 Air Quality Impacts at Arctic National Wildlife Refuge

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m3)	Ambient Background (µg/m3)	Total Impact (µg/m3)	NAAQS/AAAQS (µg/m3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	41	38	78.8	188	42
	Period [a, b]	0.14	2.9	3.04	100	3
SO_2	1-hour [a]	0.76	7.7	8.46	196	4
	3-hour [a]	0.54	18	18.5	1,300	1
	24-hour [a]	0.17	6.8	6.97	365	2
	Period [a, b]	0.013	0.3	0.31	80	0
PM_{10}	24-hour [a]	2.7	48	50.7	150	34
$PM_{2.5}$	24-hour [a]	0.45	7.1	7.55	35	22
	Period [a, b]	0.023	2.2	2.22	12	19

[a] The maximum impacts are reported for all averaging periods.

[b] Due to the two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore the reported values represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8760 hours and conservatively represent an annual average.

Table 4.6-18. GMT1 Alternative D1 Air Quality Impacts at Gates of the Arctic

Pollutant	Averaging Period	Maximum Predicted Impact (µg/m^3)	Ambient Background (µg/m^3)	Total Impact (µg/m^3)	NAAQS/AAAQS (µg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	0.44	38	38.4	188	20
	Period [a, b]	0.0024	2.9	2.90	100	3
SO_2	1-hour [a]	0.046	7.7	7.75	196	4
	3-hour [a]	0.038	18	18.0	1,300	1
	24-hour [a]	0.017	6.8	6.82	365	2
	Period [a, b]	0.0010	0.3	0.30	80	0
PM_{10}	24-hour [a]	0.33	48	48.3	150	32
$PM_{2.5}$	24-hour [a]	0.037	7.1	7.14	35	20
	Period [a, b]	0.0032	2.2	2.20	12	18

[a] The maximum impacts are reported for all averaging periods.

[b] Due to the two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore the reported values may represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8760 hours and conservatively represent an annual average.

Table 4.6-19. Cumulative Alternative D1 Air Quality Impacts at Community of Nuiqsut

Pollutant	Averaging Period	Maximum Predicted Impact (μg/m^3)	Ambient Background (μg/m^3)	Total Impact (μg/m^3)	NAAQS/AAAQS (μg/m^3)	Percent of NAAQS/AAAQS
NO_2	1-hour [a]	2.7	38	40.7	188	22
	Period [a, b]	0.17	2.9	3.07	100	3
SO_2	1-hour [a]	0.71	7.7	8.41	196	4
	3-hour [a]	0.60	18	18.6	1,300	1
	24-hour [a]	0.31	6.8	7.11	365	2
	Period [a, b]	0.025	0.3	0.33	80	0
PM_{10}	24-hour [a]	4.8	48	52.8	150	35
$PM_{2.5}$	24-hour [a]	0.15	7.1	7.25	35	21
	Period [a, b]	0.029	2.2	2.23	12	19

[a] The maximum impacts are reported for all averaging periods.

[b] Due to the two erroneous WRF files, both 2007 and 2009 had to be run in separate periods in CALPUFF. Therefore the reported values represent an annual average for only 2008, while 2007 and 2009 have periods much less than 8760 hours and conservatively represent an annual average.

Visibility conditions calculated for cumulative impacts using the FLAG method were evaluated at each Class II area of concern to determine if the 98th percentile change in light extinction exceeds the 10 percent change in light extinction thresholds (equivalent to 1.0 dv) for Alternative D1. The cumulative visibility impacts, however, exceed both the 0.5 and 1.0 ddv thresholds at both Sensitive Class II areas. The cumulative impacts are likely controlled by the nearby offshore and onshore sources and their proximity to the Arctic National Wildlife Refuge. Additional model runs with refined GMT1 source data would be expected to show reduced cumulative impacts on visibility.

Table 4.6-20. Cumulative Alternative D1 Number of Days Greater Than 0.5 ddv

Area	Number of Days Greater Than 0.5 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	86	108	96
Gates of the Arctic	11	12	19

Table 4.6-21. Cumulative Alternative D1 Number of Days Greater Than 1.0 ddv

Area	Number of Days Greater Than 1.0 ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	50	59	48
Gates of the Arctic	1	1	2

Table 4.6-22. Cumulative Alternative D1 Maximum ddv

Area	Maximum ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	9.016	8.628	7.791
Gates of the Arctic	1.243	1.039	1.182

Table 4.6-23. Cumulative Alternative D1 98th Percentile ddv

Area	Maximum ddv		
	2007	2008	2009
Arctic National Wildlife Refuge	3.623	4.267	4.504
Gates of the Arctic	0.566	0.586	0.784

When proposed GMT1 Project emissions are combined with RFD emissions, the cumulative deposition impacts exceed the DAT at the Arctic National Wildlife Refuge for nitrogen, but are below the DAT for the Arctic National Wildlife Refuge for sulfur and for both pollutants at Gates of the Arctic National Park for Alternative D1. As with the predicted cumulative visibility impacts, deposition is likely affected by the nearby offshore and onshore sources.

Table 4.6-24. Cumulative Alternative D1 Deposition Impacts

Area	Pollutant	Averaging Period	Maximum Impact (kg/ha/yr) [a]	DAT (kg/ha/yr)	Percent of DAT (%)
Arctic National Wildlife Refuge	Nitrogen	Annual [b]	2.37E-02	0.005	474
Gates of the Arctic	Nitrogen	Annual [b]	4.68E-03	0.005	94
Arctic National Wildlife Refuge	Sulfur	Annual [b]	3.91E-03	0.005	78
Gates of the Arctic	Sulfur	Annual [b]	7.93E-04	0.005	16

[a] Maximum cumulative impacts occur in the first portion of year 2007 (7100 hours), thus do not represent a true annual impact. The conversion from g/m2/s to kg/ha/yr assumes 8784 hours, thus reported impacts are conservative.

[b] Maximum cumulative impacts occur in year 2008, thus represent a true annual impact.

Cumulative far-field impacts were not modeled and calculated for Alternative D2 because Alternative D1 analysis results are representative of potential Alternative D2 impacts.

The results of the far-field modeling for Alternatives A and D1 provide the following comparisons:

- Alternatives A and D1 are predicted to have the same impacts at the Arctic National Wildlife Refuge when comparing the percentage of the NAAQS/AAAQS for each pollutant and averaging period. Note that this is because background concentrations are significantly higher than modeled concentrations and thus background concentrations dominate the total impact for both Alternatives.

- Alternatives A and D1 are predicted to have the same impacts at Gates of the Arctic National Park when comparing the percentage of the NAAQS/AAAQS for each pollutant and averaging period. Note that this is because background concentrations are significantly higher than modeled concentrations and thus background concentrations dominate the total impact for both Alternatives.

- While Alternative D1 deposition impacts are predicted to be slightly higher at the Arctic National Wildlife Refuge and Gates of the Arctic National Park than those for Alternative A, the difference is negligible.

Conclusion

Cumulative impacts to the atmospheric environment would be low due to the relatively low quantity of emissions and short duration through the construction phase compared to existing North Slope infrastructure.

Cumulative impacts are predicted when all RFD is included in the modeling due to the projected scope of oil and gas development on the North Slope.

As stated in the 2012 IAP, the implementation of Required Operating Procedure A-9 under each alternative should reduce the cumulative effect to air quality from oil and gas, and non-oil and gas, activities in the planning area.

4.6.7 Noise

The project area is remote and sparsely populated with few existing sources of man-made noise. The cumulative impact from noise associated with the proposed GMT1, conceptual GMT2, and RFF projects would be moderate and long-term. Noise from construction and gravel mining would be limited primarily to the winter months and would terminate after about two years. Cumulative impacts to noise are discussed more fully in BLM (2004, § 4G.5.9).

Past and Present Impacts and Their Accumulation

Noise is unique in that it only occurs as an action is occurring. In addition its range is very limited. Noise from project activities can be expected to impact resources in the vicinity of these activities (e.g., GMT1, GMT2, and Nuiqsut).

Existing sources of noise include: vehicle operations; aircraft operations, boat operations (outboard motors), and oil and oil field equipment operations. Operation of equipment during exploration, drilling, facility construction (including mining activities) and production and use of aircraft for transportation of personnel and materials contribute noise to the environment. During peak periods of construction and drilling, noise levels would be considerably higher than during operations, but would be short-term and would not occur for all facilities at the same time.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Several non-oil and gas-related activities have the potential to introduce noise sources or additional noise into the project area. These activities include gravel mining and transport, scientific studies or recreational activities that utilize aircraft, setup of remote camps with generators, or other related activities.

Reclamation of past military or legacy well sites would involve transportation of people and equipment to remote sites where noise generating source may be limited.

GMT 2 Development

GMT2 would require additional extraction, which would lead to noise impacts in Nuiqsut as a result of blasting. Cumulative impacts of noise associated with the construction and operation of

GMT2 would extend the duration of impact associated with both the GMT2 and GMT1 facilities. Aircraft access for construction of the conceptual GMT2 would be similar to the construction of GMT1, but would not occur for several years after the GMT1 Project has been completed. If the roadless alternative is selected, the GMT2 Project would also likely be developed as a roadless development, adding another airport into an area where no airport currently exists. If both GMT1 and GMT2 have road access to Alpine, the CD5-GMT1 road would continue to have noise impacts associated with vehicle traffic.

Oil and Gas Exploration and Development Activities

Primary noise impacts from RFF offshore development would be aircraft use, notably helicopters. Additional impacts include noise from offshore seismic and drilling activities, and boat and barge traffic. If an associated gravel road and pipeline were to cross the NPR-A, there would be associated impacts as a result of noise and industrial activity along the pipeline route.

Cumulative impacts to noise from RFF onshore oil and gas activities west of the Alpine field, such as in the Bear Tooth Unit, would be similar to those associated with the GMT1 Project, would be additive, and are expected to be localized and potentially long-term. All activities would have the potential to produce local impacts on noise. Noise from generators, aircraft, human presence, and associated activities could have some seasonal impacts to Nuiqsut. Conventional oil and gas development in the Colville-Canning area could have an effect on noise in the Umiat/Colville area.

Contribution of the Alternatives to Cumulative Impacts

Impacts from noise for the action alternatives are addressed in Section 4.2.3.3. The potential noise associated with Alternatives A and B of the GMT1 Project is unlikely to impact the community. However, residents of the NVN travel widely for subsistence and may come within the auditory range of one of these stationary noise sources (see Map 3.3-10). Under Alternatives A, B, and C, the transport of gravel over similar routes and durations would produce noise impacts to Nuiqsut at approximately the same intensity. Future development with a gravel road at GMT2, and future development at Bear Tooth, could extend these impacts in the future until those sites are reclaimed.

Cumulatively, the greatest noise impacts would result from Alternative C, which requires the most gravel to construct. Alternative C, which would result in the highest intensity of construction noise impact to Nuiqsut residents among the action alternatives. Alternative C would have greater noise impacts to the community of Nuiqsut resulting from the proximity of air traffic, construction, and use of the Nuiqsut Airport and planned Nuiqsut Spur Road to the NVN. This noise impact would be in addition to that of Alternative A, because the road construction west, from the junction of the Nuiqsut Spur Road, is common to both Alternatives A and C. Cumulative impacts from future development in Nuiqsut would be greatest under Alternative C, as future development would theoretically utilize the village airport for its industrial activity.

Alternatives D1 and D2, should future development be via ice road and aircraft, would pose an additional noise impact mechanism not present with Alternatives A, B, and C. Both alternative would use aircraft to access the site when there is no ice road, primarily to support travel and cargo for operations personnel and pipeline inspection overflights, helicopters would be used as well to support ice road clean up and inspections and flights for special studies. Under Alternatives D1 and D2, aircraft noise would be audible to drill site workers housed at the occupied structure pad on a regular basis. Noise from aircraft flying between APF and GMT1 under Alternatives D1 and D2 may be audible at Nuiqsut. Future development would likewise require additional airports, and thus additional flights and noise originating from the APF and headed westward.

Alternative E would have no incremental adverse cumulative impact from noise.

Conclusion

The cumulative impact of the increased vehicle noise due to use of the CD5-GMT1 road would be minor intensity and long term in duration. Under Alternatives D1 and D2, noise from aircraft and traffic on ice roads likely would have a greater cumulative impact than noise from Alternatives A, B, and C due to the synergistic effects by airports at GMT1, GMT2, and Umiat in a relatively short flight distance. Noise impacts from vehicle access to the Umiat area via the Umiat road(s) also would be moderate and long term.

The BLM (2004, § 4G.5.9) found that because the community of Nuiqsut is several miles from the proposed development, noise impacts would be minor unless future development occurred much closer to Nuiqsut or any other community. The project would result in negligible incremental increases in localized ambient noise from construction and operations equipment and aircraft. The 2004 cumulative analysis estimated that noise impacts from infrastructure and activities related to past, present and reasonably foreseeable would be localized and short-term, and the sources of noise would not be geographically concentrated, however, new information indicates that some impacts may be major and potentially long-term as development continues on the North Slope.

The direct, indirect, and cumulative impact from noise associated with the proposed GMT1, conceptual GMT2, and completion of CD5 and the Nuiqsut Spur Road would be moderate and long-term. Noise from construction and gravel mining would be limited primarily to the winter months and would terminate after about two years.

Reduction of potential noise impacts is provided through design and operations, and mitigation measures described in Section 4.7. Workers in the project study area would be subject to Occupational Safety and Health Administration (OSHA) standards for hearing protection if, and as, necessary.

4.6.8 Climate Change

BLM (2012, § 4.8) provides an updated analyses and conclusions about the cumulative impacts of oil and gas development in NPR-A which includes the GMT1 and the conceptual GMT2 Project study area. These evaluations and conclusions are incorporated by reference and summarized below.

> *"Emissions from sources have contributed to increases in criteria pollutants, hazardous air pollutants, hydrocarbons, and greenhouse gases. It may be difficult to discern whether global climate change is already affecting resources within and adjacent to the [NPR-A]. Projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change that could affect air quality, visibility, and atmospheric deposition may not be measurable within the reasonably foreseeable future. Existing climate prediction models are global or continental in scale. There are no tools available*

> *to estimate potential impacts of a single greenhouse gas emission source on global climate change.”* (BLM 2012, § 4.8.7.1, p. 72)
>
> *“Although the cumulative effects of global greenhouse gas emissions are well-understood, our current scientific understanding of climate change does not allow us to relate specific sources of greenhouse gas emissions to any specific climate-related regional or global impacts. Further, since the specific effects of [oil and gas development projects in NPR-A], which may or may not contribute to climate change, cannot be determined, it is not possible to determine whether any particular action will lead to significant climate-related environmental effects.”* (BLM 2012, § 4.8.7.1, p. 75)

Although the project is not anticipated to cumulatively impact climate change, the effects of climate change for each resource are fully described in Chapter 3, *Affected Environment*.

BLM (2012, § 4.8.7) concluded the cumulative effect of climate change is likely more pronounced on the North Slope than elsewhere in Alaska and may include an increase in particulate matter to the extent shallow lakes and ponds dry up or are smaller, watersheds would experience a change to drier soils, and thermokarsting may increase as ice-rich permafrost becomes unstable with increases in ambient surface temperatures. Raynolds et al. (2014) found that climate change induced thermokarsting, lakeshore erosion, and changes to river bars and banks, has occurred across the Prudhoe Bay Oilfield and west of the field.

The cumulative impacts of Alternatives A and B on climate change are considered to be identical. Alternative C would have a very slight increase in cumulative impacts because of a greater overall distance of vehicle traffic on gravel roads between Nuiqsut, GMT1, GMT2, and Alpine. In addition to increased emissions of greenhouse gasses from vehicles, road and road dust contribute to increased thermokarsting, which in turn can alter the distribution of water on the tundra and affect localized vegetation and waterfowl habitats (Raynolds et al. 2014). Alternatives D1 and D2 eliminate gravel road traffic and substitute winter ice road access and aircraft to both GMT1 and the conceptual GMT2 which may produce more emissions that the other action alternatives. There may be fewer incremental impacts if Alternative E is selected through the reduction or elimination of emissions that may contribute to climate change.

4.6.9 Biological Resources

4.6.9.1 Vegetation and Wetlands

The land area within the project study area is approximately 97 percent wetlands (see Section 4.3.1) and impacts to vegetation and wetlands would result from construction, operations, and abandonment or rehabilitation of sites. The cumulative impacts to vegetation and wetlands include the direct loss of land cover due to placing gravel fill on the tundra and by mining gravel, and indirect loss of land cover as a result of the location of fill, modification of surface drainage, gravel spray and dust (extending outward 300 feet from the facility footprint). Cumulative impacts to vegetation and wetlands are discussed more fully in BLM 2004, § 4G.6.1, and BLM 2012, § 4.8.7.5 and § 4.8.7.6.

Past and Present Impacts and Their Accumulation

BLM (2012) summarized past and present direct and indirect impacts of non-oil and gas and oil and gas-related activities on wetlands and vegetation.

Approximately 2,500 acres of direct impacts to vegetation and wetlands from non-oil and gas activities persist on the North Slope today. Oil and gas activities have caused approximately 56,000 acres of direct impacts to vegetation and wetlands that persist today; another 18,400 acres of indirect impacts have also occurred, some of which persist today. Since most of these impacts are associated with ongoing non-oil and gas development, as well as oil and gas-related activities, these impacts to vegetation and wetlands are additive to future impacts and would be likely to persist for several decades or more (BLM 2012, § 4.8.7.5). However, the rate at which vegetation and wetlands are disturbed by development has slowed substantially in recent years due to advances in technology and a slowing of oil field development on the North Slope (BLM 2012, § 4.8.7.6).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The primary impact to vegetation and wetlands associated with non-oil and gas RFF projects are the permanent loss of vegetation and wetlands through the placement of gravel to support infrastructure and transportation systems such as roads. The Nuiqsut Spur Road, Colville River Road Access, and the community of Nuiqsut are all within the boundaries of the project study area and thus, construction in these locations would have additive impacts to vegetation and wetlands.

GMT 2 Development

Similarly to non-oil and gas projects, the primary impact to vegetation and wetlands associated with the conceptual GMT2 Project would be the permanent loss of vegetation and wetlands through the placement of gravel to support infrastructure and transportation systems such as roads. This cumulative impact evaluation assumes that any infrastructure associated with the conceptual GMT2 Project would be in wetland vegetation types, which is true for the proposed GMT1 Project and several other projects in the Nuiqsut area.

Direct and indirect impacts on vegetation and wetlands from the conceptual GMT2 Project are expected to be similar to those of the GMT1 Project. However, the location of the GMT2 Project area is to the west of the GMT1 Project area, and as such, the GMT2 Project has the potential to affect different amounts of vegetation types and wetlands.

As currently conceptualized, direct impacts to vegetation in the GMT2 Project area, assuming construction of the GMT1-GMT2 road, would affect tussock tundra (65 percent), moist sedge-shrub tundra (24 percent), old basin wetland complex (7 percent), and wet sedge meadow tundra (4 percent); all other vegetation types comprise less than 1 percent of the overall direct impacts. Under this development scenario, indirect impacts to vegetation in the GMT2 Project would be to moist tussock tundra (58 percent), moist sedge-shrub meadow (26 percent), old basin wetland complex (9 percent), patterned wet meadow (4 percent), nonpatterned wet meadow (1 percent), and sedge marsh (1 percent); all other vegetation types comprise less than 1 percent of the overall indirect impacts.

Direct impacts to vegetation in the GMT2 Project area if the GMT1-GMT2 is not constructed, would be limited to tussock tundra (95 percent) and moist sedge-shrub tundra (4 percent) with all other vegetation types comprising less than 1 percent of the overall direct impacts. Under this development scenario, indirect impacts to vegetation in the GMT2 Project would be to Moist tussock tundra (59 percent), moist sedge-shrub meadow (22 percent), old basin wetland complex (8 percent), patterned wet meadow (4 percent), nonpatterned wet meadow (3 percent), sedge marsh (2 percent), moist dwarf shrub (2 percent), and deep open water without Islands (1 percent); all other vegetation types comprise less than 1 percent of the overall indirect impacts.

Cumulative impacts from the addition of the GMT2 Project would be additive.

Oil and Gas Exploration and Development Activities

The Alpine Satellite Development Project facilities (except CD3) and all of the Nuiqsut Spur Road, Colville River Road Access, and the community of Nuiqsut are within the boundaries of the project study area and thus, construction in these locations would have additive impacts to vegetation and wetlands.

Impacts from future seismic and exploration would accumulate and be additive to past effects to wetlands on the North Slope. Vegetation recovery studies have shown that most impacts to vegetation from seismic activities and exploration should be minor and short term (NRC 2003).

The primary impact to vegetation and wetlands associated with the proposed project, conceptual GMT2 Project, and other RFF projects are the permanent loss of vegetation and wetlands through the placement of gravel to support infrastructure and transportation systems such as roads. According to BLM (2012, § 4.8.7.6) oil and gas development offshore in the Chukchi and Beaufort seas, construction of a road between Umiat and the Dalton Highway, construction of a commercial gas pipeline and unconventional oil and gas development east of the NPR-A could affect up to 50,100 acres of wetlands and floodplains. The total future direct and indirect impacts to wetlands and floodplains on the North Slope would be the sum of impacts from the gravel footprint, excavation of material sites, and construction of elevated and buried pipelines. The total area of direct, long-term impacts to wetlands from future development would be approximately 47,000 acres, which would be additive to the acres already impacted from past and present oil and gas activities. Based on an eight-to-one ratio for indirect to direct impacts (based on Alternative A indirect and direct impacts), a total of approximately 376,000 acres of wetlands of the 23-million-acre petroleum reserve could be indirectly impacted over the long term by gravel from future oil and gas development in the NPR-A (BLM 2012, § 4.8.7.6).

The loss of vegetation and wetlands through the development of GMT1, GMT2, and other RFF projects will also affect other resources, which rely on these for habitat. For example, the footprint of the Umiat road would affect about an additional 185 acres of vegetation and wetlands that may be used for habitat. Development of the Umiat road and a road leading from the Dalton Highway to the boundary of the NPR-A could make additional developments within the Umiat area and NPR-A more economical, causing a synergistic increase in the amount of vegetation and wetlands lost in the NPR-A through both direct and indirect actions.

Although the increase in the amount of area disturbed by oil and gas development has slowed dramatically in recent years, BLM (2012) estimated that an additional 3,750 acres could be covered by gravel and 750 acres impacted by gravel mines east of the NPR-A between 2012 and 2100. Approximately 27,000 acres of vegetation would be indirectly affected by dust, changes in hydrology, and thermokarst (BLM 2012, § 4.8.7.5).

Oil and gas development and operation would cause the following long-term impacts: affect wetlands by burial of vegetation under gravel pads, gravel roads, and gravel airstrips;

excavating gravel at mine sites; constructing vertical support members for elevated pipelines; and excavating trenches for buried pipelines. Construction of gravel pads, roads, and airstrips could also result in indirect effects by altering the moisture regime of vegetation near the structures due to dust and snow accumulation and modification of natural drainage patterns. Impacts to floodplains could occur from river channel crossings by pipelines and roads, which could destroy vegetation where bridge pilings or vertical support members were required for the crossing. These factors could combine to warm the soil, deepen thaw, and cause thermokarst adjacent to roads and other gravel structures. Changes may also occur over time to habitat continuity, driving out more sensitive, interior species, and providing habitat for hardier opportunistic and non-native species in wetlands.

As oil and gas development and production increase on the North Slope, the more need there will be for removal of infrastructure and rehabilitation of vegetation. Removal of aboveground facilities, pipelines, bridges, and power poles would have a minor impact on vegetation. Roads and pads will remain unaffected if they are maintained, but once maintenance ceases, thaw subsidence in ice-rich areas could result in settling of the gravel structures into thermokarst troughs. Removal of the roads and pads would accelerate thaw subsidence, but would also accelerate the reclamation process. Removal of gravel fill has recently been done in wetlands, and preliminary studies suggest that wetland mosaics of vegetation can be restored.

The impacts of continued development west of GMT1 in the Bear Tooth Unit would be expected to have the same small incremental effect on vegetation and wetlands as is currently occurring. Permanent loss of vegetation and wetlands used for habitat would likely be negligible due to the small number of acres likely to be affected.

Contribution of the Alternatives to Cumulative Impacts

Section 4.3.1 discusses the direct impacts due to the footprint of Alternatives A, B, C, D1, and D2.

The BLM (2004) predicted the potential cumulative impacts to wetlands and vegetation to be minor (BLM 2004, § 4G.6.1). The incremental contribution to cumulative impacts from CPAI's proposal would be minor, unless a large oil spill was to occur. Impacts to the North Slope vegetation communities from ASDP termination activities would result in a small temporary contribution to cumulative impacts and a recovery over the long term, although the benefit would be very small relative to the total area of tundra vegetation. The affected area is a small fraction of the total North Slope acreage. It is also not expected that synergistic impacts (whether beneficial or adverse) to vegetation would occur as a result of developing additional acres. The potential cumulative impacts to vegetation and wetlands of the proposed project are within the range analyzed by BLM in 2004.

The vegetation and wetlands impacts of the action alternatives are within the range of cumulative impacts of oil and gas activities analyzed in 2012 (i.e., minor and localized; BLM 2012, Table 4.8, p. 74). Non-oil and gas development and oil and gas activities would occupy a total of less than 14,000 acres within the largely undeveloped 4.3-million-acre area comprising the Harrison Bay and Lower Colville River watersheds. Future impacts to vegetation both inside and outside of the NPR-A are additive to the impacts to vegetation that have accumulated in the past and persist today, but in the context of the entire North Slope, these cumulative impacts would be relatively minor.

Conclusion

If global climate change persists, the cumulative effects to wetlands and floodplains from oil and gas development, and non-oil and gas development, on the North Slope could be greater than predicted. Climate change may eventually lead to shifts in the composition of Arctic tundra. Permafrost may thaw to an increased depth each season, which will cause varying degrees of impacts on subsidence, soil moisture, and vegetation. The potential for many shallow streams, ponds, and wetlands in the Arctic to dry out under a warming climate is increased by the loss of permafrost. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near NPR-A, potentially leading to synergistic impacts to vegetation.

Overall, the direct, indirect, and cumulative impact to vegetation and wetlands associated with the proposed GMT1, conceptual GMT2, and completion of other RFF projects would be moderate intensity and long-term duration.

4.6.9.2 Fish and Fish Habitat

The potential impacts to fish as a result of oil and gas development associated with CPAI's proposed project include injury at water-use intakes, altered water quality, physical habitat changes (water quantity, flow patterns, and geomorphology), point and non-point source pollution, increased turbidity and sedimentation, and barriers to fish movements. Collectively, these could contribute to reduced success at different life history stages, behavioral changes, diminished condition, susceptibility to pollutants or disease, shifts in fish species distribution, and mortality. Cumulative impacts to fish and fish habitat in the project area are discussed more fully in BLM (2004, § 4G.6.2), and BLM (2012, § 4.8.7.7).

Past and Present Impacts and Their Accumulation

Impacts on fish to date from most North Slope non-oil and gas activities, such as developing villages, recreation, hunting, research, waste removal and remediation projects, and winter overland supply operations have been minor and localized. Impacts on fish from military Distant Early Warning-Line stations that initially accumulated along the coast have been recovering since abandonment (BLM 2012, § 4.8.7.7).

Impacts to fish from seismic activities and exploration over the last several decades should have largely been acute and short-lived. Explosive-based seismic surveys and exploration that included construction of gravel infrastructure have been replaced by Vibroseis-based surveys and winter exploration that utilizes temporary ice infrastructure, which have fewer potential repercussions on the environment. Aquatic habitats and local fish communities that were temporarily impacted in the past have likely recovered (BLM 2012, § 4.8.7.7).

Some aspects of North Slope oil and gas development and production have caused impacts on fish that have accumulated, while impacts on fish from other aspects have not persisted. Impacts from gravel pads and roads as well as causeways have accumulated by impeding fish movements and significantly altering fish habitat by changing physical and chemical conditions. Year-round freshwater use for domestic facilities, seawater use for waterflooding, and oil spills have all effected fish in ephemeral ways that have not likely accumulated (BLM 2012, § 4.8.7.7).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Impacts on fish from Distant Early Warning-Line stations should continue to diminish over time if no new facilities are constructed and cleanup efforts continue. Other non-oil and gas activities that will take place in the NPR-A and adjacent lands related to village development; recreation, hunting, and research and associated small camp, watercraft, and floatplane use; waste removal and remediation projects; and winter overland supply operations will probably increase in the future. However, in most cases, minor impacts on fish would be localized and brief and would not accumulate (BLM 2012, § 4.8.7.7).

Construction of new gravel roads provides improved access to subsistence and sport harvest of fish from waters that were previously remote. Improved access carries a risk that small populations of slow growing fish may be overharvested. Although this is possible, it is unlikely that substantially increased harvest levels would go unnoticed or unchecked. Accordingly, there is still a risk of overharvesting local populations of fish.

GMT 2 Development

The predicted road corridor linking GMT1 with a conceptual GMT2 site would not require major river crossings such as the GMT1 road crossing of the Tiŋmiaqsiġvik (Ublutuoch) River, although at least one relatively small fish-bearing stream would be crossed (tributary to Blackfish Creek west of GMT1). Lakes along the route would be potential water sources for ice road construction, although only a few of the lakes near the conceptual GMT2 access road route are identified as containing species in addition to ninespine stickleback (Map 3.3-4). In general, there are fewer streams and lakes in the vicinity of GMT2 compared to GMT1.

Under GMT1, Alternatives D1 and D2, the GMT1-GMT2 road would not be built and both GMT1 and GMT2 would require annual ice road construction. This would require more water withdrawal over the life of the proposed GMT1 Project and the conceptual GMT2 Project. Also under the GMT Project development scenario that does not include construction of the GMT1-GMT2 road, up to approximately 10 acres of Deep Open Water without Islands habitat may be indirectly impacted. This habitat type could possibly have indirect impacts with respect to fish as deep water lakes often provided overwinter fish habitat, if connected to fish-bearing streams.

Oil and Gas Exploration and Development Activities

To date, very little abandonment (except for single exploration or development wells) has occurred anywhere on the North Slope. However, abandonment of gravel pads and roads, as well as pipelines, would most likely only have a temporary impact on local aquatic habitats. Removal of problematic stream crossing structures would contribute to positive cumulative impacts on fish by allowing fish to reach habitats that were previously made inaccessible.

It is expected that future seismic surveys and exploration drilling operations will continue using current technologies. Based on evidence that these current techniques effectively mitigate impacts on fish, the localized impacts that could occur would not be expected to accumulate. Airgun-based seismic activities and exploratory drilling in the Chukchi Sea and Beaufort Sea could impact coastal marine fish as well as anadromous fish from the NPR-A, primarily due to disturbance. Nearshore operations would potentially impact more fish than offshore operations since many fish species tend to concentrate along the coast during much of the open-water season. Overall, impacts on fish from seismic activities and exploration in the NPR-A, lands to the east, and in the Chukchi and Beaufort seas would not likely accumulate (BLM 2012, § 4.8.7.7).

The elements of onshore North Slope oil and gas development and production most likely to contribute to future impacts on fish that could accumulate include permanent infrastructure (e.g., roads, pads, pipelines, and causeways) and gravel mining necessary to build the infrastructure. The gravel infrastructure (roads, pads, airstrips) and associated gravel mining associated with oil and gas development and production have caused impacts on fish that have accumulated by impeding fish movements and significantly altering the physical and chemical conditions of fish habitat. Oil and gas development and production to the east of the NPR-A would require additional facilities and infrastructure that would be additive to impacts from NPR-A development. A road connecting Umiat with the Dalton Highway would increase the likelihood of additional impacts to the east of and within the NPR-A. This road to Umiat could also lead to synergistic pressures on fish in the Colville River and its tributaries due to greater use of the area for sport and subsistence fishing (BLM 2012, § 4.8.7.7).

Offshore oil and gas development and production in the Chukchi and Beaufort seas could have additional impacts on fish that could accumulate. Onshore support infrastructure associated with offshore activities would increase the extent of the anthropogenic footprint already projected to occur with NPR-A development, adding to the impacts described above. Causeways, docks, or other similar structures could further hinder or divert marine or anadromous fish migrations along the coast, with each coastline structure exacerbating the impact. This support infrastructure for offshore activities could also have a synergistic effect by increasing the amount or rate of onshore development, which could link into these facilities, roads, and pipelines. Similarly, infrastructure built for coastal onshore oil and gas activities could encourage offshore development, effectively creating a positive feedback loop (BLM 2012, § 4.8.7.7).

Collectively, these cumulative impacts from onshore oil and gas development and production could reduce the size and structure of fish populations, diminish individual fish condition, and shift local fish community composition and species distribution (BLM 2012, § 4.8.7.7).

Impacts on fish from North Slope oil spills on land thus far have not accumulated because the spills have been small and cleanup and rehabilitation efforts have generally been successful. Regardless, given the magnitude of development scenarios, this situation could change, with the probability of spills entering aquatic habitats increasing. Also, as pipelines from onshore and offshore development age and degrade, spills would probably be more frequent and impacts on fish could be additive. Furthermore, oil and gas development in the Chukchi and Beaufort seas would be much more likely to lead to spills that would enter coastal waters and impact anadromous and marine fish. Impacts on fish from even small individual spills in coastal waters could accumulate over time (BLM 2012, § 4.8.7.7).

Contribution of the Alternatives to Cumulative Impacts

Impacts under CPAI’s proposed project are expected to be higher during the construction phase. In general, the greater amount of infrastructure and activities, the higher the expected incidents of impacts to fish and fish habitats. As such, the highest anticipated impacts would occur under Alternatives A and C followed by Alternatives B, D1, and D2. Alternative B would avoid pipeline crossings of two tributary streams, potentially reducing the likelihood of a large spill reaching a river, although under all of the action alternatives there will be at least one water body crossed by a pipeline. Overall impacts under Alternatives A and C are anticipated to be similar. With respect to Alternatives D1 and D2, the lack of road and associated bridges and culverts would avoid many of the potential disruptions to fish and fish habitats, although annual ice roads would be required for the life of the project (long term) to provide access for heavy equipment to the GMT1 site. Alternatives D1 and D2 would also require additional pipelines (diesel and water), which would pose an incremental spill risk.

The overall anticipated impacts for the action alternatives for CPAI's proposed GMT1 Project with respect to fish and fish habitat are expected to be similar with respect to intensity (medium), extent (local), and context (important) and duration (long term). Alternative E would have no impacts to fish or fish habitat.

Conclusion

The direct, indirect, and cumulative impact to fish and fish habitat associated with the proposed GMT1, conceptual GMT2, and other RFF projects would be additive and in some scenarios, could be synergistic. Most of the RFF projects would result in some cumulative impacts to fish and fish habitat to the extent that they increase the footprint of gravel pads and roads. Projects which introduce infrastructure across fish-bearing streams or are perpendicular to hydrologic flow would have a greater cumulative impact to fish and fish habitat. Although cumulative impacts are expected to have a negligible effect on fish populations in the project study area or in the Harrison Bay and Lower Colville River watershed. Most RFF projects would only have additive cumulative impacts in the localized area of development. Alternative E would have no incremental adverse cumulative impact to fish and fish habitat.

The BLM (2004) found that the direct, indirect, and cumulative impacts to fish and fish habitats are expected to be localized, minor, additive, and are not expected to be synergistic. Although there is a potential for large impacts to fish from large oil spills, the risk of such spills is relatively small. The probability is higher for smaller spills, but the impacts from such spills, if they entered freshwater habitats, would likely be small, temporary, and additive and unlikely to severely affect fish populations, especially in light of control and cleanup activities implemented in response to spill events (BLM 2004, § 4G.6.2). Impacts on fish from North Slope oil spills on land thus far have not accumulated because the spills have been small and cleanup and rehabilitation efforts have generally been successful (BLM 2012, § 4.8.7.7). A large spill reaching Crea Creek or the Tiŋmiaqsiġvik (Ublutuoch) River could have long-term adverse impact to fish; the risk of such a spill is considered unlikely. No adverse effect to essential fish habitat is expected from project facilities.

Impacts to fish from the current proposed project are within the range considered by BLM (2012, § 4.8.7.7).

If predicted shifts in physiochemical characteristics of the environment occur with climate change, this could contribute to an increased level of cumulative impacts on fish in the Arctic. For example, if water temperatures increase excessively, metabolic stress for many fish species would be greater and result in lower tolerance thresholds to land-use impacts. Changes in hydrologic regimes could include timing and quantity of flow and could contribute to fish passage problems at stream channel or wetland road crossings. Potential impacts from climate change could be positive for fish, as well. If the ice-free period for freshwater and marine habitats increases significantly, this would mean a longer feeding season for fish and shorter periods of stress during winter. A moderate increase in water temperature could also contribute to a more productive feeding season and further enable fish to survive the winter and additional stress from oil and gas activities (BLM 2012, § 4.8.7.7).

4.6.9.3 Birds

As noted in Section 4.3.3, all of the action alternatives associated with CPAI's proposed GMT1 Project have the potential, via direct and indirect impacts, to affect birds, bird behavior, and their nesting, brood-rearing, foraging, and molting habitats through habitat loss, alteration, and disturbance, such as physical changes resulting in loss of habitat, displacement from habitats altered by vehicle noise, dust deposition, and thermokarst, attraction to habitats altered by thermokarst and early green-up adjacent to gravel infrastructure, or disturbance from increased aircraft noise or visual stimuli. Cumulative impacts to birds are discussed more fully in BLM (2004, § 4G.6.3), and BLM (2012, § 4.8.7.8).

Past and Present Impacts and Their Accumulation

The BLM (2004) found that the additive impacts of past, present, and RFF activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope BLM (2004, § 4G.6.3.2, p. 1273).

Overall direct mortality impacts due to collisions with vehicles, aircraft, buildings, pipelines, powerlines and communications towers were estimated to occur only at very low levels in the North Slope oilfields during present and future developments. BLM pointed out that NRC (2003) concluded that reduced productivity was the most substantial cumulative impact to bird populations due to oil and gas development activities, and that determination was based on decreased productivity due to increased levels of predators attracted to the development area. The NRC (2003) review focused on the Prudhoe Bay Oilfield, with most studies conducted through the mid 1990s when the landfill and dumpsters were accessible by gulls, ravens, bears and foxes. Since the late 1990s, the landfill has been fenced to exclude bears, and animal proof dumpsters have been installed throughout North Slope oilfields (BLM 2004, § 4G.6.3.2, p. 1273).

More recently, a four year avian study on the ACP further corroborated this concept with evidence of increased predation risk for passerine nests within five kilometers of oil field infrastructure (Liebezeit et al 2009). When the relationship was tested by avian species individually, not all avian groups (notably semipalmated and pectoral sandpipers) exhibited the same findings (Liebezeit et al 2009). The inconsistent results among species may have been due to variability in survey year, conditions, or sites. The following recommendation was provided for gaining a better understanding of this notable potential cumulative impact to avian species, "We recommend targeted management actions to minimize anthropogenic effects and suggest new research needed on this issue as expanding development is planned for the ACP of Alaska. In particular, we recommend research on demography of key predators and their importance with respect to nest survival, and experimental studies that better address challenges posed by high natural variability (Liebezeit et al 2009)."

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Increased harvests resulting from increased access to remote areas via new roads, especially from subsistence hunting, were characterized as a serious cumulative factor. Subsistence harvest within the ASDP area would affect approximately 2,800 birds and eggs, compared to an estimated 950 nesting waterbirds and ptarmigan affected by habitat loss, alteration, and disturbance caused by reasonably foreseeable future development within the Plan Area.

The BLM (2012, § 4.8.7.8) analyzed potential cumulative impacts across the North Slope to non-special status bird species occurring in the NPR-A, and conclusions are discussed below.

Impacts on birds from non-oil and gas activities that are part of BLM operations or authorizations were not expected to accumulate.

GMT 2 Development

Potential impacts to birds from the GMT2 Project are expected to be similar to those of the GMT1 Project. However, the GMT2 Project study area has the potential to impact different proportions of specific bird habitats, as habitat types may occur in different quantities and locations throughout the conceptual GMT2 Project study area.

Under a development scenario that includes construction of the GMT1-GMT2 road, direct and impacts to vegetation in the GMT2 Project area would affect bird habitats. The vegetation types affected would include tussock tundra, moist sedge-shrub tundra, old basin wetland complex, wet sedge meadow tundra, moist tussock tundra, moist sedge-shrub meadow, patterned wet meadow, nonpatterned wet meadow, and sedge marsh in various quantities as described in *Vegetation and Wetlands* discussion.

Under a development scenario that does not include construction of the GMT1-GMT2 road, direct impacts to vegetation in the GMT2 Project area would affect bird habitats. The vegetation types affected would include tussock tundra, moist sedge-shrub tundra, moist tussock tundra, moist sedge-shrub meadow, old basin wetland complex, patterned wet meadow, nonpatterned wet meadow, sedge marsh, moist dwarf shrub, and deep open water without islands in various quantities as described in *Vegetation and Wetlands* discussion.

Additionally, lakes along the proposed GMT1-GMT2 road would be potential water sources for ice road construction; likewise, these lakes could be used as sources for ice road construction if the GMT1-GMT2 road is not constructed (i.e., GMT1 Alternatives D1 and D2). This use of water could potentially impact bird habitat or food sources in affected lakes. Impacts under a roadless development scenario would be greater as both GMT1 and GMT2 would require annual ice road construction, which would require more water withdrawal over the life of the proposed GMT1 Project and the conceptual GMT2 Project.

Together, the cumulative impacts of GMT2 and GMT1 on birds would be additive.

Oil and Gas Exploration and Development Activities

BLM expected that the impacts of facilities for future projects on bird populations, though additive, would be substantially less than those of past projects because of the smaller areas involved.

The BLM (2012, § 4.8.7.8) analyzed potential cumulative impacts across the North Slope to non-special status bird species occurring in the NPR-A and came to the following conclusions: Oil and gas development in the Chukchi and Beaufort seas offshore leases, construction of a road between Umiat and the Dalton Highway, and construction of a commercial gas pipeline and unconventional oil and gas development east of the NPR-A could cause direct and indirect impacts to bird habitat. Large discoveries of oil in the Chukchi or Beaufort seas offshore could make additional developments in the northern NPR-A more economically feasible, resulting synergistically in even more habitat and disturbance impacts to birds in the NPR-A. Cumulative impacts on bird productivity and abundance are likely to be long-term and could result in adverse impacts on productivity of some species of birds.

Contribution of the Alternatives to Cumulative Impacts

Overall with respect to birds, all of the action alternatives would have minor impacts. All future impacts will be additive to the impacts to birds and bird habitat that have accumulated in the past and persist today, but in the context of the entire North Slope west of the Canning River, these cumulative impacts are expected to be relatively small. The 2012 IAP/EIS found that if current rates of development continue into the future, about 3,750 additional acres of bird habitat would be lost through the construction of pads, roads, and airstrips through the year 2100 and 750 acres by gravel mines. About 27,000 additional acres would be indirectly affected by dust, changes in hydrology, and thermokarst through 2100. The impacts of the proposed GMT1 Project are within the range considered by BLM (2012).

With respect to CPAI's proposed project, direct impacts to bird habitats from gravel placement would be greater for Alternative C than Alternatives A, B, and D1 and D2. The number of flights required for transport of personnel and supplies needed for operation of the drill site and facilities for Alternatives D1 and D2 is expected to result in impacts of low intensity disturbance and displacement to birds in the project study area and surrounding area resulting in a limited, regional level extent of impact. The air traffic at the GMT1 facility under Alternatives D1 and D2 would be additional to the existing activity in the APF and Nuiqsut airspaces, and would continue for long term while additional flights required under Alternatives A, B, and C would drop off after construction is completed.

Alternative C would have greater direct and indirect impacts than the other action alternatives with respect to direct gravel impact to high-value habitat, fugitive dust, and mortality risk from vehicle strikes. Alternative B, while having a similar road length to A, would affect greater area of potential high-value waterbird habitat than Alternative A, due to its more southern route through drained lake basins. Alternative A would have the least amount of potential cumulative impact to birds among all of the action alternatives with other direct and indirect impacts predicted to be less than Alternatives B, C, D1, and D2.

Alternative E would not have any positive or negative impacts on birds.

Conclusion

Direct impacts to birds associated with the GMT1 Project are expected to be localized and minor in nature with no adverse impacts expected at the population level. The direct, indirect, and cumulative habitat loss of bird habitat generally would be of low intensity, long-term in duration, localized, and minor. Overall, it is anticipated that less than 1 percent of the total bird habitat in the project study area would be impacted by any single action alternative.

If climate change over the next several decades were to result in substantial changes in weather patterns, vegetation types and distribution, and insect abundance, habitat disturbance impacts from oil and gas activities could be exacerbated additively, and perhaps synergistically, and extend beyond the life of the oil and gas fields. Changes in vegetation as a result of climate change would directly impact the amount and types of habitat available to tundra nesting birds. Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the NPR-A, potentially leading to synergistic impacts to bird habitat (BLM 2012, § 4.8.7.8).

Oil spills would not significantly add to cumulative impacts, except for an unlikely to very unlikely large spill to aquatic habitats.

Based on breeding density, the CEAA may be considered a high-value resource for some avian species (Walker 2012). Further development in the CEAA may result in a cumulative reduction in avian habitat and an increase in disturbance. These impacts are not expected to cause pervasive cumulative impacts as the impacts of CPAI's currently proposed and RFF projects on bird populations, though additive, would be less than those of past projects because of the smaller areas involved and the large amount of avian habitat existing in the area of evaluation. The contribution from the GMT1 Project is expected to be negligible with respect to the cumulative impacts analysis area, and would be a decrease in acreage footprint from that approved in BLM (2004a). Alternative E would not have any incremental cumulative impacts to birds.

The combination of impacts from GMT1, coupled with impacts from the conceptual GMT2 and other RFF projects in the Nuiqsut and Umiat areas, would be additive, long-term, and localized with the contribution from the GMT1 Project having overall minor impact to birds. Impacts from RFF projects are anticipated to be of a similar nature as those of the proposed project considering the range of action alternatives. A synergistic effect to bird habits at Umiat and the Nuiqsut area are not expected. The overall cumulative impact to birds for the Harrison Bay and Lower Colville River watersheds for the proposed project, conceptual GMT2, and other RFF projects is considered to be minor.

4.6.9.4 Terrestrial Mammals

Caribou

Both the TH and the CAH use the project study area in low densities for calving, and for winter/summer forage during one or more seasons each year. The TH tends to use the area more than does the CAH. Although the footprint of facilities is a good indicator of potential impact to caribou, the activity occurring at the production pad, road and airfields produce different impacts to caribou.

Cumulative impacts on caribou as a result of habitat loss and disturbance to animals are discussed in general terms under impacts on terrestrial habitats. Caribou may be affected by temporary ice roads and pads, and by disturbance caused by construction and operations, especially during migration and calving periods. Cumulative impacts to terrestrial mammals are discussed more fully in BLM (2004, § 4G.6.4.1), and BLM (2012, § 4.8.7.9).

Past and Present Impacts and Their Accumulation

Cumulative oil development in the Prudhoe Bay-Kuparuk area encompasses more than 500 square miles, and hundreds of miles of gravel roads cross a large portion of the CAH calving range. Approximately 2,500 acres of habitat have been directly impacted by non-oil and gas development on the North Slope and those impacts continue to persist. Oil and gas activities have caused an additional habitat loss or alteration of over 17,000 acres that persist today. Since most of these impacts are associated with ongoing residential and non-oil and gas commercial development, or oil and gas activities, these impacts to habitat are additive to future impacts and would be likely to persist for several decades or more in the absence of an active reclamation program (BLM 2012, § 4.8.7.9).

Oil and gas development has altered the distribution of female CAH caribou during the calving season and interfered with caribou movements between inland feeding areas and coastal insect-relief areas. Female caribou may also experience lower parturition rates when in close proximity to oil field development. It has also been suggested that declines in CAH caribou productivity in the early 1990s may have been the result of additive impacts of oil field development and high insect activity, although populations of TH and CAH caribou have increased between the mid-1970s and 2008. Thus, disturbance of caribou due to oil field development may adversely affect caribou populations, but these impacts are not readily apparent based on population trends. The WAH, whose range does not overlap the current oil fields and whose insect-relief habitat is not on the coastal plain, increased in numbers until about 2003. Since then, population estimates suggest a stable or slowly declining population (BLM 2012, § 4.8.7.9).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

As described in BLM (2004), cumulative impacts on caribou from road traffic would be expected to involve short-term displacement, especially during calving when maternal caribou avoid areas within 1.2 to 2.5 miles (2-4 km) of roads, but generally would not be expected to have measurable effect on herd abundance or large-scale patterns of distribution (BLM 2004, p. 1276).

Non-oil and gas activities on the North Slope would continue to disturb mammals and cause the loss of minor amounts of mammal habitat. In most cases, loss of habitat would be temporary, lasting only a few years. Distant Early Warning Line Stations and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Furthermore, villages are likely to increase in size causing the loss of additional habitat. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century (BLM 2012, § 4.8.7.9).

GMT 2 Development

The impact of conceptual GMT2 Project would depend on the alternative selected for the GMT1 Project (i.e., road or roadless construction). Impacts associated with GMT2 and westward migration of activities into the NPR-A would result from increased vehicle or aircraft traffic in an area where there currently is none. The duration of impact could be extended if GMT1 Alternative D2 (seasonal drilling) is selected as development of GMT1 would also be extended further in time.

The addition of the GMT2 Project could add increased hunting pressure to caribou herds due to increased access via a westward expansion of development, although the RFF GMT2 Project is not located within the current high-density calving ranges of the TH or CAH caribou. Under both construction scenarios (GMT1-GMT2 road constructed or not), potential impacts to caribou could occur based on increased noise (vehicles, aircraft, etc.), increased vehicle traffic, loss of habitat, etc. If GMT2 is constructed with road access, there would be continued traffic on the CD5-GMT1 road, until abandonment and reclamation occurs at GMT2.

Oil and Gas Exploration and Development Activities

Based on past seismic activity on the North Slope, the BLM assumes continuation of the recent experience of three to four seismic crews active in NPR-A each winter. Exploration sites with gravel pads, disturbed areas around these pads, exploration airstrips, and gravel exploration roads have been replaced in recent years by ice roads, airstrips, and drilling pads to reduce the costs and environmental effects of gravel construction. Impacts from ice roads and pads are short-term and are not expected to accumulate. As a result, only a small amount of habitat is likely to be affected long-term by exploration activities (i.e. seismic) (BLM 2012, § 4.8.7.9).

Oil and gas development in the Chukchi and Beaufort, construction of a road between Umiat and the Dalton Highway, construction of a commercial gas pipeline and unconventional oil and gas development east of the NPR-A could cause direct, terrestrial impacts on up to 12,630 acres of mammal habitat and indirect impacts on 37,585 acres (BLM 2012, § 4.6.7.8). Although direct habitat loss from cumulative oil and gas development on the North Slope would affect only a small proportion of the total area, indirect habitat loss, or functional loss, could result from long-term displacement of wildlife from the vicinity of oil and gas activities and could involve a much larger area. Future gas and both conventional and unconventional oil exploration and development between the Colville and Canning rivers, in addition to construction of an Umiat road and a commercial gas pipeline, would increase the amount of activity within the CAH caribou range. Future offshore leases in the Beaufort and Chukchi seas could expose TH and CAH caribou to additional activities related to oil and gas development (through onshore facilities to support offshore leases). Future leases in the NPR-A could expose a large number of the TH caribou to exploration and development activities on their summer and winter grounds, and during migration. Animals from the WAH caribou would also be exposed to development activities in their summer range.

Depending on the alternative selected the Umiat road(s) project could have negative impacts to caribou migration to the extent that it would intersect spring/fall migration routes between the Teshekpuk Lake area and the central Brooks Range (Maps 4.3-3 and 4.3-4); the Umiat road(s) could also have significant negative impacts on subsistence activities affecting primarily Anaktuvuk Pass and Nuiqsut. The Umiat road could have traffic amounts similar to the Dalton Highway opening a large, currently non-easily accessible, area to the public. Non-local hunters could use the road to hunt caribou. The road would result in easy public access to the Colville River and thus by boat to the Colville Delta and Beaufort Sea as well as to any navigable tributary of the Colville. The Meltwater Corridor alternative for a road to Umiat could limit public access, thus offsetting negative impacts (AK DOT 2012). The road, traffic, and hunters would be in the path of north-south migration routes and could potentially affect caribou from the TH and CAH during some autumn and spring migrations.

Construction of gas pipelines would have short-term effects on wintering caribou if caribou are present during construction. This could affect both the CAH and TH. Once buried, the pipelines would have no further disturbance effects except for brief periods of maintenance. It is anticipated that these effects would be minor and would not accumulate. A much greater impact from these pipelines would be effects from all the gas development that a pipeline would make possible (already analyzed under all alternatives) within the NPR-A and to the east.

The increase in area disturbed by oil and gas development on the North Slope has slowed in recent years (above). If the current rates continue into the future for areas east of the NPR-A and the ratio of gravel mine acres to gravel footprint acres remains about 5:1, about 3,750 additional acres of habitat would be destroyed for construction of pads, roads and airstrips through the year 2100 and 750 acres by gravel mines. About 27,000 acres (6:1 ratio) would also be indirectly affected by dust, changes in hydrology, and thermokarst. The area between the Colville and Canning rivers represents much of the range of the CAH. In some winters, this area is also important habitat for some TH caribou (BLM 2012, § 4.6.7.8).

The spills associated with reasonably foreseeable future projects could affect terrestrial mammals on the North Slope. Cumulative effects would depend on the number, size, location, and timing of spills, the type and effectiveness of the oil spill response, and the species and population of terrestrial mammals exposed to the spill. Potential oil spills from both offshore and onshore oil activities would be likely to have a small effect on terrestrial mammals because comparatively low numbers of animals would be expected to be disturbed or contaminated, or to ingest contaminated food sources and die as a result.

Abandoned gravel pads and roads could provide some benefits as insect-relief sites for caribou, and provide special habitat for burrowing species such as foxes. The ultimate fate of the gravel pads and roads would not be known until closer to the end of the production field life. Permitting agencies could require that gravel be removed, in part or total, and the tundra revegetated. If other uses are determined by the permitting agencies to be preferable, the agencies could allow the permittee to leave the gravel pads in place, either revegetated or not revegetated.

Contribution of the Alternatives to Cumulative Impacts

The combined GMT1 and conceptual GMT2 Project would have the greatest impact under Alternative C. Impacts associated with vehicle traffic would be greatest under Alternative C, due to the increased distance vehicles would have to travel. Alternatives D1 and D2 would have no permanent (gravel) road traffic, but the absence of impacts from roads are likely offset by the increase in impacts from air traffic at the Nuiqsut Airport, APF, at GMT1, and at the conceptual GMT2 site. The use of aircraft at four airports that are 11 to 19 miles apart under Alternatives D1 and D2 is expected to have the greatest overall impact to caribou. Data are presented for caribou in Sections 3.3.1 and 4.3.1, *Vegetation and Wetlands*, and Sections 3.3.4 and 4.3.4, *Mammals*.

In addition to direct and indirect impacts to caribou from the GMT1 Project and conceptual GMT2 Project, the addition of the GMT2 Project could add increased hunting pressure to caribou herds due to increased access via a westward expansion of development. As noted in Section 4.3.4, the GMT1 Project and reasonably foreseeable GMT2 Project are not located within the current high-density calving ranges of the TH or CAH caribou.

Conclusion

Overall, industry and agency actions on the North Slope are expected to have minor impacts to caribou herd productivity. The area between the Colville and Canning rivers represents much of the range of the CAH. In some winters, this area is also important habitat for some TH caribou. Cumulative impacts on caribou are within the range of cumulative impacts from oil and gas activities considered by BLM (2012), which estimated there would be a direct reduction of 43,150 acres of caribou habitat by 2100 (Table 4.6-8). Alternative E would have no incremental adverse cumulative impact to caribou populations and distribution on the North Slope. The contribution from all alternatives of the GMT1 Project is expected to be minor or negligible, and synergistic effects at the herd level would not be anticipated. This is within the range of cumulative impacts addressed in BLM (2004).

Impacts to all mammalian populations from the combined impacts of vegetation change (from both human activities and climate change) and climate change induced weather patterns could prove to be synergistic rather than additive. Impacts from the current project are within the range considered in 2012. The TH calving distribution has been expanding in recent years, so future impacts are difficult to predict. Some caribou could be displaced from insect-relief areas in the summer, but this impact could be offset by the creation of new insect-relief areas.

Grizzly Bear, Fox, and Other Terrestrial Mammals

Impacts under the proposed project's action alternatives are expected to be higher during the construction phase. Construction of the project action alternatives would result in long-term, direct and indirect habitat loss due to gravel extraction and the placement of gravel for roads, pads, and, under Alternatives D1 and D2, an airstrip (Table 4.3-15). Once construction is completed, the drilling and operation phase would affect terrestrial mammals and their habitats through medium-term habitat alteration and disturbance, medium-term potential for vehicle collision and mortality for the sake of human safety, and medium-term altered survival or productivity.

The cumulative impacts to grizzly bear, foxes, and other terrestrial and marine mammals would be additive when considering the proposed project and all other RFF projects, which would extend the area of impact to a much larger area. Cumulative impacts to terrestrial mammals are discussed more fully in BLM 2004, § 4G.6.4.1, and BLM 2012, § 4.8.7.9.

Past and Present Impacts and Their Accumulation

Approximately 2,500 acres of habitat have been directly impacted by non-oil and gas development on the North Slope and those impacts continue to persist. Oil and gas activities have caused an additional habitat loss or alteration of over 17,000 acres that persist today. Since most of these impacts are associated with ongoing residential and non-oil and gas commercial development, or oil and gas activities, these impacts to habitat are additive to future impacts and would be likely to persist for several decades or more in the absence of an active reclamation program (BLM 2012, § 4.8.7.9).

Grizzly bear, foxes, and other terrestrial mammals have been little affected, or some may even have benefited from development on the North Slope. Subsistence and recreational hunting pressure has likely increased from historic levels due to increases in human populations and better access to the North Slope. Still, based on subsistence harvest surveys, subsistence harvest of mammals has been relatively stable since the early 1990s. Based on population trends of game mammals on the North Slope, neither hunting nor other human activities appear to be adversely affecting mammal populations (BLM 2012, § 4.8.7.9).

Future Impacts and Their Accumulation

The BLM (2012, § 4.8.7.9) analyzed potential cumulative impacts across the North Slope to mammals occurring in the NPR-A. Some impacts that could prove to be synergistic rather than additive are the combined impacts of vegetation change (from both human activities and climate change) and climate change induced weather patterns on the productivity of all mammalian populations; vegetation change, climate change induced weather patterns, increased insect activity, and year-round development impacts on the productivity of caribou populations; and predation, oil development and climate change on muskoxen. Mammalian populations have inherent levels of resilience, through behavioral flexibility and movement, to change in different factors affecting survival and productivity. Development of oil and gas in the NPR-A, alone or in combination with similar development elsewhere on the North Slope or offshore, could result in a decrease in this level of resilience. For some species, the magnitude of decrease may be adequate to result in negative population level responses.

Activities Not Associated With Oil and Gas Exploration and Development

Non-oil and gas activities on the North Slope would continue to disturb mammals and cause the loss of minor amounts of mammal habitat. In most cases, loss of habitat would be temporary, lasting only a few years. Distant Early Warning-Line and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Furthermore, villages are likely to increase in size causing the loss of additional habitat. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century (BLM 2012, § 4.8.7.9).

GMT 2 Development

Potential impacts from the conceptual GMT2 Project are expected to be similar to those associated with the GMT1 Project. Given the proximity of GMT2 to GMT1, direct and indirect impacts to specific habitats from both projects would be cumulatively additive. Construction and operation of the GMT2 Project would allow for increased access to westward habitat types, and thus species residing within them, which has the potential to increase hunting pressure on species present in the areas in or adjacent to the GMT2 Project.

Although the footprints would increase when GMT1 and the conceptual GMT2 are combined, the cumulative impacts to grizzly bear, foxes and other terrestrial and marine mammals are expected to be similar to those described for GMT1 and its action alternatives due to the generally widely dispersed habitat requirements of these species; these impacts are expected to be minor under Alternatives A, B, and C and moderate under Alternatives D1 and D2.

Oil and Gas Exploration and Development Activities

The BLM (2004) found that oil development on the North Slope would likely result in increased abundance of Arctic foxes near development areas, which may present a rabies health hazard to humans in the oilfield areas. The attraction of grizzly bears to human refuse may lead to the loss of bears as the result of interactions with humans, which could lead to an eventual decline in bear abundance near development areas. The cumulative impacts on muskoxen, moose, wolves, wolverines, and small mammals from oil and gas development on the North Slope would be local and short term, within 1 to 2 miles of exploration or development facilities, and with no adverse impacts on populations (BLM 2004, § 4G.6.4.1).

Of the RFF projects, the Umiat road and offshore development with its associated onshore development would likely have the greatest additive impact based on the area affected. In the case of the Umiat road, with 102 miles of proposed roadway, mammals on the North Slope, which may have experienced little impact to date, could be impacted more widely based on the expanded network of development and farther reaching access for hunters. The addition of the Colville River Road Access would complete a road connection providing year-around vehicle access to fish and wildlife resources along the Colville River and its delta, as well as to estuarine and marine resources along the coast. Offshore development and development of onshore support facilities would have cumulative additive impacts to marine mammals and their habitats. This impact would be anticipated to be long-term, localized, and depending on the species and location would range in intensity.

Contribution of the Alternatives to Cumulative Impacts

Impacts to terrestrial mammals for the action alternatives are presented in Section 4.2.1. Overall, Alternatives A, B, and C are expected to result in minor impacts to terrestrial mammals. Alternatives D1 and D2 would be expected to result in overall moderate impacts to terrestrial mammals. Alternatives A, B, and C would have similar impacts to terrestrial mammals, with impacts due to habitat loss and alteration expected to be of minor intensity, long-term duration, and local extent (Table 4.3-17). The affected resources, which in this case include important subsistence food resources for the local community, are rated important because caribou fill a distinctive ecosystem and ecological service role within the locality and region.

Some mammal populations (e.g., fox and grizzly bear) have been little affected from development on the North Slope. The greatest threat to grizzly bears may be increased hunter access under Alternatives A, B, and C, as well as a potential increase in mortality in the defense of life and property at the GMT1 and the conceptual GMT2 sites. Fox populations may increase, but mitigation measures should minimize any potential expansion of fox populations in the project study area.

Conclusion

The cumulative impacts to grizzly bear, foxes, and other terrestrial and marine mammals would be additive when considering other RFF projects, which would extend the area of impact to a much larger area.

If climate change over the next several decades were to result in widespread changes in vegetation composition and insect abundance, disturbance effects of oil and gas activities to terrestrial mammals could be exacerbated, and could extend beyond the life of the oil and gas fields. If these cumulative effects were to result in reductions in caribou populations, there could also be a reduction in the abundance of predators such as wolves, bears, and wolverines. Other impacts that could prove to be synergistic rather than additive are the combined effects of vegetation change (from both human activities and climate change) and climate change induced weather patterns on the productivity of all mammalian populations; vegetation change, climate change induced weather patterns, increased insect activity and year-round development effects on the productivity of caribou populations; and of predation, oil development and climate change on muskoxen.

The implementation of new potential mitigation measures in conjunction with Lease Stipulations and Best Management Practices, required for the protection of terrestrial mammal resources under all alternatives, should reduce the cumulative effect to terrestrial mammal resources from oil and gas, and non-oil and gas activities.

4.6.9.5 Marine Mammals

Marine mammals are not expected to occur either within the project study area, or north of the project study area along the coastline of Harrison Bay. The exceptions are polar bear (which are covered under Threatened and Endangered Species), spotted seal, bearded seal, and the beluga whale. Other marine mammals, which rarely occur in the Beaufort Sea, are not expected to experience actual or cumulative impacts from the development. These species include ribbon seal, gray whale, minke whale, narwhal, harbor porpoise, and killer whale. Sections 3.3.4 and 4.3.4 discuss the remote chance of spotted seal, bearded seal, or beluga whales being impacted during an oil spill reaching open water. If spotted seals, bearded seals, or beluga whales were to come into contact or ingest oil, it could lead to negative impacts for survival of individuals and productivity of the local population, especially if the occurrence was repetitive.

The location of the GMT1 Project is such that impacts to marine mammals are considered to be minor. Cumulative impacts to marine mammals are discussed more fully in BLM 2004, § 4G.6.4.2, and BLM 2012, § 4.8.7.10.

Past and Present Impacts and Their Accumulation

The Arctic is often considered to be a pristine environment and relative to other areas, much of the Arctic is pristine. There have long been substantial human activities and impacts in the Arctic. For gray whales, the most dramatic population level impacts were associated with commercial whaling that occurred from the mid-nineteenth through early twentieth centuries. More recently, climate change and increasing human activities (particularly with regard to oil and gas activities) may be having as yet uncertain, but, possibly, substantial impacts. Limited data preclude the quantitative assessment of cumulative impacts for most marine mammal populations. Other than gray whales, abundance estimates are unreliable and population trends are poorly understood or completely lacking for non-special status marine mammals in the Beaufort and Chukchi seas (Allen and Angliss 2011). Understanding and differentiating population level impacts from climate change impacts, oil and gas activities, or other factors is extremely difficult. Some information is available on how individual animals respond to oil and gas activities but the observations are short term and provide little usable data for longer-term or population-level impacts (BLM 2012, § 4.8.7.10).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

In light of credible modeled predictions that the extent of summer sea ice will continue to decrease and reach near zero coverage within only a few decades (Wang and Overland 2009), commercial shipping throughout the Arctic is likely to increase in the future (Arctic Council 2009). Larger numbers of vessels in the Beaufort and Chukchi seas will put more sound into the water, potentially causing more marine mammals to deflect or be disturbed, and masking sounds the animals use to communicate or to sense their environment. Increased traffic would increase the risk of ship strikes and the potential for adverse impacts associated with bilge discharge or spilled fuel (BLM 2012, § 4.8.7.10).

Although commercial harvest of fish resources in the Arctic Management Area is prohibited until there is sufficient information available to *"support sustainable management of a commercial fishery"* (NPFMC 2009), commercial fishing could increase in the future. Commercial fisheries on the North Slope are currently generally small coastal operations that likely affect only a small number of marine mammals. If large commercially exploitable stocks of fish are found in the region, increased numbers of fishing vessels could expand northward into Arctic waters. Commercial fisheries would potentially compete with seals and beluga whales for prey species, and seals and whales could suffer increased mortality from entanglement in fishing nets and other gear. Marine mammals may also be displaced from preferred feeding habitats by noise and visual disturbances caused by fishing activities (BLM 2012, § 4.8.7.10).

As public awareness of the Arctic increases, there will likely also be a continued increase in tourism and science. Impacts associated with these activities will be similar to those described for fishing and commercial shipping (BLM 2012, § 4.8.7.10).

GMT 2 Development

Due to the location of the conceptual GMT2 Project being similarly distant from the coast, impacts are expected to be minor. Further development in the cumulative impacts evaluation area related to the conceptual GMT2 development may also impact beluga whales, spotted seal, and bearded seal through a cumulative increase in disturbance. These impacts are not expected to cause pervasive cumulative impacts, as the impacts of the currently proposed and RFF projects on beluga whales, spotted seal, and bearded seal, though additive, would be less than those of past projects due to the on-shore nature of the facilities. Impacts to marine mammals would be additive, but still minor.

Oil and Gas Exploration and Development Activities

Oil and gas development could affect these species as a result of noise and disturbance. Disturbance associated with air traffic could result in potential adverse impacts to distribution and cause shifts in areas of regular use, such as Colville River Delta haul-outs for spotted seal.

The possible marine activities associated with oil and gas and other activities within the NPR-A are relatively small compared to the many other large changes that are occurring in the Arctic Ocean. Therefore, activities associated with NPR-A will likely have only a small contribution to cumulative impacts to marine mammals in the Beaufort and Chukchi seas.

The BLM (2004, § 4G.6.4.2) found that onshore development with associated facilities along the Colville River would expose some spotted seals to increased noise and disturbance associated with vessel and air traffic. Future facilities in river deltas and elsewhere along the coast and near rivers would have the potential to affect seals and whales. Beluga have already been exposed to oil-exploration activities in the Beaufort Sea, including seismic surveying, drilling, air and vessel traffic, dredging, and gravel dumping. A future increase in these activities in the Beaufort Sea (especially barge traffic to the North Slope, and some icebreaker activity to support oil exploration) could affect how seals are distributed near the activity for one season (less than one year) during high levels of activity. However, some seals would adapt to marine and air traffic, industrial noise, and human presence. Displacement from cumulative industrial activities is not likely to affect the overall abundance, productivity, or distribution of seals and beluga whales in Alaska's Beaufort Sea (BLM 2004, § 4G.6.4.2).

Contribution of the Alternatives to Cumulative Impacts

The location of the GMT1 Project is such that impacts to marine mammals are considered to be minor under all the action alternatives.

Conclusion

The combination of impacts from GMT1 coupled with impacts from the conceptual GMT2 and other RFF projects in the Nuiqsut and Umiat areas, would be additive, long-term, and localized. The contribution to cumulative impacts from the GMT1 Project would have negligible direct, indirect, and cumulative impacts to marine mammals. Impacts from RFF projects, other than offshore development, are anticipated to be of a similar nature to those of the proposed project. Offshore development and development of onshore support facilities would have cumulative additive impacts to marine mammals and their habitats. This impact would be anticipated to be long-term, localized, and depending on the species and location would range in intensity. The overall cumulative impact to marine mammals, notably beluga whales, spotted seal, and bearded seal, for the Harrison Bay and Colville River delta for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible.

The BLM (2012, § 4.8.7.10) found that the contribution of impacts from the NPR-A to the overall cumulative impacts to non-special status marine mammals will likely be relatively small.

Climate change, offshore oil and gas exploration, development and production, and commercial shipping and fishing could have large impacts on marine mammals in the future. Those impacts will be from anthropogenic sounds, ship strikes, and possible discharges, including spilled oil. Species resistance or resilience to the changes associated with climate change as well as feedback and interactions remain highly uncertain (BLM 2012, § 4.8.7.10).

4.6.9.6 Threatened and Endangered Species

Threatened and endangered species are known to occur in the project study area and cumulative impacts evaluation area. Overall impacts to threatened and endangered species are expected to be minor, localized, and negligible on a population basis. The following evaluations for threatened and endangered species reflect the impacts from GMT1 together with RFF projects in the Nuiqsut and Umiat areas. Unless otherwise noted in the subsequent discussions, Alternative E would have no incremental adverse cumulative impact to threatened and endangered species populations and distribution on the North Slope.

Cumulative impacts to threatened and endangered (or special status species) are discussed more fully in BLM 2004, § 4.G.6.5, and BLM 2012, § 4.8.7.11. Individual species are discussed in the following sections.

Spectacled and Steller's Eider

Section 3.3.5.1 discusses the distribution, population, and habitat associations of the spectacled eider. There is no designated critical habitat for the spectacled eider on the North Slope. Multi-year surveys show the spectacled eider is present in the project study area; with the species occurring in high concentrations on the Colville River delta and north of the NVN. The closest spectacled eider nest is about 0.8 mile from an existing or proposed facility. Habitats utilized by the spectacled eider adjoin the conceptual location of the road, production pad, and pipeline system of the proposed GMT1 Project. The spectacled eider could be impacted by the proposed project under the action alternatives as a result of direct habitat loss, disturbance and displacement, obstruction of movement, and mortality.

Section 3.3.5.2 discusses the distribution, population, and habitat associations of Steller's eider. There is no designated critical habitat for the Steller's eider on the North Slope. Multi-year surveys show Steller's eiders are present in the general area to the north and west of road and pipeline system to the GMT1 and the conceptual GMT2 production pad, road, and pipeline system, but not within the project study area. The type of impacts to the Steller's eider for all the proposed project alternatives and RFF projects are expected to be the same as for the spectacled eider, as described above. It is noted however, that the probability of impacts to the Steller's eider is considerably lower because they occur infrequently in the project area. The overall cumulative impact to spectacled and Steller's eiders for the Harrison Bay and Lower Colville River watersheds for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible. Cumulative impacts to threatened and endangered (or special status species) are discussed more fully in BLM 2004, § 4.G.6.5, and BLM 2012, § 4.8.7.11.

Past and Present Impacts and Their Accumulation

Approximately 2,500 acres of habitat on the North Slope have been directly impacted by non-oil and gas development and those impacts continue to persist. Oil and gas activities have caused an additional habitat loss or alteration of over 17,000 acres that persist today. Although only a small portion of this area would have been used by threatened and endangered species, much of it has occurred along the coastline and near Barrow, areas where spectacled and Steller's eiders and yellow-billed loons are often found. Whether these impacts are associated with non-oil and gas residential and commercial development, or oil and gas activities, the impacts to habitat are additive to future impacts and would likely persist for several decades or more in the absence of an active reclamation program. The typical gravel pad and amount of roadway needed to service a development have become smaller over time, reducing the amount of habitat lost due to development as compared to past levels (BLM 2012, § 4.8.7.11).

Direct and indirect impacts from disturbance, of many different types, are difficult to measure, but are likely accumulating as the number of developments and the amount of developed area increase. New oil and gas developments have reduced their footprint size and the corresponding direct impacts have been reduced, however these new developments often rely on aircraft support for transportation of personnel and equipment potentially increasing disturbance to feeding, nesting, staging and molting birds. The impacts of predators on threatened and endangered species populations may be waning as industry reduces the amount of predator-attracting garbage in the fields. Habitat loss and disturbance can add incrementally to the impacts of development on threatened and endangered species (BLM 2012, § 4.8.7.11).

Whether past impacts to threatened and endangered species populations from habitat loss or disturbance are associated with non-oil and gas residential and commercial development, or oil and gas activities, these impacts are additive to any potential future impacts (BLM 2012, § 4.8.7.11).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

BLM (2012) evaluated the future impacts associated with non-oil and gas-related activities (BLM 2012, § 4.8.7.11) as summarized below.

Non-oil and gas activities are expected to continue in the future resulting in the loss of small amounts of habitat and disturbance to threatened and endangered species. In many cases, loss of habitat from these activities would be temporary, lasting only a season or a few years. However, habitat loss and disturbance associated with military facilities, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. Villages are likely to increase in size, causing the loss of additional habitat, increase disturbance and will likely increase the predation rate of spectacled and Steller's eiders and nests in the vicinity of the human expansion. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century. Subsistence harvest of spectacled eider adults and eggs apparently continues to impact these species, although overall numbers of birds and eggs taken over their entire range are not known. It is currently illegal to use lead shot while hunting waterfowl, although lead shot is allowed for hunting upland species. Illegal use of lead shot for hunting waterfowl, or legal use of lead shot for hunting upland species near waterfowl habitats could contribute to the impacts of lead poisoning on eider populations. Programs currently are underway by the USFWS and the NSB to inform hunters of harvest closures on these species in an effort to decrease this source of mortality. However, lead shot appears to persist in the environment and any additional lead shot would be additive to past amounts, incrementally increasing the chance of eider exposure and further reducing survival.

GMT 2 Development

Potential impacts to eiders from the GMT2 Project are expected to be similar to those of the GMT1 Project. However, the GMT2 Project study area has the potential to impact different proportions of specific eider habitats, as habitat types may occur in different quantities and locations throughout the conceptual GMT2 Project study area.

Under a development scenario that includes construction of the GMT1-GMT2 road, direct and impacts to vegetation in the GMT2 Project area may affect bird habitats. The vegetation types affected would include tussock tundra, moist sedge-shrub tundra, old basin wetland complex, wet sedge meadow tundra, moist tussock tundra, moist sedge-shrub meadow, patterned wet meadow, nonpatterned wet meadow, and sedge marsh in various quantities as described in *Vegetation and Wetlands* discussion.

Under a development scenario that does not include construction of the GMT1-GMT2 road, direct impacts to vegetation in the GMT2 Project area may affect bird habitats. The vegetation types affected would include tussock tundra, moist sedge-shrub tundra, moist tussock tundra, moist sedge-shrub meadow, old basin wetland complex, patterned wet meadow, nonpatterned wet meadow, sedge marsh, moist dwarf shrub, and deep open water without islands in various quantities as described in *Vegetation and Wetlands* discussion.

Additionally, lakes along the proposed GMT1-GMT2 would be potential water sources for ice road construction; likewise, these lakes could be used as sources for ice road construction if the GMT1-GMT2 road is not constructed (i.e., GMT1 Alternatives D1 and D2). This use of water could potentially impact eider habitat or food sources in affected lakes. Impacts from a development scenario that does not include the GMT1-GMT2 road would be greater as both GMT1 and GMT2 would require annual ice road construction, which would require more water withdrawal over the life of the proposed GMT1 Project and the conceptual GMT2 project.

Together, the cumulative impacts of GMT2 and GMT1 on eiders would be additive.

Oil and Gas Exploration and Development Activities

The BLM (2012, § 4.8.7.11) analyzed potential cumulative impacts across the North Slope to spectacled and Steller's eiders occurring in the NPR-A. Development activities that could contribute to cumulative impacts to spectacled and Steller's eiders and their habitat on the North Slope include onshore oil and gas development by federal, state, and Native entities; federal and state offshore oil and gas development (including the construction of onshore infrastructure); oil and gas transportation, including commercial gas pipelines; and road construction. All of these activities involve construction of infrastructure that would directly destroy habitat within the immediate footprint of the project and indirectly affect potential habitats for eiders through disturbance, predation, dust, flooding, changes in natural drainage patterns, thermokarst, snow drifting, and oil and chemical spills. Development in the northern portion of the NPR-A could have a synergistic effect on spectacled eiders using the Colville River delta by the need for increased infrastructure or air or ground traffic in the delta to transport oil and gas, or corresponding supplies and equipment, to or from the NPR-A.

Impacts on spectacled and Steller's eiders from seismic activities and exploration in the NPR-A, lands to the east, and in the Chukchi and Beaufort seas (i.e., the current project, conceptual GMT2, and other RFF projects) would be additive, and would likely accumulate. Development of a road between Umiat and the Dalton Highway could increase exploration operations along that road and also within NPR-A due to improved accessibility.

Contribution of the Alternatives to Cumulative Impacts

The BLM (2004) found that the incremental contribution of the Alpine Field to the cumulative impacts on spectacled and Steller's eiders on the ACP was likely to be limited to occasional disturbance from aircraft overflights resulting in temporary, nonlethal impacts. Disturbance of some individual eiders as a result of both onshore and offshore oil and gas operations would likely be unavoidable over the long term. The impacts from typical activities associated with cumulative exploration and development of oil and gas prospects on the North Slope and adjacent marine areas may include small declines in local nesting or loss of small numbers of spectacled eiders (and potentially Steller's eiders). These impacts would occur through disturbance of survival and productivity, predation pressure enhanced by human activities, and collisions with structures and vehicles. Increased human access via new roads and highways may result in locally severe increases in subsistence hunting pressures. Alternatively, subsistence hunting may decrease if hunters choose to avoid developed areas. The cumulative activities discussed above may cause localized impacts within the Colville River delta but are unlikely to cause significant cumulative population impacts (BLM 2004, § 4G.6.5.2).

Under Alternative A of CPAI's proposed GMT1 Project, no significant impact to the spectacled eider population is expected due to the low population density in the vicinity of the proposed facilities. All of the action alternatives have the potential to result in direct habitat loss; direct habitat loss under Alternative A would be less than the other action alternatives. Alternative A would have less indirect habitat loss than Alternatives B and C, and greater indirect habitat loss than Alternatives D1 and D2. Disturbance and displacement is expected to be lowest under Alternative A. While Alternatives D1 and D2 would decrease the disturbance and displacement associated with a permanent gravel road, the construction and operation of an airstrip could increase these impacts. All action alternatives associated with the proposed project could increase the presence of avian predators, which are drawn to man-made facilities. Under alternatives A, B, and C, the construction of a road system could improve access for subsistence hunting of birds. Alternative E may have a positive impact with respect to the spectacled eider by retaining habitat.

Conclusion

The combination of impacts from GMT1 coupled with impacts from the conceptual GMT2 and other RFF projects in the Nuiqsut and Umiat areas, would be additive, long-term, and localized. The contribution to cumulative impacts from the GMT1 Project would have negligible direct, indirect, and cumulative impacts to spectacled and Steller's eiders. Impacts from RFF projects are anticipated to be of a similar nature to those of the proposed project. A synergistic effect to spectacled and Steller's eider habitats in the Umiat and Nuiqsut areas is not expected. The overall cumulative impact to spectacled and Steller's eiders for the Harrison Bay and Lower Colville River watersheds for the proposed project, conceptual GMT2, and other RFF projects is considered to be negligible.

All future impacts would be additive to prior and current impacts to spectacled and Steller's eiders and their habitat. However, in the context of the North Slope west of the Canning River, these cumulative impacts would be relatively small (BLM 2012, § 4.8.7.11) and would be dependent upon RFF project locations relative to eider populations and their preferred habitat.

Further development in the cumulative impacts evaluation area related to the conceptual GMT2 development and other RFF projects may also impact spectacled and Steller's eiders through a cumulative reduction in habitat and an increase in disturbance. These impacts are not expected to cause pervasive cumulative impacts, as the impacts of the currently proposed and RFF projects on spectacled and Steller's eider population, though additive, would be less than those of past projects due to smaller project areas (by comparison) and the large extent of existing habitat in the area of evaluation. The contribution from the GMT1 Project is expected to be negligible with respect to the cumulative impacts evaluation area, and would be decreased from that approved in the 2004 ASDP ROD due to the reduced footprint of the proposed project.

Changes to habitat as a result of climate change would lead to synergistic impacts, as described above in cumulative impacts to birds.

Yellow-Billed Loons

Section 3.3.5.3 discusses the distribution, population numbers, and habitat associations of yellow-billed loons. NPR-A IAP/EIS Map 3.3.8-4 (BLM 2012) shows there is a concentration of yellow-billed loons associated with the lake area upstream from the confluence of the Tiŋmiaqsiġvik (Ublutuoch) River with Judy Creek. Deep water lakes with fish are preferred yellow-billed loon habitat. Several deep water lakes with fish are located within the general project study area and within the larger cumulative impacts evaluation area; none of these lakes are in close proximity to proposed facilities for GMT1 or the conceptual GMT2.

Overall impacts from the proposed project are expected to be minor to yellow-billed loons under all of the action alternatives. Cumulative impacts to threatened and endangered (or special status species) are discussed more fully in BLM 2004, § 4.G.6.5, and BLM 2012, § 4.8.7.11.

Past and Present Impacts and Their Accumulation

Past and present impacts and their accumulation for loons would be the same as those summarized above for spectacled and Steller's eiders.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Future impacts of activities not associated with oil and gas and their accumulation for loons would be the same as those summarized above for spectacled and Steller's eiders and would include the loss of habitat, disturbance, and increased predation. Potential non-oil and gas impacts are expected to range from a season to well into the foreseeable future.

GMT 2 Development

The development of GMT2 would have similar impacts as the GMT1 Project for loons. However, the GMT2 Project study area has the potential to impact different proportions of loon habitats, as habitat types may occur in different quantities and locations throughout the conceptual GMT2 Project study area. Impacts to loons would be similar to spectacled and Steller's eiders.

Oil and Gas Exploration and Development Activities

Future oil and gas exploration, development, and production would have future impacts for loons similar to those for spectacled and Steller's eiders.

Contribution of the Alternatives to Cumulative Impacts

Under all of the action alternatives, deep water lakes in the cumulative impacts evaluation area could be used for winter water withdrawals; these withdrawals are not expected to adversely impact yellow-billed loons.

Cumulative impacts to the yellow-billed loon across the North Slope were analyzed in the 2012 NPR-A IAP/EIS. Potential cumulative impacts to loons would be the same as those summarized above for spectacled and Steller's eiders.

Conclusion

Overall impacts from the proposed project are expected to be minor to yellow-billed loons under all of the action alternatives.

The proposed project, in conjunction with the conceptual GMT2 and other RFF projects, could have a small additive cumulative effect with respect to yellow-billed loons as further development may result in additional infrastructure and ice roads/pads over a wider area. In addition, the development of offshore development and associated onshore facilities may also have an additive cumulative effect with respect to yellow-billed loons, as this species is known to utilize marine waters. At any given location, the additive cumulative location would be dependent upon RFF project locations relative to loon populations and their priority habitat.

Polar Bear

Section 3.3.5.4 discusses the distribution of polar bear, a wide-ranging animal that can be found along the coast of the entire North Slope. Maternal polar bear dens are documented along the mouth of the Colville River delta, but have not been documented inside the project study area

(BLM 2012, Map 3.3.8-6). There is no designated critical habitat for this threatened species on the North Slope. The zone of previously designated critical habitat extended southward from the shoreline of the Beaufort Sea a distance of 5 miles in this area. This 5-mile zone includes CD5, but does not include the APF. GMT1 is more than 12 miles inland from the coastline and the conceptual GMT2 Project is about 23 miles from the coast. Approximately 2 miles of the GMT1 pipeline system to and from CD5 are within or immediately adjacent to the 5-mile zone. CPAI has an approved polar bear plan for its existing operations on the North Slope. This plan would be expanded to incorporate operations for the GMT1 and the conceptual GMT2 Project.

Impacts to polar bears from the proposed GMT1 Project could result through habitat loss, disturbance, incidental harassment, intentional hazing, or mortality. Polar bears are likely to be impacted in similar ways to terrestrial mammals. Cumulative impacts to marine mammals and threatened and endangered (or special status species) are discussed more fully in BLM 2004, § 4G.6.4.2 and § 4.G.6.5, and BLM 2012, § 4.8.7.10 and § 4.8.7.11.

Past and Present Impacts and Their Accumulation

Prior to the twentieth century, both the Chukchi/Bering and Southern Beaufort Sea polar bear populations probably existed near carrying capacity (Allen and Angliss 2010). Once harvest by non-Natives became common in the 1960s, the size of the Southern Beaufort Sea population declined substantially (Amstrup et al. 1986, Amstrup 1995). Since passage of the Marine Mammal Protection Act in 1972, both the southern Beaufort and Chukchi/Bering sea populations seem to have increased (Allen and Angliss 2010). However, polar bears have since been listed as threatened range-wide because of climate change-related threats to the species' sea ice habitat (BLM 2012, § 4.8.7.11).

Changes in sea ice conditions can have cascading effects that increase the magnitude of impacts from other sources of impact. For example, thinning ice and a greater extent of marginal ice stability in the fall may already be leading to reduced sea ice denning, and a corresponding increase in denning on land, in Southern Beaufort Sea bears (Fischbach et al. 2007). This in turn increases the probability of disturbance to denning bears from human activities. The chances of bear-human encounters in coastal villages and industrial areas also increases with a greater proportion of the Southern Beaufort Sea or Chukchi/Bering Sea populations coming on land during the fall open-water period, or as the amount of time individual bears spend on land increases (BLM 2012, § 4.8.7.11).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

BLM (2012) described potential cumulative impacts to polar bears from non-oil and gas activities that would result from harvest (subsistence, handicrafts, and recreation), other sources of direct mortality, research, pollution and contaminants, and coastal development. These activities and impacts are described below and are summarized from BLM 2012, § 4.8.7.11.

Hunting by non-Natives has been prohibited since 1973 although Alaska Natives living in coastal communities can hunt polar bears for subsistence and the making of handicrafts. The Southern Beaufort Sea population is currently considered depleted (Allen and Angliss 2010), and harvest quotas are set by the Inuvialuit-Iñupiaq Council. The harvest level for the Chukchi/Bering Sea population is not limited at this time; while the Alaska Native harvest from this population is reported to have declined recently, the portion of harvest that occurs in Russia is not well quantified (Allen and Angliss 2010).

Polar bears are occasionally killed during defense of life and property (Brower et al. 2002). Other relatively rare sources of mortality include predation by other polar bears, injury during fights or attacks among polar bears for reproductive advantage (Swenson et al. 1997), and injury received during play bouts (Taylor et al. 1985). Polar bears may also occasionally sustain serious injury while hunting, which can lead to death (Stirling et al. 2008).

There are several on-going research programs studying polar bears that may cause short-term adverse impacts to individual polar bears observed in surveys or targeted in capture efforts and may also incidentally disturb other bears nearby.

Persistent organic pollutants and the heavy metal mercury are known to have accumulated in individuals of the Southern Beaufort Sea and Chukchi/Bering Sea populations of polar bears, although adverse impacts have not been demonstrated for individual bears nor are the contaminants thought to have population-level impacts. However, contaminant body burdens, in combination with other factors such as loss of sea ice habitat and decreased prey availability, could ultimately contribute to adverse impacts in the health or productivity of individual polar bears.

The BLM estimates that approximately 1,800 acres have been occupied by community development in six Alaska North Slope villages through 2008, with much of the development associated with these villages occurring along the coast. Fourteen Distant Early Warning-Line sites were constructed along the coast of the North Slope in the 1950s, ranging in size from 150 to 2,835 acres. Beginning in the 1990s some of these sites have been remediated and restored, while others were converted to National Weather Service stations. Coastal development since 1900 has likely increased disturbance impacts to bears and increased human-bear encounters, but there is no evidence that this has significantly affected polar bear populations. If land-based denning by polar bears increases with declines in sea ice, future coastal development may make potential polar bear denning habitat prone to disturbance or unavailable.

GMT 2 Development

The development of the conceptual GMT2 Project would result in an increase in infrastructure on the North Slope. The development of oil and gas resources increases the potential exposure of polar bears to human activities and increases the potential for interactions. The conceptual GMT2 Project would include disturbances in the form of a 13.0-acre pad and a 9.0-mile pipeline under all potential development scenarios. Under GMT1 Alternatives A, B, and C, if GMT2 were developed, a gravel road connecting GMT2 to GMT1 would be constructed. Under GMT1 Alternatives D1 and D2, the GMT1-GMT2 road would not be constructed, and additional infrastructure would include a 0.7-mile access road, a 31.9-acre airstrip with apron, and a 17.5-acre occupied structure pad.

The conceptual GMT2 Project, in conjunction with the GMT1 Project, represents an additive cumulative effect with respect to polar bears.

Oil and Gas Exploration and Development Activities

Cumulative impacts to polar bears from activities across the North Slope were fully considered in BLM (2012). Oil and gas development in the Chukchi and Beaufort Seas has the greatest potential to lead to additive impacts for polar bears. Even small spills that could not be completely remediated could accumulate over time and could include direct fouling of polar bears, their prey, or their habitat. These spills could foul ice and shorelines, so the continued risk of direct exposure remains, as does the risk of long-term contamination of both marine and terrestrial habitats (BLM 2012, § 4.8.7.11). Proposed activities with the most potential to affect polar bears in the NPR-A include oil and gas exploration and development, aircraft and watercraft traffic, winter overland travel, and recreational and research activities. These activities could affect polar bears by causing direct mortality from defense of human life, accidental oil spills, and lethal impacts during research activities; altering polar bear behavior, physiology, or movements; or disturbing or destroying snow dens, which could cause impacts to cubs at critical life stages, resulting in mortality (BLM 2012, § 4.8.7.11).

Contribution of the Alternatives to Cumulative Impacts

Under the action alternatives, polar bears may be drawn or attracted to human activity associated with the proposed project resulting in incidental or intentional harassment. Under Alternatives A, B, and C, which add permanent gravel roads, there is an increased risk of collision with vehicles. These alternatives also increase the local transportation network, thus allowing easier access for subsistence hunters. Alternative C may cause a greater disturbance to polar bears than Alternatives A and B as the Nuiqsut Spur Road passes within 1 mile of potential polar bear denning habitat. Under Alternatives D1 and D2, there would be little or no habitat loss and less obstruction of movement; Alternatives D1 and D2 may increase disturbance due to increased air traffic. Overall, under the action alternatives, impacts to polar bears are considered to be minor. Alternative E would have no negative impacts to polar bears.

Conclusion

Oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat. In particular, some polar bear denning habitat has likely been altered or made unavailable as a result of construction and human activity. The amount and effect is unknown, but likely minimal, since the majority of historic dens were offshore and most land dens were to the east of major development (Amstrup and Gardner 1994). The main land-based polar bear travel corridor (within 1 mile of the coast) and nearshore area have been fragmented to some extent; but the effect has likely been minimal. This minimal effect can be attributed to the small amount of development that has occurred related to total area, and the ability of polar bears to cross man-made routes, including roads and causeways. Whereas industry activities have had some impacts on individual polar bears, there is no evidence these impacts have resulted in changes to polar bear populations (BLM 2012, § 4.8.7.11). While other threats are managed or are not currently thought to be significant threats to polar bear populations, each could become significant in combination with future effects of climate change and the resultant loss of sea ice. Changes in the extent and timing of sea ice are expected to have a significant impact on polar bears through alteration of their distribution, nutritional status, reproductive success, and ultimately their abundance.

When evaluating the currently proposed project in conjunction with the conceptual GMT2, climate change, and other RFF projects, these projects could have an additive cumulative effect with respect to polar bears. Further development may encroach on polar bear denning habitats and the placement of additional infrastructure would increase disturbances, the potential for encounters, and obstruction to movement. Offshore development and development of onshore support facilities would have cumulative additive impacts to polar bears and their habitats. This impact would be anticipated to be long-term, localized, and depending on the species and location would range in intensity.

Bowhead Whale and Ringed Seal

Two species of marine mammals listed under the ESA are present in the Beaufort Sea: the bowhead whale (endangered) and the ringed seal (threatened). As discussed above for polar bears, all but the CD5 pad, a short section of pipeline system from GMT1, and a short section of pipeline system from CD5 to CD1 are further than 5 miles from the coast. This infrastructure would not likely impact these species.

Cumulative impacts to bowhead whales, and ringed seals are most likely to occur as a result of subsistence hunting, vessel transportation, air transportation, commercial fishing, spills or other discharges to the marine environment, dredging, coastal development, and climate change (BLM 2012, § 4.8.7.11). Cumulative impacts to marine mammals and threatened and endangered (or special status species) are discussed more fully in BLM 2004, § 4G.6.4.2 and § 4.G.6.5, and BLM 2012, § 4.8.7.10 and § 4.8.7.11.

Past and Present Impacts and Their Accumulation

For Bering-Chukchi-Beaufort Seas bowhead whales, the most dramatic population level impacts were associated with commercial whaling that occurred from 1849 to 1915 (Bockstoce and Botkin 1983). In fact, all circumpolar bowhead populations are still recovering to varying degrees from commercial whaling today (Zeh et al. 1993; BLM 2012, § 4.8.7.11).

More recently, climate change and increasing human activities (particularly with regard to oil and gas activities) may be having large impacts on these species. For bowheads, some information is available on how individual animals respond to oil and gas activities but the observations are short-term and provide little usable data for longer-term impacts on individuals or the population. Bowheads seem to be highly sensitive to low levels of anthropogenic sounds and deflect away from those sounds or change their behavior. Ringed seals seem to be quite tolerant of anthropogenic activities. Little is known about other species (BLM 2012, § 4.8.7.11).

Although some information exists on how individual animals respond to anthropogenic sounds, it is not known how those impacts accumulate. Most bowhead whales annually return to Beaufort Sea to feed, and much information exists on how individual animals respond to anthropogenic sounds (Richardson et al. 1995). One such response is that migrating bowhead whales have avoided areas of specific human activities ranging from 1-2 km to over 20 km (Richardson 1999, 2008). Bering-Chukchi-Beaufort Seas bowheads do not seem to have habituated to industrial activities. If impacts were countervailing or do not accumulate over years, cumulative impacts or past and present activities may have been minimal to date (BLM 2012, § 4.8.7.11).

Hunting and commercial fishing are the two primary factors that have affected bowhead whales in the past and continue today while ringed seals are thought to have been relatively unaffected yet by anthropogenic sources. While commercial fishing, vessel strikes, and subsistence take have removed individuals from the bowhead population and possibly affected population growth rates, the impact is minimal and has not altered a strong population growth trend (George et al. 2004; BLM 2012, § 4.8.7.11).

Noise and disturbance associated with offshore seismic and drilling activities, and boat and barge traffic have affected bowhead whales, causing deflection and behavioral changes (Richardson et al. 1995). A large body of literature exists about the sensitivity of bowhead whales to industrial sounds and activities (see NRC 2003); however, it is not known how impacts from these stressors accumulate. Bowhead populations have been increasing for at least three decades despite oil and gas activities. It is possible, though, that the population could have increased more rapidly in the absence of industrial activities. It appears that ringed seals are relatively insensitive to some disturbance impacts from oil and gas activities such as vessel traffic, offshore seismic and drilling activities but studies have not been completed to assess with confidence whether long-term persistent changes in behavior exist that could lead to reduced fitness and population changes. Other impacts from oil and gas activities such as vessel discharge, introduction of new biota, oil spills, and changes in prey distribution or abundance have a high probability of negatively impacting seals (BLM 2012, § 4.8.7.11).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Non-oil and gas activities could also contribute to cumulative impacts on bowhead whales and ringed seals. Principle impacts include: shipping, commercial fishing, subsistence hunting, tourism, and climate change. Although a few individuals would likely be injured or killed, non-oil and gas activities are not expected to have much impact on the bowhead whale or seal population, and bowhead whale populations have increased steadily under current management (George et al. 2004, Zeh and Punt 2005). However, if major commercial shipping routes become established in the Arctic, ship strikes of bowheads and other shipping-related impacts may occur at higher rates (e.g., oil spills, debris, bilge water) (Reeves et al. 2012; BLM 2012, § 4.8.7.11).

A presumably small number of bowhead whales could be injured or killed as a result of entanglement in fishing gear or collisions with ships (Reeves et al. 2012). Fishing would compete for seal prey items and over time may produce population level impacts due to decreased body conditions of seals from nutritional stress. It is expected that subsistence harvesters would continue to harvest bowhead whales and that traditional seal harvest will continue (BLM 2012, § 4.8.7.11).

Past and present activities associated with hard rock mining, operation and rehabilitation of Distant Early Warning-Line and similar military sites, tourism, and scientific research can cause impacts to bowhead whales and ringed seals and result in disturbance, deflections, and masking of whale and seal sounds. These disturbances can be expected to continue or possibly increase in the future (BLM 2012, § 4.8.7.11).

It is likely that reduced sea ice and climate changes could result in increased commercial shipping traffic and increased commercial fishing. These activities could result in an increase in vessel collisions for bowheads resulting in additional injury and mortality (BLM 2012, § 4.8.7.11).

Increased fishing effort in areas currently used by bowheads and ice seals would likely result in an increased rate of encounters with fishing gear, greater entanglement rates and subsequent injury, loss of fitness, and mortality. Ringed seals would experience an increased competition for food resources, which could affect overall body condition and recruitment into the population (BLM 2012, § 4.8.7.11).

GMT 2 Development

The conceptual GMT2 Project, in conjunction with the GMT1 Project, would have a negligible cumulative impact based on the project location relative to these species.

Oil and Gas Exploration and Development Activities

The potential impacts of future oil and gas development on the North Slope to special status marine mammals was analyzed in BLM (2012). If a large oil spill were to occur as a result of (1) development and production associated with any past, present, or reasonably foreseeable future development project on the North Slope or in the Beaufort or Chukchi seas, or (2) grounding of a large commercial vessel, some bowhead whales and ringed seals would likely be impacted. However, most whales directly exposed to spilled oil would likely experience temporary, nonlethal impacts from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil-contaminated prey, baleen fouling, reduction in food resources, or temporary displacement from some feeding areas. A few individuals could be killed if they were to experience prolonged exposure to freshly-spilled oil. Reproductive impacts are also possible. Impacts to seal species would depend on a number of factors such as the amount and duration of exposure, and proportion of oiled prey consumed. Reduction in food resources would be more detrimental to seal species due to their life history characteristics when compared to long-lived bowhead whales with large stored energy supplies. Oil spill cleanup activities (e.g., vessel and aircraft traffic) could displace some bowhead whales, should those activities coincide with the fall migration.

If there is increased offshore exploration and development activities, the potential for cumulative impacts to marine mammals by noise or other activities would increase. Whale species most likely to experience cumulative impacts include gray whales. Increases in ice-free periods and ice retreat may be accompanied by a northward shift in commercial fisheries and shipping traffic, potentially increasing rates of disturbance, entrapment, entanglement, and vessel strikes. Offshore oil and gas exploration and development, should it occur in areas occupied by whales, would result in disturbance impacts and may impact foraging success, possibly to the extent that fitness is reduced. Contribution of impacts from onshore NPR-A activity to the overall cumulative impacts to special status marine mammals will likely be relatively small (BLM 2012, § 4.8.7.10). While specific effects of climate change and ocean acidification on bowhead whales and ringed seals are uncertain, ice seals, in particular, may experience loss of habitat and changes in prey distribution and availability. Impacts of the currently proposed project are within the range of impacts analyzed in BLM (2012).

Of the RFF projects, development of offshore prospects and onshore support infrastructure would have the greatest potential impact to these species based on the location of these projects. The impacts would be additive to those of GMT1 and future onshore development in the NPR-A. A full evaluation of how potential offshore development and associated onshore support infrastructure could impact these three species is outside of the scope of this SEIS.

Contribution of the Alternatives to Cumulative Impacts

Under all of the action alternatives for the proposed GMT1 Project, the impact to bowhead whales and ringed seals is considered negligible based on the project location relative to these species. Alternative E would have no incremental impact due to the lack of development.

Conclusion

In the Arctic, industrial sounds and other disturbances have displaced whales from preferred habitats; these impacts can be difficult to quantify and to determine if they accumulate. In addition to noise and disturbance from existing oil development, seals and bowhead whales could be affected by future offshore development in the Beaufort and Chukchi seas.

The probability of a spill reaching marine waters under the proposed project is very low (see Section 4.3.4.2). In the event of a spill reaching marine waters, the spill would need to reach waters of greater depth well offshore from the coastline to coincide with the seasonal preference of these three species for an impact to occur. An oil spill could affect marine mammals in offshore or coastal areas, with the impacts depending on the location and amount of oil spilled and time of year. The impacts of future habitat alteration associated with gravel island construction, platforms, or other structures related to oil development would likely be minor.

The presence of small amounts of hazardous materials, including hydrocarbons and previously used insecticides, would likely have minor impacts on marine mammals.

The BLM (2004) found that the overall cumulative impacts of the proposed development and other past, present, and reasonably foreseeable future activities would be minor. Impacts were expected to be the potential loss of up to several hundred seals and walruses, and probably less than 10 gray whales. Cumulative noise and disturbance in the Beaufort Sea and on the North Slope are expected to briefly and locally disturb or displace a few seals and gray whales (BLM 2004, § 4G.6.4.2).

4.6.10 Social Systems

4.6.10.1 Cultural Resources

Cumulative impacts to cultural resources could occur in the project footprint due to additive direct impacts. Direct impacts could occur from ground disturbing activities including excavation of gravel; construction and maintenance of gravel roads, pads, airstrips, bridges and culverts; construction of ice roads and pads; construction of VSMs for power lines and pipelines; and any other disturbance of the ground surface in the proximity of project components. Other activities and events that could cause direct impacts to cultural resources include damage caused by equipment during the construction, drilling, and operation phases of the project, and unanticipated accidents such as blowouts, spills, or fires and subsequent cleanup activities. The act of placing fill over the existing surface is preceded by inventories by qualified archaeologists and, assuming known sites are avoided and depending on consultation, is not expected to adversely impact any known or unknown cultural resources. There may also be adverse impacts to undiscovered cultural and archaeological resources to the extent culverts create gullying during spring breakup.

Cumulative impacts to cultural resources are discussed more fully in BLM 2004, § 4G.7.5, and BLM 2012, § 4.8.7.12.

Past and Present Impacts and Their Accumulation

Impacts to cultural resources from road and pad construction, gravel mining, and disturbance associated with development and production activities have occurred in the past and the potential for impact continues today. Cultural and paleontological research and excavation, non-oil and gas development, recreation, and oil and gas exploration and development have resulted in impact to cultural resources on the North Slope, either from stratigraphic disturbance, destruction, or unauthorized collection (BLM 2012, § 4.8.7.12). If cultural resources removed in the past have been preserved in museums or other institutions, their losses probably should not be tallied as negative cumulative impact. In the areas of the North Slope that are open to oil and gas exploration and development, about 2,500 acres have been disturbed or covered with gravel as a result of non-oil and gas development activities. In association with oil and gas exploration and development, approximately 1,750 acres have been disturbed by blading roads and establishing exploration sites, and airstrips. As of ten years ago, gravel mining had disturbed about 6,400 acres. It is estimated that another 9,200 acres have been covered with gravel. While some cultural resources in these areas have undoubtedly been damaged, destroyed, or buried under gravel most of these impacts have occurred outside the NPR-A. Recent technological developments, including use of snow trails, ice roads and pads, low surface pressure vehicles, horizontal drilling, and development that does not require a gravel road linkage to the Prudhoe Bay/Kuparuk infrastructure have reduced the amount of surface disturbance associated with exploration and development activities, with likely benefits to the preservation of cultural resources. Generally speaking, over the last 30 years, federal and state regulations, as well as management stipulations pertaining to cultural resources, have presumably slowed the cumulative impacts to cultural resources (BLM 2012, § 4.8.7.12).

From a cumulative perspective, more cultural sites have been disturbed and cultural material removed from the North Slope in general and the NPR-A in particular as the result of scientific studies than has been destroyed or removed through unauthorized collection resulting from oil and gas exploration and development or other construction-related activities (BLM 2012, § 4.8.7.12). While the scientific value and significance of the material that was obtained through scientific work is known, the value and significance of material obtained through unauthorized collection or that was destroyed will never be known. This is the greatest potential cumulative impact to cultural resources.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Additional cumulative impacts not described in BLM (2012) could include impacts to other aspects of the cultural landscape including subsistence camps and cabins, trails, traditional use areas, traditional cultural properties, and sacred locations. Additional impacts could include changes in use of or access to culturally important locations, loss of cultural connections, decreased use of the landscape in the vicinity of project components, disruptions to ambient noise levels and changes to the viewshed in culturally sensitive areas, or gradual shift of cultural activities away from development.

GMT 2 Development

When taking into consideration, the proposed GMT1 Project and conceptual GMT2 Project, the cumulative impacts of these developments would be similar and additive. As noted above, impacts to cultural resources are primarily limited in extent to areas where gravel would be mined. If development of GMT1 exhausts the currently available supply of gravel at the ASRC Mine site, construction associated with a conceptual GMT2 Project, or other RFF projects that require gravel would have an additive cumulative impact. GMT2 would be subject to the same SHPO and NSB requirements to avoid cultural sites in the Alpine Field as applied to the GMT1 project. To the extent that cultural resources are removed or destroyed as a result of gravel mining, these resources cannot be restored and thus are unique and impacts are long term.

Oil and Gas Exploration and Development Activities

Increased oil and gas development activities on the North Slope would result in an increased need for gravel for infrastructure construction. The excavation of up to 150 million cubic yards of gravel equates to about 2,200 acres of surface/near-surface impact on the North Slope by the end of this century. Many prehistoric and historic sites are located on well-drained ground, and on much of the North Slope, well-drained ground often equates with gravel deposits. Gravel deposits are not common in the northern portion of the NPR-A and as a consequence will probably be fully exploited. As more gravel deposits are excavated, the probability for impacts to cultural resources increases. As previously mentioned, pipeline construction, especially buried pipelines, pose a heightened threat to cultural resources.

Technological innovations that reduce the amount of surface disturbance associated with oil and gas activities and the current slowing of oil and gas development on the North Slope will contribute to the future protection of cultural resources and the cumulative impacts.

Contribution of the Alternatives to Cumulative Impacts

Cumulative impacts to cultural resources could also occur from indirect impacts in the 2.5-mile project study area including removal, trampling, or dislocation of cultural resources and culturally sensitive areas by personnel and visitors, complete or partial destruction of a site from erosion, melting permafrost, vibrations, or other landscape changes caused by GMT1 Project components; the loss of traditional meaning or importance of a resource or loss of cultural association with a resource; neglect of a resource that causes deterioration; and transfer, lease or sale out of federal ownership without proper restrictions.

Gravel mining at the existing ASRC Mine site, is analyzed across all alternatives for development of GMT1 and would also be necessary for any future development of GMT2.

Although there are differences between the alternatives in terms of the number of cultural resources affected and the level of potential noise impacts, the nature and overall degree of impacts on cultural resources do not vary substantially by alternative. Table 4.1-2 provides a summary of expected impacts for all action alternatives. In contrast to the BLM (2004), the current analysis identifies that the intensity of potential impacts to cultural resources would be medium, because the impacts to the cultural landscape would result in a detectable alteration. This is supported by the documentation and recent update of the Nuiqsut Cultural Landscape (SRB&A 2013a) and consideration of the impacts of the project on this cultural landscape, which had previously not been assessed in either of BLM's previous EISs (BLM 2004; 2012).

Alternative E would have no incremental adverse cumulative impact to cultural resources on the North Slope.

Conclusion

The BLM (2004) concluded that the cumulative impacts of the proposed Alpine Field development and other RFF developments on cultural resources would be minimal. Development would be expected to impact cultural resources to some degree; these impacts would be additive. Because of the nature of cultural deposits (their generally unpredictable location and context, on surface or near surface), the magnitude of the impact is difficult to estimate. However, it is expected that if current procedures for survey and inventory before exploration and development activities continue, the impact to the resource would be minimal (BLM 2004, § 4G.7.5).

As in the past, assessments to identify and protect cultural resources prior to the initiation of surface disturbing activities will be a major factor in reducing future cumulative adverse impacts to cultural resources. Climate change will cause alterations to the environment, ecosystems, and habitats of the North Slope, and potential thawing of permanently frozen ground could result in the erosion of riverbanks and beach bluffs. The future effects of climate change are unknown regarding potential cumulative impacts to cultural resources. Climate change will cause alterations to the environment, ecosystems, and habitats of the North Slope, and if substantial could affect cultural resources. Climate change will probably cause the alteration of weather patterns and an increase in the frequency and intensity of spring and fall storms with the potential to adversely impact near-shore cultural sites (BLM 2012, § 4.8.7.12).

Because of the varying circumstances of occurrence surrounding the location and vulnerability of cultural resources, the significance of future impacts to the resource is difficult to assess in terms of the cumulative case. However, if the protections that are currently in place carry forward, then the cumulative impact would be expected to be minor within the NPR-A.

Evaluating impacts associated with undocumented cultural deposits in an area where RFF projects could occur cannot be quantified and is outside the scope of this SEIS.

Overall, the GMT1 Project in addition to other current and RFF activities would increase the amount of gravel required, resulting in additional disturbance to currently undeveloped areas. The severity of impacts will vary because not all sites that may be disturbed as a result of development have any cultural resources or ones determined significant. Planned developed that avoids known cultural deposits could have a countervailing effect with respect to the cumulative case. Alternative E would have no incremental adverse cumulative impact to cultural resources on the North Slope.

The National Historic Preservation Act, particularly Section 106, provides umbrella coverage and consideration for cultural resources on federal lands, as does the Archaeological Resources Protection Act and the Antiquities Act. The implementation of BMPs and Lease Stipulations, in conjunction with these federal regulations, required for the protection of cultural resources under all alternatives, should reduce the cumulative effect to cultural resources from oil and gas, and non-oil and gas activities, in the planning area.

4.6.10.2 Sociocultural Systems

Overall impacts to the sociocultural characteristics of North Slope communities (other than Nuiqsut) associated with the CPAI Development Plan and past, present, and RFF development will occur, but none of the development scenarios is expected to result in overall impacts that would be greater than those caused by technology, previous development, and climate change. Cumulative impacts to sociocultural systems are discussed more fully in BLM 2004, § 4G.7.1, and BLM 2012, § 4.8.7.14. The analysis of the direct and indirect environmental consequences of the GMT1 Project on sociocultural systems within the community of Nuiqsut found that all alternatives would likely have major, albeit varying, impacts. Nuiqsut would therefore be likely to experience major impacts to sociocultural systems as a result of the CPAI Development Plan and past, present, and RFF developments.

The cumulative impacts of past, current, and RFF actions on subsistence activities are discussed below, under "Subsistence." Subsistence activities are key to maintaining social ties within Iñupiaq communities, and therefore any disruption to the hunting, harvesting, processing, distribution, and consumption of subsistence resources will also have impacts on social organization in the community.

Past and Present Impacts and Their Accumulation

Although North Slope Iñupiat have experienced the impacts of development on their social organization since their initial contact with non-Iñupiaq explorers since the early 19th century, the cumulative impacts analysis is limited to 1970 onward. Today, oil and gas development on the North Slope is a primary source of impacts on social organization among the Iñupiat, especially for the community of Nuiqsut although, as described above, changes to community structure, cultural values, and community health and welfare, predate oil and gas development on the North Slope.

The cumulative impacts of oil and gas development on sociocultural patterns over the last 40 years are hard to establish with quantitative precision given the lack of baseline data. However, there is evidence that North Slope sociocultural systems have been subject to both positive and negative ongoing, additive, and synergistic cumulative impacts from oil and gas activities. Stresses on North Slope sociocultural systems include residents' inability to access traditional use areas, threats to resources, decreased spiritual connection with the land, participating in multiple permitting processes for development and associated public meetings, intra-community conflicts associated with development, and being ignored or discounted by agency representatives. Long-term stresses would result in greater impacts to sociocultural systems. These ongoing impacts are anticipated to be substantially more intense in Nuiqsut than in other NSB communities. Additionally, negative sociocultural impacts associated with development will likely continue to match or outweigh the benefits of development in Nuiqsut, whereas it is anticipated that economic benefits that will accrue to other communities will outweigh the negative impacts those communities, more distant from development, will experience.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Non-oil and gas activities on the North Slope could disturb subsistence resources and cause subsistence users to avoid such areas while activities are underway.

Former Distant Early Warning Line Stations as well as the adjacent active and inactive Air Force Radar Sites and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century. However, out-migration from North Slope villages is emerging as a major sociocultural concern for the NSB. Older NSB residents often move to Anchorage for steady health care. Younger generations have several reasons for moving to larger communities (i.e., from other NSB villages to Barrow or from the NSB to Anchorage or Fairbanks or the Lower 48) that include the regular attractions of modernity and urban environments, including greater education and employment opportunities, larger and more varied social networks and cultural outlets, and easier access to a greater variety of consumer goods. Also, most NSB villages have housing shortages and the cost of rent, and other necessities is higher than in urban centers (BLM 2012, § 4.8.7.14).

GMT 2 Development

The conceptual GMT2 would have similar impacts as GMT1, with the principal differences of a second employment opportunity for residents and two construction/development phases (there likely would be several years between the start of production at GMT1 and the start of construction for GMT2). A phased construction/development scenario is expected to result in only minor, if any, changes in the number of permanent residents at Nuiqsut, primarily due to the relatively small scale of development and few opportunities for long-term employment during operations. A phased construction schedule would have positive benefits for employment for residents at Nuiqsut. The potential benefits of a phased construction schedule may not be as pronounced under an Alternative D1 or D2 development scenario, especially if GMT1 Alternative D2 (seasonal drilling) is selected. Many of the sociocultural benefits that would be associated with those alternatives for GMT1 that include a permanent gravel road (Alternatives A, B, and C) would be similar for GMT2: namely, the ability to use a permanent road to commute to work at GMT2 would likely increase local employment at the site.

Oil and Gas Exploration and Development Activities

The GMTU is located within the jurisdictions of several entities, which have varying authorities and perspectives on oil and gas development activities on lands within the Unit. These include the BLM for federal land in the NPR-A (including both BLM-managed surface and subsurface, as well as land that has been selected by Kuukpik Corporation but not yet conveyed), the NSB, Kuukpik Corporation as a surface land owner, and ASRC as the owner of the subsurface rights under Kuukpik Corporation land. The GMT1, conceptual GMT2 Project, and other RFF activities on the North Slope do not change the scope of authorities of these institutions but may change where said authorities are applied if land and subsurface federal ownerships are transferred to the two Native corporations. Cumulative impacts to sociocultural systems in Nuiqsut include increased tension among community and regional institutions including the NVN, the City of Nuiqsut, Kuukpik Corporation, ASRC, BLM, and the NSB regarding their role in and jurisdiction over development activities on the North Slope.

As the area impacted by oil development in the future increases, especially in proximity to local communities, cumulative impacts are likely to increase. For example**,** Nuiqsut, Barrow, Atqasuk, and Anaktuvuk Pass are currently dependent on subsistence caribou harvest from the CAH and TH; additional future development may have additive impacts to subsistence harvest from these herds leading to synergistic impacts on subsistence-harvest patterns (including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources), social bonds, and cultural values (BLM 2012, § 4.8.7.14).

Oil and gas-related RFF activities that could affect social organization on the North Slope include offshore oil and gas development and the onshore infrastructure to support it. These activities, in combination with the development of GMT1, will increase the potential for interactions between Nuiqsut residents and non-local workers as well as the potential for conflicts within the community of Nuiqsut regarding their support for or opposition to these projects. Tensions between different community institutions could result in additional strains on social cohesion.

Depending on the alternative selected the Umiat road could potentially provide public road access to traditional hunting areas along the Colville River, thus resulting in even greater potential for human competition and interactions with non-Iñupiaq individuals who may not share the same cultural values and respect for the land. However, the Meltwater Corridor alternative could limit public access, thus offsetting negative impacts (AK DOT 2012). Increased employment of Nuiqsut residents could disrupt social systems by removing residents for extended periods of time from their families and reducing their ability to participate in subsistence activities, thus weakening social ties within the community. Increased income may also result in income disparities between households and families in the community, adding to social tensions.

The potential for additional exploration to the west of the community (including the conceptual GMT2 development) in addition to the oil and gas exploration to the south of the community associated with development of the Umiat road, the Bear Tooth Unit, and the Tofkat Prospect, will result in residents feeling even more surrounded by development, and left with fewer options for hunting in areas where no oil and gas infrastructure exist. The incremental construction of development-related infrastructure throughout the community of Nuiqsut's traditional hunting and harvesting areas may result in the erosion of identity or cultural connection with those lands. This impact has already occurred with traditional use areas or camps within existing development areas that are no longer accessible to local residents.

The possibility of a major oil spill in the marine environment and its impacts on bowhead whales, other marine mammals, and fish are residents' greatest concerns associated with offshore development—now increased significantly by the greater likelihood of offshore oil and gas activity in both the Chukchi and Beaufort seas. Offshore development in the Beaufort Sea may require onshore processing facilities and would require onshore pipelines. Such facilities in the NPR-A would impact TH year-round and may accumulate with other disturbances for that herd particularly during calving and insect-relief seasons. Impacts during those seasons could at some point have population level effects on the TH, although it is not clear that has occurred for the CAH under similar circumstances. This support infrastructure would also have impacts on fish that would be additive to those created by onshore oil and gas activities as described above.

Construction of gas pipelines would have short-term effects on wintering caribou if caribou are present during construction. It is anticipated that these effects would be minor. A greater impact from a gas pipeline would be effects from additional gas development that a pipeline would make possible within and to the east and west of NPR-A.

These and other stresses accumulate because they interact and are repeated with each new lease sale, EIS, development proposal, and facility expansion. Income from royalties, taxes, and jobs, generated by oil and gas activity and available to residents of the North Slope, would be anticipated to offset some increased costs associated with travelling further to hunt.

Contribution of the Alternatives to Cumulative Impacts

With completion of the Nuiqsut Spur Road, residents of Nuiqsut will have facilitated access (by road and off-road vehicles) to subsistence resources in the Colville River delta as well as being able to travel via road to employment opportunities in the Alpine Field including (under alternatives A, B, and C) construction of facilities for the GMT1 and the conceptual GMT2 Project. Residents of Nuiqsut have expressed concern that development of the GMTU would adversely impact their ability to harvest caribou. Long-term road access should facilitate access to subsistence resources in the same manner contemplated by the Kuukpik Corporation when applying for the Nuiqsut Spur Road.

The cumulative impacts of the past, present, and RFF activities on economic organization are tied closely to cumulative impacts on subsistence. The community of Nuiqsut participates in a mixed subsistence-market economy. The increasing presence of development activities in and around the community may disrupt the economic organization of the community through changes in subsistence activities and participation in the cash economy. If subsistence activities or resources are disrupted to the extent that overall harvests of subsistence resources decline, then residents may begin to rely more heavily on wage employment and participate less in traditional subsistence activities. As discussed in Section 4.4.5, disruptions to subsistence activities may be highest under Alternatives D1 and D2 due to increased helicopter traffic associated with that alternative. Alternatively, increased income in the community either through Native corporation dividends or wage employment, under Alternatives A, B, C, D1, and D2, may provide more people with opportunities to participate in subsistence activities, including residents who previously could not participate in subsistence activities due to a lack of equipment or money for fuel. The cumulative impacts on the overall economy are discussed below (under “Economy”).

Alternatives A, B, C, D1, and D2 would have similar impacts to population due to the scale of development. Alternative C may provide the greatest opportunity for employment simply because more road and airport development work would occur near town. Alternatives D1 and D2 would likely disincentivize local employment at GMT1 and GMT2.

In terms of overall impacts, Alternatives A and B would likely have the fewest impacts to because they require less air traffic close to the community and because development related ground traffic would be limited to the road between CD5 and GMT1. Alternative C would likely have more impacts than Alternatives A and B, because it would move development-related ground traffic closer to the community, along the road between Nuiqsut and CD5, and because the community would experience more air traffic if used as a hub, which could result in deflection of subsistence resources near the community. Alternatives D1 and D2 would likely have the greatest impact of all the alternatives, as they would result in increased footprint for the project, in increased air traffic in hunting areas west of the community, and would create a new source of air traffic that did not exist before.

Conclusion

The GMT1 Project, in addition to past, present, and RFF activities on the North Slope, is not expected to result in substantial changes to population or employment levels for the community of Nuiqsut. Increasing development activities on the North Slope, particularly those that occur in areas accessible from the community of Nuiqsut by road, may result in more residents obtaining employment in the oil and gas industry. As discussed in the BLM (2012, §§ 4.8.7.13 and 4.8.7.14), several effects of climate change are particularly significant in the western Arctic, could further affect subsistence resources and land uses, and are therefore likely to create significant social anxiety for the Iñupiat.

The BLM (2012) found that the overall extent of expected cumulative impacts on sociocultural systems would vary depending on the alternative selected, but that no scenario was expected to result in overall impacts that would be more substantial that those caused by technology, other aspects of modernization, and climate change. The current SEIS sociocultural systems analysis is focused on Nuiqsut and the potential impacts of GMT1. It finds that all of the action alternatives are likely to result in a mixture of sociocultural benefits and adverse impacts that are, on the whole, of a degree and intensity that can be characterized as major. However, the current analysis found substantially higher degrees of negative sociocultural impacts associated with Alternatives D1 and D2.

Performance-based lease stipulations and BMPs should reduce the cumulative effect to sociocultural systems from oil and gas, and non-oil and gas activities, in the planning area. The analysis in this SEIS concludes that the current stipulations and best management practices are adequate to protect human health and the environment but are anticipated to be inadequate to reduce several primary sociocultural impacts below the level of major for the community of Nuiqsut. Several new potential mitigation measures are proposed for inclusion in the ROD. The impacts of the GMT1 Project when considered in combination with GMT2 and the RFFs are anticipated to have major adverse sociocultural impacts on Nuiqsut. Data is insufficient to determine the level of sociocultural impacts to the year 2100 for other NPR-A communities: moderate economic benefits can be expected and impacts to subsistence that fall above the level of likely to have a significant impact are identified in the ANILCA 810 analysis.

4.6.10.3 Economy

The BLM (2004) describes cumulative impacts to the economy as potential gains in direct employment, which would include additive jobs in petroleum exploration, development, and production, and oil spill cleanup activities (BLM 2004, § 4G.7.2.1). Cumulative impacts are projected to generate additive employment and personal income increases for local, NSB, and state residents.

Overall cumulative economic impacts resulting from increased development on the North Slope would have benefits at state, regional, and local levels. Cumulative impacts to the economy are discussed more fully in BLM 2004, § 4G.7.2, and BLM 2012, § 4.8.7.20.

Past and Present Impacts and Their Accumulation

The NSB has transformed to a mixed cash-subsistence economy. Particularly in the last 40 years, residents have both benefited and grown accustomed to the result of modern capital development on the North Slope. In addition to the petroleum industry, the NSB has become a dominant economic organization on the North Slope. The NSB taxes the oil and gas facilities and uses the revenues to provide education and a wide array of other public services within its boundaries. Property taxes on oil and gas infrastructure provided over 82 percent of the total revenues received by the NSB in 2009 (BLM 2012, § 4.8.7.20).

Kuukpik Corporation collects revenues from their ownerships in the Alpine field and enters into surface access agreements for use of Kuukpik land. Kuukpik Corporation owns surface lands within the project area, and ASRC owns the subsurface minerals. Development in the Alpine field would directly benefit these entities, as described in Section 4.4.3. The royalties to ASRC from production of these fields would generate revenues for the corporation and its shareholders. Seventy percent of these petroleum royalties will be shared with the other Alaska Native regional corporations in accordance with section 7(i) of ANCSA.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Continued recreational, research, and other activities are expected to largely follow historic economic patterns. Growth and development associated with villages and military sites are also expected to continue (BLM 2012, § 4.8.7.20).

GMT 2 Development

Production of oil from the conceptual GMT2 site would likewise result in economic benefits on both the borough and local levels by extending operations at the Alpine field. Alternative E will not add an incremental beneficial cumulative impact to the state, NSB, or local economies as a direct result of reduced oil and gas revenues since development GMT1 would be denied, and the conceptual GMT2 Project would not occur. Conversely, the reduction of oil and gas activities in the NPR-A might have beneficial impact to local mixed economies such as Nuiqsut’s, where a majority of the residents rely on subsistence resources for food security. Specific cumulative impacts to economies at the state, NSB, and local level for the action alternatives are discussed briefly below.

The development of the GMT2 Project may expand oil and gas development activities to the west and south of current development if it were connected via roadway to existing facilities at Alpine or to the community of Nuiqsut. The expanded access and facilities may increase the future development in the NPR-A as projects that are currently not economically feasible may become more feasible. Development of GMT2 would also extent the existence of the GMT1 facilities which would be required to support development at production at GMT2; this extension of operating duration would also increase the duration of impacts associated with the GTM1 project. And although GMT1 and the RFF GMT2 Project would involve staggered construction, simultaneous operations would occur for a moderate duration until production activities at both sites cease.

The positive impacts to the economy that would occur as a result of development of the GMT2 Project may be delayed or may not occur if GMT1 Alternative D2 (season drilling) is selected because the extended years of drilling would delay production.

Oil and Gas Exploration and Development Activities

Events that would affect the economy of the NSB and the State of Alaska result from existing and future onshore and offshore oil and gas leasing and development, assisted by the potential construction of natural gas pipelines and an Umiat road. The Meltwater Corridor alternative for a road to Umiat could limit public access, thus offsetting negative impacts (AK DOT 2012). Oil and gas exploration and development will occur on existing leases on State- and Native-owned lands east of the NPR-A, federal and Native-owned leases in the NPR-A, and federal and state leases in the Beaufort and Chukchi Seas. Future oil and gas lease sales with subsequent exploration and development may occur in the NPR-A, Chukchi Sea, Beaufort Sea, and lands east and west of the NPR-A. Construction of a natural gas pipeline is required to take North Slope gas to market, and would be important to the local and state economy. A foothills route for the Umiat road from the Dalton Highway to the Colville River or into the NPR-A would improve the economic potential of oil and gas resources in that area, probably leading to earlier production schedules and possibly resulting in development of some marginal accumulations. Economic impacts to the State, borough, and local economies are within the range analyzed in BLM (2012 § 4.8.7.20).

Kuukpik and ASRC will likely benefit from other RFF oil and gas activities in the area as mentioned, and ASRC benefits economically from the oilfield services it provides. Additionally, proximity of NPR-A communities, particularly Nuiqsut, to development in and near the NPR-A can provide opportunities to those communities. These opportunities could extend to community businesses that might provide goods and services, as well as residents who might obtain work as a result of the development and production activities.

Revenues from exploration and development of oil and gas resources in the NPR-A and elsewhere on the North Slope have added economic stability to local communities. The cumulative economic impacts also apply at the local community level. Although smaller scale, the economic ramification can be of high intensity, long-term, localized, and major since communities in the NPR-A receive revenue from oil and gas through land ownerships used by industry, distribution of special funds unique to the NPR-A, and appropriations for a variety of services from the State government. There are a number of jobs in Nuiqsut that are technically NSB but paid for with NPR-A Impact funds from the State's share of revenues collected from federal development. Continuing or expanding those opportunities are dependent on NPR-A royalty revenues.

Contribution of the Alternatives to Cumulative Impacts

Production of oil from the GMT1 would, for a substantial period into the future, be a source of revenue to the NSB, which in turn, becomes part of the source of allocations to local communities. Production of oil resources from the GMTU under the cumulative case would be one of the sources of oil and tax revenues that would go to the NSB. For the purposes of this analysis, it is assumed that Alternatives A, B, C, D1, and D2 would generate similar tax revenues. Alternative E would provide no revenues to the NSB since there would be no production from the GMTU. Impacts to the State economy are based on the assumption that there are commercial quantities of recoverable oil and gas in the GMTU in addition to those that would be extracted at the GMT1 site. GMT1 and the conceptual GMT2 would go on line at different times; phased construction and production would extend the overall economic effect of the revenue stream to the State from the GMTU over time. The cumulative effect of production and a pipeline system to CD5 would have a beneficial effect on other undiscovered oil and gas resources in the GMTU by having road access into the GMTU under Alternatives A, B, and C.

The impacts to the economy under the action alternative would be similar; however, there may be slight differences in employment, income, and revenues due to differences in capital spending. It is estimated that the total capital cost of Alternatives B, C, and D1 would be higher (12, 14 and 80 percent, respectively) than the cost of Alternative A. Alternative C may also lead to increased economic benefits for the NVN due to additional income from use of the airport and hotel.

Conclusion

Overall cumulative economic impacts resulting from increased development on the North Slope would have benefits at state, regional, and local levels.

Climate change could negatively impact the economy for the North Slope; because villages are primarily located at or near sea level, any increase in mean sea level or violent storms may require relocation of part or all of villages and subsistence camps. This would have a major negative economic impact to the villages and the NSB, and a substantial impact to the state if it must help fund the relocation.

4.6.10.4 Land Use

Cumulative impacts to land use from oil and gas exploration, development, and production in the NPR-A and across the North Slope will result in development of previously undisturbed areas and will change the character of land use, resulting in increases in noise and disturbance, and potentially adversely affect habitats and subsistence. Most of the cumulative impacts from future development were expected to be localized to the development facilities. Cumulative impacts to land use in the project area are discussed more fully in BLM 2004, § 4G.7.6.

Past and Present Impacts and Their Accumulation

Poor soil conditions and lack of access in the NPR-A limit uses of these lands. The Plan Area considered in the ASDP EIS (BLM 2004), which includes GMT1, accounts for 890,000 acres of the 4.3-million-acre NPR-A (or 21 percent). Of this, the Alpine Field Development accounts for approximately 100 acres, and the NVN accounts for 5,900 acres of development. The remaining land is undeveloped, outside of subsistence-related camps and cabins and the Helmerick's property. North Slope Alaska Natives, particularly those in Nuiqsut, use the ASDP Plan Area for subsistence hunting and gathering. Oil exploration and scientific research activities also occur in various locations.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

The majority of activities that may take place in the future have the potential to impact land use including several non-oil and gas-related activities. Anticipated non-oil and gas activities include archaeological and paleontological excavations, camps associated with scientific studies, recreational use, overland moves by transport vehicles, reclamation of former military or legacy well sites, expansion of existing communities, or the construction of new roadways. All of these activities would impact existing land use to some extent. Changes could be both positive or negative depending on location, ownership, and current uses.

GMT 2 Development

The combination of GMT1 and the conceptual GMT2 Project would not change existing land use of federal land in the NPR-A, reflecting a DOI decision to issue oil and gas leases with an implied expectation by the lease holder that environmentally responsible development of discovered commercially recoverable oil and gas resources would be approved. The conceptual GMT2 involves an area selected by the Kuukpik Corporation. Land owned by the Kuukpik Corporation is designated for a mixed use, which includes oil and gas production facility operations associated with Alpine. Until these lands are conveyed, BLM manages all selected land in the same manner as federal land in the NPR-A. Overall, the cumulative impact to land use by construction of the GMT1 and the conceptual GMT2 under any of the action alternatives is not expected to change the land uses now in place. Alternative E would deny the development of GMT1 and the conceptual GMT2 would not occur.

When taking into consideration the proposed GMT1 Project and conceptual GMT2 Project, the cumulative impacts of these developments would be similar and would not change existing land use. Changes to visual resources, subsistence, land use, and other resources will occur as the result of development in currently undeveloped areas increases.

Oil and Gas Exploration and Development Activities

The GMTU is located within the jurisdictions of several entities, which have varying authorities and perspectives on oil and gas development activities on lands within the Unit. These include the BLM for federal land in the NPR-A (including both BLM-managed surface and subsurface, as well as land that has been selected by Kuukpik Corporation but not yet conveyed), the NSB, Kuukpik Corporation as a surface land owner, and ASRC as the owner of the subsurface rights under Kuukpik Corporation land. The GMT1, conceptual GMT2 Project, and other RFF activities on the North Slope do not change the scope of authorities of these institutions but may change where said authorities are applied if land and subsurface federal ownerships are transferred to the two Native corporations. Cumulative impacts to sociocultural systems include increased tension among community and regional institutions including the NVN, the City of Nuiqsut, Kuukpik Corporation, ASRC, BLM, and the NSB regarding their role in and jurisdiction over development activities on the North Slope.

The 2004 ASDP EIS stated that additive cumulative impacts on land use, habitats, and subsistence on the North Slope would be expected to occur from current and future development and operation of energy, transportation, and utility facilities. The continued development of previously undisturbed areas on the North Slope will change the character of land use, cause increases in noise and disturbance, and potentially adversely affect habitats and subsistence. Most of the cumulative impacts from future development were expected to be localized to the development facilities.

Other RFF projects considered in this SEIS (i.e., Umiat road, offshore oil and gas development, etc.) would have an additive impact with respect to land use to the extent that development associated with RFF projects may extend into areas which have not be set aside for oil and gas development.

Contribution of the Alternatives to Cumulative Impacts

Alternative A was cited and designed to comply with all relevant lease stipulations, as well as most of the BLM (2013) BMPs governing surface uses. Alternative E may not have an adverse cumulative impact to the overall land ownership on the North Slope since land ownership is fixed by federal law. However, the location of unfilled land entitlements for the State and to Native corporations may move to other valid existing selections by the Kuukpik Corporation within NPR-A. Selected land associated with GMT1 and the conceptual GMT2 may not transfer from federal to private ownership because it is reasonable to conclude that most of these selections were based on prospective oil and gas development. The extent that existing valid selections by the Kuukpik Corporation would or would not continue to patent is beyond the scope of this SEIS.

Conclusion

Other related cumulative impacts to land use are discussed under *Subsistence and Recreation*.

4.6.10.5 Recreation

Cumulative impacts to recreation from oil and gas exploration, development, and production in the NPR-A and across the North Slope would results from construction and operation of facilities and roadways resulting in decreased solitude and primitiveness and increased access to recreational opportunities. Cumulative impacts to recreation are discussed more fully in BLM 2004, § 4G.7.7, and BLM 2012, § 4.8.7.16.

Public recreational facilities in the project study area are nonexistent and recreational opportunities in this area are a function of the natural setting. Primitive unconfined recreational opportunities (e.g. backpacking, sightseeing, and hunting) are possible, but access is limited due to the remote nature of the area. Public recreation in the area is of low intensity and primarily limited to non-local visitors who float the Colville River between Umiat and Nuiqsut.

Past and Present Impacts and Their Accumulation

The BLM (2012) considered the effects of past and present non-oil and gas and oil and gas-related activities and their accumulation on Recreation resources (BLM 2012, § 4.8.7.16) as described below.

Non-oil and gas activities would have minimal temporary or short-term impacts to recreation resources within the NPR-A. Temporary structures such as tents, vehicles such as Rolligons, and noise from generators, aircraft, human presence, and associated activities could have some minimal seasonal impacts on the setting, experiences, and desired beneficial outcome from use of public land. All of these identified non-oil and gas activities are transitory and seasonal, thus limiting the likelihood of recreationists encountering them in any given location.

The previous and current growth of communities around and within the project study area may have a negligible impact on recreation resources through competition for resources on public lands. The past use of lands for military development and the adjacent active and inactive Air Force Radar Sites, do not take away from recreation opportunities although these areas are generally not available for use by recreationists.

Some past oil and gas exploration activity resulted in gravel pads and runways that remain today and can be beneficial for recreationists. Past oil and gas activities, including legacy wells, have left drums and other debris that would impact a recreationist for the duration that the items are visible.

Overall, the impacts to recreation resources and use from past and present activities are considered negligible. Past activities have left some mark on the land that can detract from the recreation experience however, evidence of past use is scattered and localized.

Future Impacts and Their Accumulation

Future impacts to recreation and recreational resources are anticipated from both non-oil and gas and oil and gas activities. Impacts could be both positive and negative.

Activities Not Associated With Oil and Gas Exploration and Development

In the future, after reclamation has taken place on past military development sites, there may be remaining gravel runways and pads that could be used to access sites and to camp which could benefit recreationists and other activities such as research. Nevertheless, this could lead to competition among user groups for this resource (BLM 2012, § 4.8.7.16).

Development of the Nuiqsut Spur Road and/or the CRAR would provide easier access for recreationalists in the project study area. Future impacts could be both positive and negative.

GMT 2 Development

The conceptual GMT2 Project, under Alternative A, B, and C would increase access to the area that may be available for future public use by adding approximately 9 miles of industrial gravel road from the GMT1 site, which would also tie into the existing Alpine facilities and the community of Nuiqsut. Residents of Nuiqsut would have similar access to the conceptual GMT2 area via the Nuiqsut Spur Road under these 3 alternatives. Alternatives D1 and D2 are unlikely to provide any increased opportunity for public access to the general project study area since there is no permanent surface access and the two new airports (except for emergency situations) would not be available to private aircraft. Alternative E would maintain existing recreation resources and opportunities in the project study area, although public access would only be improved via the Nuiqsut Spur Road, with no additional roads going west.

Oil and Gas Exploration and Development Activities

The BLM considered impacts to recreation across the North Slope that may result from future oil and gas and related activities. RFF projects would have an additive cumulative impact on recreation resources in the NPR-A BLM (2012, § 4.8.7.16); it is assumed that impacts in the project study area would be similar.

Of the proposed and RFF projects, depending on the alternative selected, the Umiat road has potential to impact recreational opportunities in the cumulative impacts evaluation area. The construction of the Umiat road would add approximately 102 miles of new roadways and tie into the Dalton Highway. This tie in could increase access for potential recreationalists along the road corridor and in the Umiat area. Likewise, other developments, to the extent that they connect to the Umiat road system would also have an additive impact in opening up the area for recreation. The road would result in easy public access to the Colville River and thus by boat to the Colville Delta and Beaufort Sea as well as to any navigable tributary of the Colville. Thus, the potential impact to recreation although overall is considered to be negligible, would be minor in the Umiat area. Note that the Meltwater Corridor alternative could limit public access, thus offsetting negative impacts (AK DOT 2012).

Contribution of the Alternatives to Cumulative Impacts

Impacts to recreation during drilling and operations are considered to be minimal due to the lack of access and limited in extent. Under Alternatives A, B, and C, the construction of new gravel roads may increase recreational access to a larger area than is currently accessible via roadway. However, because road use would be limited to industrial traffic and local residents, impacts to recreation are likely to be minimum. Alternatives D1 and D2 would not provide additional opportunity for public access as a road would not be constructed and travel in and out of the associated airstrip would be limited to industry. Alternative E would have a very small but adverse cumulative impact to public access to recreation resources on the North Slope, as no new roadways would be constructed and access would remain limited.

Conclusion

The BLM (2004) predicted that short-term impacts, such as green trails and disturbance from noise and other activities, would not accumulate. Impacts from long-term or permanent facilities such as roads, pipelines, and gravel pads would accumulate and would result in the long-term loss of solitude, quietude, naturalness, or primitive/unconfined recreation, and wilderness-type values. These impacts could be locally adverse (BLM 2004, § 4G.7.7).

As the climate warms in future years, the timing and location of recreation activities could change. For instance if wildlife distribution changes then both wildlife viewers and hunters would correspondently change the location that they recreate. Cumulatively there would be more activity, more human presence, increased noise, increased aircraft use, change in location of recreation activities, and correspondingly greater impacts on the setting, experiences, and desired beneficial outcome from use of public land. Also in the future as the climate gets warmer, the timing and location of recreation activities could change. The impacts to recreation associated with the proposed project are within the range of impacts considered by BLM (2012, § 4.8.7.16).

4.6.10.6 Visual Resources

Cumulative impacts to visual resources from oil and gas exploration, development, and production in the NPR-A and across the North Slope would result from increased development resulting in changes to the character elements of form, line, color, and texture of the natural landscape. Cumulative impacts to visual resources in the project area are discussed more fully in BLM 2004, § 4G.7.8, and BLM 2012, § 4.8.7.19.

BLM (2012, Map 2-5) identifies the visual resources in the project study area as being managed as a Class IV resource. The overall cumulative impact to visual resources in the area production facilities, elevated pipeline system, gravel road, and airports would be high.

Past and Present Impacts and Their Accumulation

Past and present non-oil and gas-related activities, including archeological collection efforts, field camps, survey work, scientific research, recreation activities, film permits, and overland moves, are seasonal and generally limited with respect to size or scale, and therefore the casual observer has been minimally impacted. Landscape modifications from previous and current growth of communities around and within the NPR-A, the past use of lands for military development, and inactive Air Force Radar Sites have impacted visual resources or scenic quality, by creating a contrast to the landscape character elements of form, line, color, and texture of a primarily horizontal natural landscape. The colors of structures and equipment associated with non-oil and gas activities contrast with the white color of the snow-covered landscape and the various hues of greens and browns. Cabins and camp structures associated with subsistence activities can be found throughout the North Slope. These structures are usually isolated single-story small plywood cabins that produce some contrast with the surrounding landforms, but on a very local scale, along lakes, rivers, and creeks (BLM 2012, § 4.8.7.19).

Airstrips are located within the NPR-A, villages, oil and gas fields, and at Deadhorse. While the profile of an airstrip is low, landform changes are introduced by brown colors in predominantly green vegetation and more regular lines than the surrounding irregular vegetation (BLM 2012, § 4.8.7.19).

Winter overland moves, such as overland transportation of fuel and supplies to villages, and previous seismic activity can leave long lasting impacts to vegetation. The contrast has been minimal from ground view and almost nonexistent from more than a few hundred feet away. After 8 to 9 years, the evidence of use would be minimal (BLM 2012, § 4.8.7.19).

Oil and gas activity prior to the 1998 lease sale left remnants (drums and other debris) of use on the landscape. As funding becomes available, the BLM has been plugging old wells, cleaning sites, and removing debris. However, debris not located at old well sites are scattered in the NPR-A. As the BLM encounters these items, GPS points are taken so that debris eventually may be able to be removed. The debris is a contrast to the landscape character elements of line, form, color, and texture of the landscape. Oil and gas activity since the 1999 lease sale has included requirements that leaseholders reclaim an area once they have completed their activity on the land. There are some wells that have been capped for future re-entry. However, they only occupy a minimal space on the landscape, approximately an imprint of 6 by 6 feet (BLM 2012, § 4.8.7.19).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Activities not associated with oil and gas exploration are anticipated to continue as they have in the past and associated impacts are expected to be similar to current impacts described above.

Of the non-oil and gas RFF projects, the CRAR has the greatest potential cumulative impacts. The proposed CRAR would permanently change the characteristic of the landscape, introduce public access into a currently non-easily accessible area, increase the overall noise level, and increase the viability of further development within the NPR-A. The Nuiqsut Spur Road would also change the characteristic of the landscape and increase the local transportation network, allowing traffic to move between Nuiqsut and the Alpine Field.

GMT 2 Development

The conceptual GMT2 Project would have additive impacts to those of the proposed GMT1 Project by extending the changes to existing visual resources to the GMT2 pad. Construction of the GMT2 Project would include development of a pad and a pipeline. GMT1-GMT2 road would also be constructed and under Alternatives D1 and D2 the GMT1-GMT2 road would not be constructed, but an access road, an occupied structures pad, and an airstrip with apron would be constructed (Table 4.6-5). The GMT2 Project would have similar visual impacts to those described for GMT1 under the action alternatives.

Oil and Gas Exploration and Development Activities

BLM (2012) concludes the cumulative effect of oil and gas development on the visual resources of the North Slope generally would be limited to the foreground-middleground zone of the viewer BLM (2012, p. 135).

Of the oil and gas-related RFF projects, the Umiat road has the greatest potential cumulative impacts. A road to Umiat would permanently change the characteristic of the landscape, introduce public access into currently non-easily accessible areas, increase the overall noise level, and increase the viability of further development in the Umiat area and within the NPR-A.

Contribution of the Alternatives to Cumulative Impacts

The BLM (2004) considered cumulative impacts to visual resources from the proposed Alpine development. Short-term impacts such as green trails would not accumulate, and would naturally recover. Impacts from long-term or permanent facilities such as roads, pipelines, gravel pads, and pits would accumulate and would result in the loss of scenic quality. Long-term impacts from future development with a possible life span of over 30 years would affect the visual resources for the North Slope. These impacts would be expected to be greatest within a 0.5-mile radius of each developed site. Pipelines could be elevated above ground level. Except during construction and repair of pipelines, there would be no associated on-the-ground activity. Therefore, long-term impacts to visual resources from pipelines would be expected to be minimal beyond approximately a 0.5-mile (BLM 2004, § 4G.7.8).

Oil and gas activities, including the action alternatives associated with the GMT1 Project would result in changes to the existing undeveloped nature of the project area. During the construction phase, the primary negative impact to visual resources from the action alternatives would result from the presence of drill rigs in the project area. During drilling and operations, pad facilities and communication towers would introduce a strong contrast to the natural landscape. The addition of gravel roads, pads, and airports as well as above-grade pipelines and bridges would also alter the existing visual landscape.

With all of the GMT1 action alternatives, there would be a cumulative adverse impact on visual resources within approximately 5 miles of proposed permanent facilities. Visual impacts under Alternatives A and B would be essentially the same. Alternative C would have similar impacts to Alternatives A and B over a slightly larger footprint due to the addition of the Nuiqsut Spur Road and upgrades at the Nuiqsut Airport. Alternatives D1 and D2 would eliminate the visual impact of a permanent gravel road to the GMT1 pad, but would include an elevated pipeline (as in the other action alternatives). This would be counterbalanced by the establishment of a new airport and instrumentation. The impacts of new facilities would change the existing visual resources associated with the GMT1 Project. For new facilities, the impact to visual resources would be of moderate intensity, long-term, and regional in extent. New facilities constructed adjacent to existing facilities or added to existing VSMs would not change the existing visual character associated with existing oil and gas facilities. All four of the action alternatives are consistent with VRM Class IV land management objectives and would impact the visual resources moderately. Alternative E would have a beneficial effect on visual resources. There would be additional beneficial effect to retaining the existing visual character of the North Slope to the extent that oil and gas activities in remote areas be reduced or foregone.

Conclusion

The overall cumulative impact to visual resources in the area from production facilities, an elevated pipeline system, gravel roads, and airports would be high. The project study area is one characterized as low relief with very low vegetation cover, suggesting the cumulative effect to visual resources could extend over a mile on a clear day. Lights at permanent facilities would also be seen from a distance of several miles during winter.

As development expands across the North Slope, primarily into areas where no infrastructure currently exists, so will the extent of impact on visual resources. Climate change could affect visual resource values by altering the current conditions of color, vegetation, land formation, adjacent scenery, and the presence of water.

Proposed and RFF projects, in conjunction with the range of action alternatives for the proposed GMT1 Project and the conceptual GMT2, would have an additive cumulative negative impact which would permanently alter the existing visual resources.

Although BMPs, lease stipulations, and mitigation measures would be taken to help blend structures and permanent facilities into their surroundings, the overall cumulative impact to visual resources in the immediate area of production facilities, elevated pipeline, gravel roads, and airports would be high. The cumulative impacts from the currently proposed project are within the range analyzed in BLM (2012).

The implementation of Lease Stipulations and BMPs, required for the protection of visual resources under all alternatives, should reduce the cumulative effect to visual resources from oil and gas, and non-oil and gas activities.

4.6.10.7 Local Transportation

Cumulative impacts to local transportation from oil and gas exploration, development, and production in the NPR-A and across the North Slope would vary depending on whether new developments link into existing road systems or rely on roadless construction and are supported by air transportation. The cumulative impacts of new local transportation facilities in the Nuiqsut area would be intense and long-term and would have both localized and regional benefits. Cumulative impacts to local transportation in the project area are discussed more fully in BLM 2004, § 4G.7.9.

Past and Present Impacts and Their Accumulation

The project study area has undergone significant changes with respect to local transportation since the 1970s. The community of Nuiqsut was reestablished in 1973, and soon after, the Trans-Alaska Pipeline System was built and production at Prudhoe Bay began. The reestablishment of the community and oil development in Prudhoe Bay and the project study area have included the development and construction of roads, airports and other supporting infrastructure in the previously undeveloped area.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Improvement of the 6-mile-long Nuiqsut Spur Road would widened the road to accommodate industrial traffic from the Nuiqsut Airport to the Alpine Field, which could be considered a beneficial effect.

The addition of the Colville River Road Access would complete a road connection providing year-around vehicle access to fish and wildlife resources along the Colville River and its delta, as well as to estuarine and marine resources along the coast. The cumulative impacts of these new local transportation facilities in the Nuiqsut area would be intense and long-term and would have both localized and regional benefits.

GMT 2 Development

Adding the conceptual GMT2 would increase the transportation network from GMT1 to GMT2 under Alternatives A, B, or C through the construction of the GMT1-GMT2 gravel road; the overall cumulative impacts from the conceptual GMT2 would be similar to those for the alternatives associated with the proposed project. Adding the GMT2 development under Alternatives D1 and D2 would not increase the local transportation network as no new roads, outside of an access road between the drill pad and occupied structures pad, would be constructed. Construction of new airstrips associated with GMT1 and GMT2 would increase transportation around the project study area, but would not have a direct benefit to the residents of Nuiqsut as these facilities would not be available for use by the public expect in emergency situations.

Oil and Gas Exploration and Development Activities

The 2004 ASDP Final EIS found that the proposed Alpine Field development, along with continued oil and gas development throughout the North Slope, would result in substantial increases in both road and air traffic levels, particularly on the central oil and gas transportation infrastructure in the Prudhoe Bay area. However, most of the transportation infrastructure on the North Slope is restricted to industry and local resident use, and operated well below capacity. Despite the substantial increase in activity levels, the existing infrastructure combined with the proposed roads and airstrips serving remote facilities, was expected to be sufficient to accommodate these increased demands for air and overland transportation. Therefore, the BLM (2004) did not anticipate any adverse cumulative impacts on transportation resources on the North Slope (BLM 2004, § 4G.7.9.1). The transportation impacts considered there are consistent with those for the currently proposed project.

The proposed Umiat Road(s) would provide year-around access between the Dalton Highway, TAPS, and a commercial gas pipeline system and the recreation and subsistence resources at Umiat as well as for prospective transportation of oil and gas resources in the Gubik Unit, Umiat Unit, and other areas in the southern parts of the NPR-A.

Other RFF projects could have a synergistic cumulative effect to the extent that new offshore and onshore developments connect to project infrastructure expanding the local transportation network and providing access to subsistence resources.

Contribution of the Alternatives to Cumulative Impacts

All of the action alternatives would increase access to the general area around GMT1. The overall increase in permanent road access, under alternatives A, B, and C, may be beneficial to future discoveries of commercially recoverable oil and gas resources in the GMTU depending on the location of the oil and gas resource. Having a gravel road system is likely beneficial to residents of Nuiqsut seeking access to traditional subsistence areas now limited to travel by ORV/snowmachine. Conversely, improved year around access may adversely impact the ability to harvest subsistence resources in the immediate area of the road and other facilities. Alternatives D1 and D2 would increase air transportation in the Nuiqsut area, but would not likely provide any beneficial improvements for local residents. Alternative E would result in no new access within the NPR-A.

Under Alternatives A, B, and C, which have similar transportation components and include linking GMT1 to existing gravel roads and infrastructure, minor impacts to local transportation are expected as most construction would take place on industry-constructed ice roads with no public impacts. These alternatives would have a minor impact over an interim duration (during construction only) on a regional basis. Under Alternative C, the six-mile long Nuiqsut Spur Road would be widened to accommodate industrial traffic from the Nuiqsut Airport to the Alpine Field, which could be considered a beneficial effect. Alternative C would also include improvements to the Nuiqsut Airport, which would be beneficial to the local community. Alternatives D1 and D2 would not include a road connection to GMT1 and would require construction of a new airport at the GMT1 pad. Alternatives D1 and D2 would result in a large increase in aircraft traffic, which would occur for the entire duration of the proposed project. As such, Alternatives D1 and D2 would have a moderate impact for a long duration on a regional basis.

Conclusion

The cumulative effect of GMT1 would be focused on the construction of an industrial gravel road system in an area currently roadless. For the GMT1 Project impacts to local transportation would occur during both the construction and operation phase. In general, impacts to local transportation range from minor to moderate on an interim to long-term basis. Cumulative impacts could be either positive or negative based on the selected alternative.

The cumulative impacts of these new transportation facilities, as they provide opportunities for other RFF projects to occur in the Umiat area, would be intense and long-term and would have both localized and regional benefits.

Potential impacts to transportation are mitigated by design, and operational features described in Section 4.7. Adherence to lease stipulations and BMPs of BLM (2013) will reduce the impacts and total area of disturbance; these include E-1, E-5, and F-1. The Applicant's Aircraft Plan is provided in Appendix H.

4.6.10.8 Subsistence

Potential cumulative impacts would be tied to regular, localized deflection or broader altered migration routes of subsistence animals, reduced access and disturbance to subsistence use areas from infrastructure, aircraft, and avoidance, and potential conflicts over harvest areas within a community (BLM 2012, § 4.8.7.13). Cumulative impacts to subsistence are discussed more fully in BLM 2004, § 4G.7.3, and BLM 2012, § 4.8.7.13. This analysis of potential impacts to subsistence as a result of GMT1 found impacts would likely be major according to the impact criteria used.

Past and Present Impacts and Their Accumulation

The community of Nuiqsut was reestablished in 1973, and soon after, the Trans-Alaska Pipeline System was built and production at Prudhoe Bay began. Since that time, oil and gas development has expanded to the west, encroaching on traditional subsistence use areas and resulting in various conflicts between industry and Nuiqsut subsistence harvesting activities.

Other activities, such as scientific research, tourism and the use of off-road vehicles, also contribute cumulatively to the impacts of oil and gas development. The use of off-road vehicles can damages habitat and impact subsistence access to popular hunting areas: if trails become so damaged they are rendered impassible, hunters may be prevented from traveling to an area or they may cause further damage by making new trails.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

All future activities, including those not associated with oil and gas exploration, production, and development, could have cumulative impacts with respect to subsistence. Two potential RFF projects that may impact subsistence resources or result in conflicts between subsistence users would be the development of the Nuiqsut Spur Road or the CRAR. If Nuiqsut hunters were to utilize new permanent roads, the community could gradually experience a shift in their subsistence harvesting patterns whereby the road becomes a hunting corridor. Such changes have been documented in other rural communities where roads have been introduced as described in BLM 2012 (§ 4.8.7.13).

GMT 2 Development

The development of GMT1 and conceptual GMT2 would introduce a pipeline, two additional oil and gas infrastructure complexes, and possibly a permanent gravel road into subsistence use areas west of the community of Nuiqsut (CD5 is the first). This westward expansion would impact subsistence use areas and could cause subsistence users to alter their harvesting patterns and potentially result in a loss of opportunities to harvest subsistence resources in traditional use areas. This loss of opportunity could have impacts on future generations, as harvesters may no longer be able to teach younger hunters about subsistence uses in traditional harvesting areas.

The extent that development of the RFF GMT2 Project would be connected via roadway and to existing infrastructures and communities, it may result in further westward exploration and development, which will likely result in significant, adverse, and long-term impacts to Nuiqsut subsistence users. The development of the GMT2 Project would also extend the operation of the GMT1 Project, and associated impacts, as the GMT1 facilities would be needed to support activity at GMT2. Although GMT1 and the RFF GMT2 Project would involve staggered construction, simultaneous operations would occur for a moderate duration until production activities at both sites cease, which will result in a longer duration of impacts. The development of GMT2 without a gravel road connection to GMT1, Alpine, or Nuiqsut would result in a further increase of aircraft and aircraft noise, which could likewise impact subsistence resources and thus the success of subsistence harvesters.

Oil and Gas Exploration and Development Activities

Proposed and current oil and gas activities in the Nuiqsut area include development of CD5 (including a bridge over the Nigliq Channel and three smaller bridges), development of the Umiat road, and winter oil and gas exploration to the west of the community. All of these activities, in combination with development of GMT1, could further increase potential for conflicts between subsistence users and oil and gas activities. Further, the proposed road to Umiat from the Dalton Highway could have substantial negative impacts on subsistence activities, in particular for Anaktuvuk Pass and Nuiqsut as discussed in the Caribou section. The Meltwater Corridor alternative could limit public access to the Umiat road, thus offsetting some of the negative impacts (AK DOT 2012). The State is undergoing the permitting process (currently suspended) to build the road with the hope that it will help promote oil and gas development in the area and within NPR-A. The project could likely make it economical to develop more oil and gas fields within the NPR-A. These developments would cause synergistic cumulative disturbances to subsistence use areas and possibly to subsistence resources. The proposed Umiat road would introduce new permanent infrastructure in subsistence use areas to the south and southeast of the community, leaving only the southwest direction as one unmarked by oil and gas infrastructure. However, because the Umiat road could open up areas to the west of Umiat to further development, the combination of these activities together would result in the community of Nuiqsut essentially being surrounded by development. This could pose difficulties for those hunters who avoid oil and gas infrastructure altogether. As noted above, the shifting of Nuiqsut subsistence use areas away from oil and gas infrastructure has been documented in various sources (RFSUNY 1984; IAI 1990b; Pedersen et al. 2000), and the GMT1 Project could contribute to those changes. In addition to opening up new areas to oil and gas development, the Umiat road could result in increased public access to the Colville River area for nonlocal hunters and tourists, thus increasing competition for local subsistence users.

RFF oil and gas activities that could contribute to cumulative impacts on subsistence include the conceptual GMT2 (discussed above); development of a natural gas pipeline from the North Slope to Valdez or Cook Inlet; and offshore oil and gas development in the Beaufort and Chukchi seas with associated onshore infrastructure. Increasing the number of oil and gas developments within Nuiqsut's existing subsistence use areas reduces the area available to subsistence users and will likely add to the existing impacts of development by increasing the incidence of potential impacts on resource availability and user access (including user avoidance).

Contribution of the Alternatives to Cumulative Impacts

Under Alternatives A, B, C, D1, and D2, Nuiqsut residents would experience direct impacts to subsistence use areas, particularly those for caribou, geese, and furbearers such as wolf and wolverine. Some winter fishing activities such as Arctic cisco and burbot fishing may also be impacted. Direct impacts on subsistence use areas would be lowest during the summer months as many of the subsistence activities that occur in the project study area take place during late fall through early spring. Except for areas of high snow drifting, user access will not be restricted for residents who wish to conduct subsistence activities in the project study area as the pipeline will be elevated to seven feet and the roads will be open to local use. User access will be restricted if residents using traditional travel routes to areas northeast of the community are not able to cross the CD5-GMT1 road. User avoidance is expected to be the primary impact related to user access, as Nuiqsut residents will likely avoid the project study area GMT1 pad and pipeline corridor (particularly under Alternatives D1 and D2). Subsistence harvesters often avoid areas of development due to concerns about contamination and because of residents' discomfort with hunting near human or industrial activity. The CD5-GMT1 road would be the first industry road to be used for subsistence access, which may offset negative impacts.

The cumulative impacts of Alternatives A, B, and C would be similar to one another, as each of these alternatives could lead to future expansion of oil and gas exploration to the west of the Colville River. Expansion further to the west of the Colville River would result in increased impacts on Nuiqsut subsistence use areas, particularly those along Fish Creek, and could potentially introduce oil and gas development into areas used by other North Slope communities such as Barrow and Atqasuk. If Nuiqsut hunters use the permanent roads built under Alternatives A, B, and C, the community could gradually experience a shift in their subsistence harvesting patterns whereby the road becomes a hunting corridor. Such changes have been documented in other rural communities where roads have been introduced.

Alternatives D1 and D2 would be less likely to facilitate westward oil and gas development. However, Alternatives D1 and D2 would create more helicopter traffic in areas used by Nuiqsut subsistence users. In Nuiqsut, disturbance from helicopter traffic is one of the most frequently reported impacts associated with oil and gas development (SRB&A 2012); Alternatives D1 and D2 would contribute to the cumulative impacts of helicopter traffic on the North Slope.

In terms of overall subsistence impacts, Alternatives A and B would likely have the fewest impacts to subsistence because they require less air traffic close to the community and because development-related ground traffic would be limited to the road between CD5 and GMT1. Alternative C would likely have more impacts than Alternatives A and B, because it would move development related ground traffic closer to the community, along the road between Nuiqsut and CD5, and because the community would experience more air traffic if used as a hub, which could result in deflection of subsistence resources near the community. Alternatives D1 and D2 would likely have the greatest impact to subsistence uses and activities of all the alternatives, as it would result in increased air traffic in hunting areas west of the community and would create a new source of air traffic that did not exist before. This high-intensity impact to subsistence would be of interim duration for construction and long-term duration during operation and it would affect multiple generations of subsistence users. While the spatial extent of impacts during construction and certain operational impacts (e.g., direct loss of subsistence use areas) would be localized, the indirect impacts of operation (e.g., increased cost, time, effort) could extend beyond the local area and affect the whole of Nuiqsut's subsistence activities (i.e., regional) in addition to introducing disruptions to caribou availability and other resources that could extend outside of the project study area and to a broader area-wide level. Lastly, the context of subsistence is an important resource that fills a unique role in the regional sociocultural environment. Thus, the overall degree of impact to subsistence is expected to be major because it is a high-intensity impact, would have impacts of long-term duration, extend to regional extents, and is an important resource.

The BLM (2004) found that additive impacts that could affect subsistence resources included potential oil spills, seismic noise, road and air traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Based on potential cumulative, long-term displacement and/or functional loss, habitat available for caribou may be reduced, unavailable, or undesirable for use. Changes in population distribution due to the presence of oilfield facilities or activities may affect availability for subsistence harvest in traditional subsistence use areas. Overall, impacts to subsistence harvest and use may have synergistic impacts with community health, welfare, and social structure. To the extent that subsistence hunting success is reduced in traditional use areas near Nuiqsut, subsistence hunters will need to travel to more distant areas to harvest sufficient resources in order to meet community needs. This will result in greater time spent away from the community for some household members and competition for resources with members of other communities. These changes in subsistence patterns may result in stress within households, family groups, and the community. The BLM (2004) analysis indicated that there may be significant impacts to subsistence.

Conclusion

Overall, the GMT1 Project in addition to other current and RFF activities could increase the severity of existing impacts on Nuiqsut subsistence uses in addition to introducing impacts on subsistence uses for other North Slope communities, particularly those whose subsistence use areas are located to the west of Colville River. These impacts include continued hunter avoidance of industrial areas, continued disturbance of hunters and wildlife from increased air and road traffic, reduced access to or loss of subsistence use areas, and reduced availability of subsistence resources in development areas. In addition, if displacement of subsistence resources occurs in Nuiqsut subsistence use areas, hunters may travel farther west to access hunting grounds, increasing the potential for competition between hunters from different communities such as Barrow. These impacts could result in increased investments in time, money, fuel, and equipment and potentially affect hunting success. As oil and gas development activities occur over a larger area and impact a greater portion of subsistence use areas, North Slope subsistence users may alter their harvesting patterns and potentially result in a loss of opportunities to harvest subsistence resources in traditional use areas. This loss of opportunity could have impacts on future generations, as harvesters may no longer be able to teach younger hunters about subsistence uses in traditional harvesting areas.

Climate change and the associated effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue as predicted (NRC 2003, Arctic Climate Impact Assessment 2004). The reduction, regulation, and/or loss of subsistence resources would have severe impacts on the subsistence way of life for residents of NPR-A communities. If permafrost loss increases as predicted, there could be synergistic cumulative impacts on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of fresh water, and availability of terrestrial mammals, marine mammals, waterfowl and fish, all of which could necessitate relocating communities or their population, shifting the population to places with better subsistence hunting, and causing a loss or dispersal of community (NRC 2003, Arctic Climate Impact Assessment 2004).

In addition to the cumulative impacts associated with oil and gas activities, several effects of climate change are particularly significant in the western Arctic. As described in BLM (2012 § 4.8.7.13), the reduction, regulation, and/or loss of subsistence resources due to climate change would have severe impacts on the subsistence way of life for residents. If permafrost loss increases as predicted, there could be synergistic cumulative impacts on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of fresh water, and availability of subsistence resources. These impacts could necessitate relocating communities or loss or dispersal of communities.

The implementation of Lease Stipulations, BMPs, and new potential mitigation measures required for the protection of subsistence resources under all alternatives, should reduce the cumulative effect to subsistence resources from oil and gas, and non-oil and gas activities, in the planning area. Several potential mitigation measures are discussed that, over time, could reduce impacts to subsistence from development of GMT1.

4.6.10.9 Public Health

Impacts to public health under all of the action alternatives are anticipated to be localized and temporary with no measurable impact on a population level. Potential impacts under the proposed project could include diverting hunters and animals, noise from increased air traffic, perception that traditional foods are contaminated, increased travel time and costs for subsistence, and poor air quality episodes. Cumulative impacts to public health are discussed more fully in BLM 2012, § 4.8.7.21.

Past and Present Impacts and Their Accumulation

The 2012 IAP/EIS public health cumulative effects analysis (BLM 2012, § 4.8.7.21) described both positive and negative health impacts for North Slope residents due to changes that have occurred in the last 50-100 years, as well as RFF actions such as oil and gas exploration and development, scientific research activities, mining projects, military developments and activities, transportation plans, community development projects, and recreation and tourism activities. As stated in the analysis, rapid modernization has led to significant changes in diet, housing, employment, and traditional culture. This has led to positive health changes including an increase in life expectancy, a decrease in infant mortality and infectious disease rates, improved health care services, public health programs, and municipal health infrastructure such as sanitation and water treatment facilities. This same transition has also led to negative health outcomes including increases in chronic diseases such as cancer, cardiovascular disease and metabolic disorders, and increases in alcohol and substance misuse, suicide, violence and other social dysfunction.

The pattern of oil and gas development that has taken place in and near the NPR-A, combined with the area's unique culture and geography has led to the creation of certain health concerns that are of particular importance. These health concerns represent areas of vulnerability whereby further oil and gas-related development may have a disproportionate impact on health and safety, and include: injury and trauma, which may be linked to the adaptation by hunters to travel further away from development to conduct subsistence activities; increases in social pathologies such as alcohol and drug misuse, social dysfunction and violence, in part due to increased opportunities to import alcohol and drugs; and health disparities due to the uneven distribution of the rewards and risks of development.

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Future non-oil and gas activities that could impact public health include scientific research activities, mining projects, military developments and activities, transportation plans, community development projects, and recreation and tourism activities. The common components of these future actions that are most likely to drive public health and safety outcomes were evaluated in BLM (2012, § 4.8.7.21): potential growth in population in the communities in the project study area; in-migration of workers, visitors, or temporary residents not originally from the area; economic changes at the level of both individual residents and the Native corporations; changes in the level or success of subsistence activities; changes to public infrastructure; potential exposure to environmental contaminants; changes in access to or use of the land; continued acculturation of the Iñupiat people and alteration of sociocultural traditions.

As the RFF actions continue the path and progress of development seen in the past, it can be expected that the changes in public health and safety outcomes will follow the same trends that have been observed in recent years as described above.

GMT 2 Development

Impacts to human health associated with the conceptual GMT2 Project would be similar to those under the range of action alternatives for the GMT1 Project. Development of GMT2 would have additive negative impacts with respect to public health. The additional footprint to the west would likely have an additive impact with respect to diverting animals and thus hunters, and an increased amount of air emissions and potential for spills. Further, the increased personnel required to construct and operate GMT2 would require additional flights (increasing noise and potentially affecting air quality), and would be an additive strain on existing medical care and emergency services. As with the GMT1 Project, these impacts would be greatest during the construction phase of the conceptual GMT2 and would be reduced once operations are underway.

Oil and Gas Exploration and Development Activities

The pattern of development and modernization that has taken place in the in and near NPR-A combined with the area’s unique culture and geography has led to the creation of certain health areas that are of particular importance. These areas include injury and trauma, social pathologies such as alcohol and drug misuse, social dysfunction and violence, and health disparities within the population.

New development tying into existing infrastructure to the east of the NPR-A will exacerbate some of these impacts. The potential extension of seasonal or permanent roads into the northeast of the NPR-A might compound issues of conflict and smuggling in Nuiqsut and other North Slope Borough communities. Air and water quality across the region are currently good. Local impacts due to site-specific activity are possible, but will depend on the characteristics of individual site plans and the presence of exposed villages or camps. More widespread development will result in a greater number of individuals on the land or in camps being exposed to local air, and possibly water, exposures.

Of particular significance for public health and safety is the potential for further increases in offshore oil and gas exploration, development and production. A ramp-up of offshore development is expected to lead to potentially substantive changes in public health outcomes via three pathways: a) the displacement of marine mammals and the subsequent reduction of success and safety of subsistence hunting; b) the potential for contamination and the fear of contamination through oil spills or routine discharge; and c) substantially increased economic returns to the NSB, village corporations and individuals with resulting positive and negative health impacts and disparities (BLM 2012, § 4.8.7.21). The direct and indirect employment resulting from oil and gas exploration and development combined with the government and Native corporation revenues are all major contributors to the positive health changes in the North Slope Borough over the last few decades.

Contribution of the Alternatives to Cumulative Impacts

Under all of the action alternatives, an increase in workers could impact the local community with respect to availability of medical care and emergency services. Impacts under all of the action alternatives are expected to be similar, with a few notable exceptions, which are discussed below. Alternative B, which avoids activities near Fish Creek, could reduce the impact on subsistence hunting areas and travel times and cost associated with subsistence would not be as high as Alternative A. Alternative C, which includes an aircraft extension and additional infrastructure in and around Nuiqsut would increase the potential for noise and poor air quality episodes. Alternatives D1 and D2, which do not include the construction of a CD5-GMT1 road, would have the least impact of any of the action alternatives in terms of potential impacts related to perception of food contamination, and avoidance of infrastructure at subsistence sites. Alternatives D1 and D2 would cause none of the impacts associated with roads (dust, emissions, noise) between CD5 and GMT1, but would increase the traffic, emissions, noise, and other public health issues associated with annual ice road construction. However, Alternatives D1 and D2 would have an increase in local noise associated with the airstrip, but would not likely be heard in Nuiqsut. Alternatives D1 and D2 will have greater impacts on public health concerns related to environmental security (e.g., oil spill response, evacuation routes, air pollution). Alternative E (No Action) would result in no change from the current baseline conditions.

Conclusion

When evaluating the currently proposed project in conjunction with the conceptual GMT2 and other RFF projects, these projects could have an additive cumulative effect, generating potentially substantive changes, with respect to public health as described above and in BLM (2012, § 4.8.7.21). The community of Nuiqsut will be most impacted by the proposed and conceptual GMT2 projects and less affected by other RFF projects to the extent that they do not connect into the existing and proposed roads or require the use of the airport at Nuiqsut. The cumulative impacts of increased development to the south, west, and north of Nuiqsut, associated with the proposed Umiat road; exploration and development in the NPR-A, the Bear Tooth Unit, and the Tofkat Prospect; and offshore development, may have synergistic effects with respect to disturbance of animals. This may result in changes to traditional hunting grounds and may require further energy (time and travel costs) to reach these resources. Additionally, the increase in development could result in a cumulative negative impact to human health resulting from impacts to air quality, water quality, or spills. Other RFF developments are not likely to have a direct impact on the availability of local emergency services.

Uncertainty over the impact of climate change on subsistence resources and related traditional lifestyles and culture, combined with new conflicts in use of the Chukchi and Beaufort Seas is a cause of concern among Iñupiaq hunters and community members. Climate change may also result in increased injury and trauma, as unusual or unpredictable weather, water, snow and ice conditions make travel more hazardous and people may travel greater distances to find marine or land mammals or edible plants.

The implementation of new potential mitigation measures, Lease Stipulations, and BMPs required for the protection of public health under all alternatives, should reduce the cumulative effect to public health from oil and gas, and non-oil and gas activities, in the planning area.

4.6.10.10 Environmental Justice

The analysis of impacts related to environmental justice considers if implementation of one of the proposed GMT1 alternatives would result in disproportionately high and adverse environmental impacts to the minority community of Nuiqsut, which is characterized as unique in context. The analysis identified environmental justice issues that would result from under all the action alternatives associated with impacts to sociocultural systems and to subsistence. The intensity of those impacts is qualified as high, the duration of effects would be long-term and of regional extent. High and adverse effects to sociocultural systems would be local.

Cumulative impacts to environmental justice are discussed more fully in BLM 2004, § 4G.7.4, and BLM 2012, § 4.8.7.15.

Past and Present Impacts and Their Accumulation

Euro-American presence, commercial whaling, and non-oil and gas development and oil and gas exploration and development have had cumulative impacts to Iñupiaq culture and to fish and wildlife used for subsistence. Euro-American presence has impacted the Iñupiat through disease and other physical and social impacts traditionally associated with colonialism. Commercial whaling nearly decimated whale stocks in the Chukchi and Beaufort seas and the over-harvest of walrus led to hunger and starvation among coastal populations; bowhead whale populations, though recovering, were nearly 80 percent below levels in the 1800s (Bockstoce 1986). Non-oil and gas development associated with military, residential, and commercial development have directly impacted several thousand acres of fish and wildlife habitat and have also indirectly affected habitat and animal behavior impacts that have accumulated and persist today (BLM 2012, § 4.8.7.15).

Sustained contact with Euro-Americans and oil exploration and development conducted by the federal government and industry have directly impacted the habitat use and behavior of subsistence species and resulted in additive impacts on subsistence resources, harvest patterns, and users. In addition, development associated with villages on the North Slope impacted subsistence resources. These activities cumulatively resulted in the loss of approximately 2,500 acres of habitat for subsistence species. These impacts have disrupted subsistence livelihoods and account for some of the social problems seen in Iñupiaq villages today. The economic benefits that NSB communities have accrued due to oil revenues have greatly helped to ameliorate social problems, although dependence on an undiversified economy based on the extraction of natural resources creates other anxieties. Climate change impacts to date have caused social anxiety and climate change is increasingly understood as an environmental justice issue (BLM 2012, § 4.8.7.15).

Future Impacts and Their Accumulation

Activities Not Associated With Oil and Gas Exploration and Development

Non-oil and gas activities on the North Slope, including archaeological and paleontological excavations, camps associated with scientific studies, recreational use, and overland moves by transport vehicles would continue to disturb Iñupiaq subsistence resources and cause users to avoid hunting in such areas while these activities are underway. Contaminated sites that persist can have long-term impacts that constitute environmental justice issues. BLM anticipates that several existing military sites will undergo remediation efforts in the next decade. Cleanup projects could potentially have short-term impacts (a "plume" created by cleanup activities) that could include a temporary increased potential for contamination of subsistence species, particularly fish, in the area around the cleanup site (BLM 2012, § 4.8.7.15).

Former Distant Early Warning Line sites as well as the adjacent active and inactive Air Force Radar Sites and other military sites, villages, airstrips, and other non-oil and gas infrastructure are likely to persist into the indefinite future. The amount of area that would be disturbed by new development on the North Slope in villages and other public facilities is projected to double to approximately 3,600 acres by 2050 and then level off for the remainder of the 21st century. However, out-migration from North Slope villages is emerging as a major concern in the NSB. The effects of climate change are expected to become more significant in the future and it is likely that Iñupiaq communities will bear a disproportionate burden of those impacts (BLM 2012, § 4.8.7.15).

Military activities and other non-oil and gas development and oil and gas exploration and development have had cumulative impacts to Iñupiat culture and to fish and wildlife used for subsistence. Non-oil and gas development associated with military, residential, and commercial development has directly impacted several thousand acres of fish and wildlife habitat and has also indirectly affected habitat and animal behavior; these impacts have accumulated and persist today. Oil and gas exploration and development conducted by the federal government and industry have directly impacted the habitat use and behavior of subsistence species, and these impacts persist today. These impacts have disrupted subsistence uses, and account, in part, for some of the social problems seen in the villages today.

Disturbance of caribou and other subsistence resources caused by additional development would accumulate with impacts from existing disturbances. Permanent infrastructure in the area will likely contribute to future impacts on fish that could accumulate. Oil and gas activities near the project area have already deterred subsistence hunters from using traditional hunting, fishing, and camping sites. Continued expansion of activity and infrastructure near the project area will increase the area considered off-limits by resource users, could deflect or divert important subsistence resources from their normal routes, and require users to travel further to harvest subsistence foods at a greater cost in terms of time, fuel, wear and tear on equipment and people, and lost wages.

GMT 2 Development

When taking into consideration the proposed GMT1 Project and conceptual GMT2 Project, the cumulative impacts of these developments would be similar. As a larger area would be impacted, the impacts could be additive, but are not anticipated to be synergistic. Some of the cumulative impacts of development of GMT1 and GMT2 would be countervailing. For example, industrial roads can provide year-round vehicle access for subsistence users at a distance of up to 20 miles that is now primarily limited to seasonal use of ice roads by ATV and snowmachine. Similarly, revenues are important to Nuiqsut in providing goods and services.

The development of GMT2 in a scenario that does not include construction of the GMT1-GMT2 road would not provide additional access for subsistence activities. Under all action alternatives, the increase in air traffic could result in further disturbance or displacement of subsistence resources, which would then in turn affect subsistence harvesters.

Oil and Gas Exploration and Development Activities

BLM (2012) evaluated the cumulative impacts of oil and gas activities to environmental justice. The evaluation included analysis of impact associated with the Umiat road, offshore development in the Chukchi and Beaufort Seas, commercial oil and gas pipelines, and conventional oil and gas exploration and development.

Impacts to subsistence resources and use areas on the North Slope from future oil and gas exploration are expected to be additive with respect to impacts from other past, present, and future non-oil and gas activities and past and present oil and gas activities. The impacts in the NPR-A would increase the total level of disturbance and the amount of subsistence use areas impacted by oil and gas development, and would be additive for the most part. However, if a pipeline for offshore oil is constructed across the NPR-A that makes development of additional fields economically viable; there would likely be synergistic effects on the amount of subsistence use areas affected, and unconventional oil and gas development, spills, and oilfield abandonment (BLM 2012, § 4.8.7.15).

In the RFF, development of oil and gas facilities is unlikely to change the population in the project study area. BLM has carefully considered community views when developing and implementing mitigation strategies to reflect the needs and preferences of these populations, to the extent practicable. Some lands have been made unavailable for oil and gas leasing, including a large portion of the eastern coastal plain of the NPR-A which is used by Nuiqsut subsistence users (BLM 2013).

Under the cumulative case, proposals for offshore oil and gas development in the Chukchi and Beaufort seas cause the greatest concern, while the potential impacts of increasing onshore development, particularly pipelines to transport offshore product from the coast to TAPS, are also of great concern. Iñupiaq users would be less likely to utilize for subsistence an area from 5 miles to 25 miles around permanent facilities and any possible environmental justice issues associated with development will be largely determined by the location of future development and by the economic benefits it brings (BLM 2012, § 4.8.7.15).

Contribution of the Alternatives to Cumulative Impacts

The cumulative impacts of Alternatives A, B, and C would be similar to one another, as each of these alternatives could lead to future expansion of oil and gas exploration to the west of the Colville River. Expansion further to the west of the Colville River would result in increased impacts on Nuiqsut subsistence use areas, particularly those along Fish Creek, and could potentially introduce oil and gas development into areas used by other North Slope communities such as Barrow and Atqasuk. Alternatives D1 and D2 would be less likely to facilitate westward oil and gas development. In Nuiqsut, disturbance from helicopter traffic is one of the most frequently reported impacts associated with oil and gas development (SRB&A 2012); all action alternatives would contribute to the cumulative impacts of helicopter traffic on the North Slope and Alternatives D1 and D2 would create greater increases in helicopter traffic. Alternatives D1 and D2 would also necessitate a larger pad (and occupied structures pad) for GMT1 and could substantially worsen sociocultural problems associated with having a lack of control over development plans that will impact the community.

Overall, impacts to the minority community of Nuiqsut resulting from GMT1 Alternatives A, B, C, D1, and D2 are expected to be major. In A, B, and C, the improved permanent access to subsistence use areas is expected to have a countervailing, beneficial effect for many residents of Nuiqsut while the various impacts associated with roads will diminish the value of the area for others. Alternatives D1 and D2 under GMT1, and conceptual GMT2 would not include the mixed impacts of the road, therefore resulting in long-term, high-intensity, and significant impacts to the community. There would be negligible overall impacts on environmental justice under Alternative E.

Conclusion

The ANILCA § 810 analysis for the proposed project concluded that, under all action alternatives, the impacts fall above the level of significantly restricting subsistence use for the community of Nuiqsut. The potential impacts to subsistence resources by displacement and impacts to access by subsistence users (including avoidance) must, in the case of the NVN, be considered as significant Environmental Justice issues.

The BLM (2004) found that development as contemplated in the cumulative case could cause long-term displacement and/or functional loss of habitat to caribou over the life of the proposed development. This could result in a significant impact on this important subsistence resource. Impacts would be considered disproportionately high adverse impacts on North Slope Iñupiat. Access to subsistence-hunting areas and subsistence resources, and the use of subsistence resources could change if oil development were to reduce the availability of resources or alter their distribution patterns. Potential spill impacts would also have disproportionately high adverse impacts on North Slope Iñupiat (BLM 2004, § 4G.7.4).

Climate change can be understood as an environmental justice issue and the Iñupiat of the North Slope are disproportionately impacted by it both by the fact that climate changes effects are more pronounced in the western Arctic and by the fact that Iñupiaq subsistence activities are particularly dependent on ice, wind, and permafrost conditions. Additionally, climate change could cause changes to the environment of the North Slope that could affect subsistence resources and users. The reduction of sea ice has exacerbated coastal erosion, the weather has become less predictable, the shore ice in spring is less stable for whaling, fall travel for caribou is hampered by a late and unreliable freeze up, ice cellars provide less reliable food storage, and a number of marine mammals are experiencing habitat loss. All of these issues create significant concerns for the Iñupiat because they are perceived as factors that cannot be controlled and that are threatening their way of life.

In evaluating GMT1, the conceptual GMT2 Project, and other RFF activities, the cumulative impacts to the community of Nuiqsut, Atqasuk, Wainwright, Point Lay, Barrow, and Anaktuvuk Pass would likely be additive to the extent that other RFF developments within the cumulative impacts evaluation area could deflect or divert subsistence resources further away from the community. The development of other RFF projects would also increase the footprint of development into currently undeveloped areas, which would have further reaching impacts. RFF projects, outside of the conceptual GMT2 Project, would likely not be countervailing unless they tied directly into the local transportation network or expanded network that would be developed if the GMT1 were constructed.

Overall, the GMT1 Project in addition to other current and RFF activities could increase the severity of existing impacts on Nuiqsut, Atqasuk, Wainwright, Point Lay, Barrow, and Anaktuvuk Pass. As oil and gas development activities occur over a larger area direct impacts to the Iñupiat would be significant and could have long-term impacts affecting both current and future generations. Alternative E would have incremental adverse cumulative impact to environmental justice on the North Slope.

The implementation of Lease Stipulations and BMPs outlined in the records of decision for the 2003 Northwest NPR-A IAP/EIS, the 2008 Northeast Supplemental IAP/EIS (BLM 2004, 2008), and the 2013 NPR-A IAP/EIS (BLM 2013) designed to ensure the continued health of subsistence resources and wildlife, are required for the protection of environmental justice under all alternatives, should reduce the cumulative effect to environmental justice from oil and gas, and non-oil and gas activities. New potential mitigation measures described in this GMT1 SEIS could reduce impacts to the community of Nuiqsut.

4.6.11 Oil, Saltwater, and Hazardous Material Spills

To date, the majority of spills on the North Slope have been less than 100 gallons with releases primarily occurring within secondary containment or onto gravel pads or roads. Impacts from these spills have been limited in area (e.g., local), duration (temporary), and size and have not occurred frequently or at large enough volumes for their impacts to have accumulated. Spills have the potential to occur at any phase (e.g., construction, drilling, or operation) of the proposed project, the conceptual GMT2, or other RFF projects. Impacts associated with spills are discussed in further detail in Section 4.5 and discussed in the preceding sections with respect to the various resources.

Development of GMT1 and its associated infrastructure is not expected to negatively impact marine mammals, as these species typically occur offshore at Harrison Bay or in the Beaufort Sea. BLM (2012, § 4.12.4) analyzes the potential impacts of a very large oil spill in the NPR-A. The potential of an oil spill reaching coastal habitats from the proposed GMT1 Project is extremely low. The cumulative impacts from each of the GMT1 action alternatives are similar in that each action alternative creates the potential for oil spills. Alternatives A, B, C, D1, and D2 are all anticipated to have a minor impact with respect to spill potential. Action alternatives (A, B, and C) that have a road located near the pipeline mitigates some of the potential for a major or undetected spill by allowing better access for surveillance and monitoring by operators. In addition, the presence of the road in close proximity to the pipeline allows better access for emergency and spill response activities, which would in turn limit the spread and overall area impacted by a spill.

Alternatives D1 and D2 may have slightly higher impact than Alternatives A, B, and C, due to the absence of the CD5-GMT1 gravel road, which may allow a leak or spill to go undetected for a longer period of time. As stated above, aircraft access to drill sites on the North Slope may be restricted by weather 13 to 22 percent of the year, which could impact CPAI’s ability to respond to a spill or emergency health and safety event. Alternative E (No Action) would have no negative impact with the respect to the potential for oils spills. Alternative E would have a beneficial effect by eliminating the potential for spills of saltwater of hazardous materials from the GMT1 and conceptual GMT2 Projects. There could be a reduction on the risk of spills in other remote area on the North Slope due to the associated potential reduction in development of oil and gas activities based on that decision.

Spills are inevitable, and any spills resulting from development of GMT1 would add to the number of spills annually from other oil industry and other RFF developments on the North Slope. Four very large spills have occurred on the North Slope; three associated with the operation of TAPS and one at BP's Gathering Center 2. Due to the relatively small size of pipelines serving GMT1, and the conceptual GMT2, along with industry standards on block valves and monitoring pipeline systems, it is unlikely that a large spill would be reasonably expected to occur from the interconnecting pipeline systems. There is nothing to suggest that the cumulative impacts of the proposed GMT1 Project and the conceptual GMT2 Project would result in a large spill of crude oil spill or product spill on the North Slope. As noted above, the majority of spills on the North Slope have been less than 100 gallons with releases primarily occurring within secondary containment or onto gravel pads or roads. Impacts from these spills have been local and temporary, and have not occurred frequently or at large enough volumes for their impacts to have accumulated. The incremental cumulative impact of spills is expected to be minor for all of the action alternatives. Spills associated with vehicle use on gravel or ice roads are mitigated by the drips and drops program in place at most North Slope facilities. Spills confined to roads (and pads) can typically be cleaned up without substantial damage to water or vegetative resources.

Proposed and RFF projects, in conjunction with the range of action alternatives for the proposed GMT1 Project, could have an additive cumulative negative impact with respect to spills; specifically the Umiat road and offshore development. The construction of the Umiat road would add approximately 102 miles of new roadways and an elevated or buried pipeline. The addition of another pipeline and associated facilities and roadways, increase the amount of stored and transferred oil and other petroleum and gas-related fluids, which in turn would increase the potential for spills. Likewise, the development of offshore infrastructure and onshore support infrastructure would also have an additive cumulative impact as the potential for spills increases. Additionally offshore development and the transfer of offshore oil and gas to onshore facilities would increase the probability of a spill to water based on the location of infrastructure.

Although development of the proposed project, conceptual GMT2, and other RFF projects would increase the potential for spills, BMPs; Stipulations; Alaska Statutes and regulations; and actions taken by the operators (monitoring, spill prevention and response planning, etc.) can help mitigate the potential for a large spill.

4.7 Mitigation Measures and Monitoring

NEPA regulations (40 CFR 1508.20) define mitigation as avoiding, minimizing, rectifying, reducing over time, or compensating for impacts of a proposed action. For actions on federal land in the NPR-A, the BLM has developed a series of protective measures to mitigate potential impacts. These are defined and evaluated as part of the IAP/EIS process, and adopted in the ROD. RODs and permits may include additional mitigation. Mitigation may also be incorporated into project design (CEQ 2011, p. 5).

In analyzing the GMT1 Project, protective measures required by BLM for activities in the NPR-A, mitigating requirements of BLM (2004a), and mitigation incorporated by CPAI into ASDP project design and practices are considered for their effectiveness in avoiding or reducing potential environmental impacts.

Due to the timeframe from exploration to development, the GMT1 Project has been subject to various BLM requirements, as summarized below:

- The BLM approval for permitting the ASDP (including GMT1) included prescriptive lease stipulations adopted by the 1998 Northeast NPR-A IAP/EIS ROD, as well as other project-specific measures to mitigate potential impacts of development (2004 ASDP ROD);
- In 2008, in adopting a new IAP for the Northeast NPR-A, the BLM adopted two types of performance-based protective measures analogous to those that had been adopted in the Northeast NPR-A (BLM 2008): lease stipulations and required operating procedures (ROPs). The analysis included a comparison of the 1998 stipulations and the 2008 lease stipulations and ROPs (BLM 2008, § 2.7, Tables 2-2 and 2-3). CPAI updated GMT1 lease obligations to comply with the 2008 lease stipulations;
- The 2008 performance-based lease stipulations and ROPs differ from the 1998 prescriptive stipulations in two general ways. The 2008 lease stipulations and ROPs: (1) reduced replication of other laws and regulations; and (2) provided more utility and effectiveness in accommodating the variation and complexity associated with North Slope activities, as well as greater ability to adapt management as new information becomes available and construction/operations methods improve. By focusing on results, the performance-based measures provide BLM with greater flexibility achieving resource protection objectives (BLM 2008, § 2.3.5);
- In 2013, BLM adopted an IAP for all lands and waters administered by the BLM in the NPR-A. BLM (2013) supersedes BLM (2004a) and BLM (2012, § 1.6.1). The two types of protective measures were maintained, and although the term BMP replaced the term ROP, the definition was retained.[18]

The ROD (2013) for the NPR-A establishes performance-based stipulations and BMPs, which apply to oil and gas and, in some cases, to non-oil and gas activities within the NPR-A and requires studies and monitoring. The following is a summary of these BMPs, which can be found in Appendix E:

- Waste Prevention, Handling, Disposal, Spills, and Public Safety
  - 11 measures include, for example, requirements for waste management, spill prevention and response, and HazMat emergency contingency plans; air quality monitoring; and monitoring for potential contamination of subsistence foods.
- Water Use for Permitted Activities
  - Limits water withdrawal from streams and lakes to protect fish and other wildlife.
- Winter Overland Moves and Seismic Work
  - Regulates winter travel to protect the soil, vegetation, streams, and denning bears.
- Oil and Gas Exploratory Drilling
  - Prohibits exploratory drilling in rivers, streams, and fishbearing lakes and construction of permanent facilities (gravel pads) for exploratory drilling.

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[18] Required Operating Procedure: Mitigation developed through the BLM planning process/NEPA process that is not attached to the oil and gas lease but is required, implemented, and enforced at the operational level for all authorized (not just oil and gas) activities in the planning area (BLM 2008a, NE NPR-A Supplemental IAP ROD, p. 35).

BMP: Mitigation developed through the BLM planning process/NEPA process that is not attached to the oil and gas lease but is required, implemented, and enforced at the operational level for all authorized (not just oil and gas) activities in the planning area (2013 NPR-A IAP ROD, p. 39).

- Facility Design and Construction
  - 20 measures include, for example, requirements that permanent facilities minimize footprint; remain 500 feet from water bodies except for crossings; allow fish passage, caribou movement, and subsistence user access (e.g., 7-foot-high pipeline and 500-foot road/pipeline separation); and USFWS-designed T&E species protections.
- Use of Aircraft for Permitted Activities
  - Requires a plan to minimize impacts to subsistence users and establishes seasonal minimum flight altitudes over raptor nest habitat and caribou calving, insect relief, and winter areas.
- Oil and Gas Field Abandonment
  - Requires that all oil and gas infrastructure "be reclaimed to ensure eventual restoration of ecosystem function."
- Subsistence Consultation for Permitted Activities
  - Requires lessees/permittees consult with subsistence communities on their proposed activities, submit a plan to show how their activities will prevent unreasonable conflicts with subsistence activities, monitor for impacts to subsistence use, and constrain employees from engaging in recreational hunting and fishing at the work-site. In addition, seismic operations are to avoid subsistence cabins.
- Orientation Programs Associated with Permitted Activities
  - Requires personnel receive orientation on range of North Slope issues, including protecting resources, subsistence, and local lifestyles and laws.
- Endangered Species Act-Section 7 Consultation Process
  - Alerts lessees that BLM may recommend modifications to exploration and development proposals to avoid impacts to species currently listed under the ESA or that could lead to an ESA listing and that BLM will not approve any activity until it completes any necessary ESA consultations.
- Summer Vehicle Tundra Access
  - Establishes requirements (studies of impacts of specific vehicles to be used and resource surveys) of applicants for approval of vehicle use on the tundra during summer.

For the GMT1 Project, the 2013 BMPs will be in effect, but no changes to the current lease stipulations – from the 2008 NE NPR-A EIS – will occur without further evaluation and discussion with the BLM. Certain 2008 lease stipulations (D1, D-2, E-2, E-3, G-1, K-1, and K-2) applicable to this project present essentially the same level of protection as the 2013 BMPs. In 2013, the 2008 Stipulation E-17 was dropped in deference to ROP E-11; however, due to project location, Stipulation 17 is not applicable to GMT1. To BLM's knowledge, these stipulations and BMPs are not inconsistent with each other. To the extent any are found to be inconsistent, the 2008 lease stipulations would control.

As described in Section 1.4.2.1, the Corps will require compensatory mitigation based on the functional value of each acre of the direct project footprint, plus the lost functional value associated with impacts to the aquatic ecosystem surrounding the project footprint. For the nearby CD5 project, also located within wetlands, the Corps required 3 acres of replacement wetlands compensation for each acre of the project footprint located outside the Colville River delta. BLM's current *Draft Regional Mitigation Manual* (BLM 2013e) states that it may be appropriate for BLM to require compensatory mitigation to be performed outside the area of impact when other types of mitigation are insufficient to mitigate direct and indirect impacts to an acceptable level at the project location. Based on this policy, and considering the Corps' will require compensatory mitigation for impacts to the aquatic ecosystem, BLM-Alaska is considering additional compensatory mitigation for impacts resulting from BLM authorizations that occur beyond impacts compensated for by the Corps permit.

4.7.1 Monitoring

Three categories of studies and monitoring are required by the NPR-A ROD:

1. Baseline studies: Studies prior to activities to better mitigate impacts associated with the activities.

   Project proponents shall be responsible for funding baseline studies to provide BLM decision-makers with sufficient information to make informed decisions on a project or series of projects. The type and scale of such studies will be determined by BLM based on the characteristics of the proposed project and location. The BLM will work with operators to coordinate any necessary surveys to ensure that consistent methods are used and that surveys are not unnecessarily duplicative. Some such studies are described in Best Management Practices A-10, A-11, C-1, E-11, E-12, E-13, E-14, E-18, K-4a, K-4b,, K-5, and L-1 and in Stipulation K-11; additional baseline information may also be required depending upon the proposed project.

2. Oversight monitoring: Monitoring to ensure compliance with applicable requirements.

   The BLM will conduct monitoring to ensure that lessees'/permittees' plans for activities and implementation of those plans conform to the relevant requirements. Project proponents may be responsible for funding oversight monitoring. Commonly oversight monitoring will require:

   - review of planning documents,
   - field visits prior to oil and gas activities to ensure compliance with requirements at the on-the-ground preparation stage for activities, construction, operational start-ups, and abandonment activities (e.g., check staking of ice roads or developments to ensure compliance),
   - presence in the field during activities to ensure compliance,
   - follow-up field visits to ensure that any required cleanup and abandonment activities were in compliance with requirements.

3. Effectiveness monitoring: Monitoring to evaluate the effectiveness of project designs and mitigation measures and thereby guide adaptive management.

Project proponents shall be responsible for funding monitoring, by private or government parties, to assess the effectiveness of project designs and required mitigations in protecting resources. Project proponents may also be required to develop a plan, approved by BLM, for adaptive management programs associated with their project. As with baseline monitoring, the type and scale of such studies will be determined based on the characteristics of the proposed project and location, and the BLM will work with project proponents to coordinate any necessary surveys to ensure that consistent methods are used and that surveys are not unnecessarily duplicative (BLM 2013).

Pursuant to the 2013 ROD, BLM is considering several new monitoring requirements and Potential New Mitigation Measures, found in Chapter 4. Several of the potential new mitigation measures identified in this SEIS call for research, monitoring, and compliance and effectiveness assessments. Additionally, BLM is considering the following new potential mitigation measure, as part of its GMT1 project authorization, which would apply to a variety of resources.

Potential New Mitigation Measure 1: Establishment and Implementation of an Effectiveness Monitoring and Scientific Studies Program at BLM

Objective: Ongoing evaluation of the effectiveness of BMPs and mitigation measures designed to maintain sustained yield of important resources in the GMTU and within the scope of cumulative impacts of GMT1.

Requirement/Standard: The Permittee will contribute funds to BLM as the lead administering agency, working with cooperators to monitor fish and wildlife populations, habitat, and ecosystem processes, functions and services potentially impacted by development; to ensure public involvement, transparency, and rigor in the development and use of the best available science for evaluating the effectiveness of BMPs and mitigation measures; and to maintain a high standard of oversight for industry-funded scientific studies related directly to the GMT1 project. BLM interdisciplinary staff and cooperators from other agencies and entities with subject matter expertise would establish a framework, including reference sites following BLM Assessment, Inventory, and Monitoring protocols, to coordinate long-term work to expand agencies' scientific understanding of baseline condition and natural ongoing processes in the Arctic, such as climate change driven effects on land and water and long-term fluctuations in caribou populations. Potential cooperators include BLM's existing partners in research, monitoring, and compliance (including but not limited to the USGS, USFWS, NSB wildlife department, ADF&G, ADEC, NPR-A Working Group, Arctic LCC, NSSI, and AOGCC) as well as Alaska Native Corporations and Tribes. Based on results of the effectiveness monitoring program, the permittee may be required to develop an adaptive management plan.

Potential Benefits and Residual/Unavoidable Adverse Impacts: The 2013 NPR-A IAP ROD requires project proponents to be responsible for funding studies and monitoring associated with exploration and development, including baseline studies prior to activities and monitoring to evaluate the effectiveness of project designs and mitigation measures guiding adaptive management. A rigorous and transparent process is necessary for the public to be able to fully trust the results that come from industry-funded work. This effort would focus on answering the questions of decision-makers and stakeholders including local residents, and to provide BLM with additional data to use in its decision making and mitigation efforts. GMT1 and future projects within NPR-A will require new studies, work planning, oversight, reporting, outreach, external coordination, and effectiveness monitoring costs. This mitigating measure would require the project proponent to contribute a significant portion of these additional costs.

4.7.2 Summary of Existing Mitigation Measures

Table 4.7-1 summarizes the mitigation measures in place through BLM (2013), the BLM (2004a), and CPAI design features and practices implemented for ASDP projects, including GMT1. Additional permitting requirements will be implemented by other federal, state, and local agencies.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
PHYSICAL ENVIRONMENT			
Physiography	C-2, E-5, 6, and 8, E-12, L-1		
Permafrost	A-1 through A-7, A-9, A-10, C-2, E-4, 5, 6, 8 and 12, L-1		
Sand and Gravel Resources	E-5, E-8		
Hydrology and Water Quality	A-1 through A-7, B-1, B-2, C-2, C-3, C-4 E-2, E-3, E-4, E-6, E-8, K-1, K-2	Prior to lake water withdrawals, lake monitoring studies that evaluate lake habitat recharge and actual recharge during breakup will be completed at BLM direction. The permittee will submit to the Authorized Officer for approval, a monitoring plan for lakes where withdrawals are expected. In order to ensure that lakes maintain their natural ability to support the same suite of species as they have in the past without water withdrawal, the plan will be for monitoring water quantity and quality throughout the period of withdrawal and the rest of the year. The monitoring will continue as long as withdrawals take place or until BLM determines that further monitoring is unnecessary. The permittee will implement a monitoring program that is approved by the Authorized Officer, which incorporates the collection of samples of suspended sediment upstream and downstream of the Tiŋmiaqsiġvik (Ublutuoch) River bridge. This monitoring program will assist in the analysis of scour and fill processes occurring in the vicinity of the bridge and determine future erosion abatement measures to be taken. The monitoring will continue until BLM determines that further monitoring is unnecessary. Monitor sedimentation upstream and downstream of the Tiŋmiaqsiġvik (Ublutuoch) River bridge. The road and pipeline bridge across the Tiŋmiaqsiġvik (Ublutuoch) River would extend from bank to bank defined as the active flow-way and the frequently active floodplain between topographical rises. This would require a bridge approximately 350 feet long at the currently proposed location; though, the bridge could be relocated close to the proposed crossing where the bank-to-bank span would be less. Approaches to the Tiŋmiaqsiġvik (Ublutuoch) River bridge would provide for natural water flow.	In the GMT1 project study area, bridges and culverts are designed to withstand a 50 year (Q50) return flood event plus 3 feet of freeboard To protect against scour and bank migration, bridge abutments are armored and piles are set deep enough so that the structures would remain stable during the design scour event. Bridge structural design accounts for the higher-magnitude, less frequent floods, and slope-protection armor would protect against the more frequent, lower-magnitude floods. A monitoring program which will assist in the analysis of scour and fill processes occurring in the vicinity of the Tiŋmiaqsiġvik (Ublutuoch) River and Crea Creek bridges. This could involve cross-section or bathymetric surveys to establish baseline conditions once the bridges are built. This will require monitoring of breakup discharges at bridges. Continuous monitoring of the Tiŋmiaqsiġvik (Ublutuoch) River will be done the first year until flow ceases. The design of culverts along the GMT1 road has incorporated the findings of fish surveys and hydrologic modeling into their design. The permittee, under the direction of the AO, will undertake monitoring of culverts during breakup for impoundments, erosion, scour, and deposition created by placement of culverts.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Hydrology and Water Quality (Continued)	A-1 through A-7, B-1, B-2, C-2, C-3, C-4 E-2, E-3, E-4, E-6, E-8, K-1, K-2	Bridge abutments would be armored, with sheet-pile wing walls. Incorporation of the findings of fish surveys and hydrologic modeling into the design of proposed bridges and culverts and subsequent monitoring of culverts and remedial measures based on this monitoring. A program to monitor water quality above and below the proposed Tiŋmiaqsiġvik (Ublutuoch) River bridge and, if necessary, identify additional erosion abatement measures.	
Air Quality	A-9, A-10, E-1, E-8	The permittee will implement a plan approved by the Authorized Officer for limiting fugitive dust. Methods of dust control could include road watering, vehicle washing, covering of stockpiled material, ceasing construction during wind events, the use of chemical stabilizers, and chip seal, and could vary for the frozen and non-frozen seasons.	Drill rigs use reduced sulfur diesel-generated power. Vehicles are equipped with block heaters. Idling practices are to shutoff and plug in vehicles in temperatures of -30 F or above to conserve fuel and reduce emissions. Finewater Mist is used in place of Halon, one of the substances believed to damage the environment. Management of Change procedures are maintained to ensure environmental considerations occur prior to purchasing new tanks or adding new air sources which may affect the environment or operating permits.
Noise	F-1		Electric power generator sets are totally enclosed or acoustically packaged to abate noise emissions. Mufflers and other measures are used to abate noise from exhaust systems of engines and turbines.
Paleontology	E-13, K-2		
Hazardous and Solid Waste	A-1 through A -7, E-4		New chemicals being considered for use in the field are reviewed to ensure that the materials will minimize the generation of hazardous waste or risk to employees. Wastes are managed according to the Alaska Waste Disposal and Reuse Guide (the “Red Book”). Most wastes are injected into the subsurface in disposal wells or used for enhanced oil recovery. Drill cuttings are disposed via annular disposal/ injection instead of using surface pits.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
BIOLOGICAL ENVIRONMENT			
Vegetation and Wetlands	A-1 through A-7, A-11 A-12, C-2, E-1, 4, 8 and 12, I-1, K-1, L-1, M-2, M-3	Where necessary, fill slopes will be stabilized using revetments, soil binders, or other methods approved by the Authorized Officer. Construction, development, and operations actions will be conducted in a manner that avoids riparian shrub areas whenever possible.	Gravel roads are watered to minimize dust and maintain integrity of the roads. Permanent camp facilities are consolidated, not spread among drill sites. Roads are built to the minimum width necessary for adequate operations and safety. Pads are designed for the minimum footprint required for the activity.
	A-1 through A-7, A-11 A-12, C-2, E-1, 4, 8 and 12, I-1, K-1, L-1, M-2, M-3	The footprint will be reduced by minimizing pad size and drilling multiple wells from a single pad and by minimizing the road footprint while avoiding the most important wetlands. Construction of facilities will occur to the greatest extent possible on relatively higher elevation and less critical wetlands. Only 6% of the gravel footprint west of the Nigliq Channel (10.6 acres of 172 acres) would be on key wetlands. The overwhelming proportion (80%) of the gravel footprint west of the Nigliq would occur on relatively dry moist sedge-shrub meadow and moist tussock tundra. Extraction of gravel and construction of gravel roads, pads, and pipelines will occur in winter using ice roads, thus minimizing potential impacts to the tundra. Road watering would occur to help control dust. Bridges or culverts would be placed in known drainage locations and, at a minimum, culverts or bridges if water flow justifies it, will be placed at approximately every 500 feet along roads. The Clover site will be rehabilitated, including interim reclamation. Note: the Clover site is no longer the proposed gravel source.	Minimum gravel road thickness of 5 feet, maintains the permafrost condition by insulating the tundra and offsetting the loss of insulating effect caused by suppression of the vegetated tundra below the gravel. Cleared snow is placed in designated areas. Stormwater is managed from all facility gravel pads to ensure no contaminants are released during spring thaw. Attaching power line cables to pipeline and VSMs reduces the disturbance to vegetation (no power poles installed). Ice roads are a minimum of 6 inches thick. Ice pads are built during construction to stage vehicles and equipment. Ice roads are routed to avoid shrub areas and large areas of tussock tundra as much as is practicable. Stream crossings are minimized where possible and the most direct route is taken to minimize the surface area of the disturbance. Off-road vehicle operators are trained to avoid tight turns on tundra. CPAI collects environmental baseline data prior to developments and monitors various environmental media as applicable during construction and operations. Revegetation studies to monitor vegetation impacts.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Fish	A-2 through A-7, A-11, A-12, B-1, B-2, C-3, C-4, C-5, E-1, E-2, E-4, E-6, E-8, E-14, K-1, K-2, L-1	CPAI will perform fish surveys and hydrologic modeling for water bodies at proposed bridge and culvert sites. The results of these surveys and modeling will be incorporated into the designs of bridges and culverts. Based on the surveys and modeling, CPAI will install bridges or culverts in roadbeds in low lying areas to ensure fish passage during high-water conditions. The fish surveys and hydrologic modeling will continue until BLM determines that further surveys and modeling are unnecessary. CPAI will continue fish monitoring studies in the plan area to ensure that the health of regional and locally important fish stocks is maintained. On a schedule to be approved by the BLM, CPAI will monitor all culverts to ensure that they are properly maintained and are providing access by fish to critical summer spawning and rearing grounds. CPAI will promptly repair any culverts that are not meeting these intended fish passage goals.	Pad and road construction is scheduled to occur in winter in low-diversity areas sparsely inhabited by large fish and not during times when migratory fish are moving to and from freshwater habitats. Installation of bridges rather than culverts across major waterways to ensure fish passage and minimize disturbance to riparian habitat.
	A-2 through A-7, A-11, A-12, B-1, B-2, C-3, C-4, C-5, E-1, E-2, E-4, E-6, E-8, E-14, K-1, K-2, L-1	CPAI will develop a mitigation plan that includes remedial measures to be taken should monitoring detect adverse impacts from the project. Intake structures specially designed to eliminate the potential for fish being impinged, entrained, or entrapped during withdrawal of water shall be used at all water sources. These structures must meet the standards developed by Alaska Department of Fish and Game. Monitoring of water withdrawals from lakes.	
Birds	A-1 through A-7, A-11 and 12, B-2, E-2, 4, 8, 9, 10, 11, 12, 16 and 18, F-1, I-1, L-1	If deemed necessary by BLM, the Authorized Officer may require vehicle traffic restrictions during brood rearing of specific species. The Authorized Officer will determine the time-frame that the traffic restrictions will be in place and what the reduced speed and amount of allowable traffic will be. Permittee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for gulls, ravens, raptors, and foxes. The permittee shall provide the Authorized Officer with an annual report on the use of oil and gas facilities by gulls, ravens, raptors, and foxes as nesting, denning, and shelter sites. Powerlines will be placed on cable trays between CD6 (GMT1) and CD7 (GMT2) rather than on separate power poles. Artificial exterior lighting on structures over 20 feet tall would be controlled. Except for required safety lighting as may be required by FAA and OSHA, illumination of taller structures would be designed to direct artificial exterior lighting inward and downward, rather than upward and outward.	Gravel hauling is restricted during most of spring and summer to avoid potential for noise disturbance to nesting waterfowl. Attach power line cables to pipeline and VSMs. Exposed wellheads (primarily exploration wells) are wrapped with tarps to prevent raven nesting. Ongoing ecological studies (e.g., birds, vegetation, hydrology) for project planning to mitigate potential impacts.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Mammals	A-1 through A-7, A-8, A-11, A-12, C-1, E-7, E-8, E-12, E-19, F-1, I-1, L-1, M-1, M-4	The permittee will develop and implement a monitoring plan for caribou movement and vehicle traffic on the roads leading to CD6 (GMT1) and CD7 (GMT2). CPAI will then develop and apply adaptive management approved by the BLM that is aimed at minimizing traffic impacts to caribou based on what is learned. Elevate pipe a minimum of 7 feet above the tundra, as measured at the VSMs.	ADF&G is consulted for grizzly bear dens and for assistance with limiting human to bear interaction. New pipelines constructed so the bottom of pipe is at least 7 feet above the tundra, and in some places more. New pipeline VSMs for sections parallel to existing pipelines are aligned to match existing VSMs where possible, to avoid a picket-fence effect. New pipelines are designed with a muted (non-shiny) coating to avoid bright flashes from sunlight that may frighten caribou.
	A-1 through A-7, A-8, A-11, A-12, C-1, E-7, E-8, E-12, E-19, F-1, I-1, L-1, M-1, M-4		Predator-proof dumpster bins are used for accumulation of food wastes. Workers are trained regarding the problems associated with feeding wildlife. Zip-lock and other containers are provided for meals-on-the-go to conceal food odors to lessen chances of attracting wildlife. CPAI prepared a Wildlife Avoidance and Interaction Plan, has training in place on waste management practices, and has project specific training on waste management for any new project to provide guidance to employees and contractors for managing predators. Through ACS, CPAI assists with quick response to wildlife impacts during an incident. ACS has a wildlife rehabilitation trailer where they stabilize the wildlife before sending off-site for treatment (most applies to birds and always in consultation with qualified veterinarians and agency personnel). CPAI maintains safe speed limits on all North Slope roads.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
ESA Species	A-1 through A-7, A-11, A-12, C-1, E-4, E-8, E-10, E-11, E-18, F-1, I-1, J	To minimize the likelihood that migrating spectacled eiders will strike structures associated with drilling activities, BLM, cooperating agencies and the Service will cooperatively develop a lighting/operating protocol to be used on all drill rigs and associated production infrastructure. The Service and BLM will work together to identify when and where the protocol should be applied. Any protocol developed will be in compliance with Federal Aviation Administration (FAA) regulations. The lighting protocol shall ensure that radiation of light outward from all drill rigs and associated infrastructure will be minimized. This will be achieved by shading and/or light fixture placement to direct light inward and downward to living and work surfaces while minimizing light radiating upward and outward. Temporary impacts to spectacled eider productivity due to disturbance and direct habitat impacts must be minimized by ensuring protection of females with nests. Ground-level activity (by vehicle or on foot) within 200 meters of occupied spectacled eider nests, from June 1 through August 1, will be restricted to existing thoroughfares. This includes “working” gravel on existing fill (pads and roads). Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 meters of occupied spectacled eider nests will be prohibited. In instances where minimal summer support/construction activity must occur off existing thoroughfares, Service-approved nest surveys must be conducted	CPAI coordinates with USFWS to locate polar bear dens so the dens can be avoided. Gravel pads and facilities are oriented to minimize wind-drifted snow accumulations that could potentially serve as polar bear habitat.
	A-1 through A-7, A-11, A-12, C-1, E-4, E-8, E-10, E-11, E-18, F-1, I-1, J	during mid-June of each year in which activities take place between June 1 and August 1. BLM and cooperating agencies will also work with the Service to schedule oil spill response training in riverine, marine and inter-tidal areas that occurs within 200 meters of shore, outside sensitive nesting/ broodrearing periods or conduct nest surveys. The protocol and timing of nest surveys for spectacled eiders will be determined in cooperation with the Service, and must be approved by the Service. Surveys should be supervised by biologists who have previous experience with spectacled eider nest surveys.	

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
SOCIOECONOMIC ENVIRONMENT			
Community Health	A-1, A-2. A-4, A-10, A-11, A-12, I-1		
Cultural Resources	C-2, E-13, I-1	Before construction of ice roads, CPAI will evaluate and assess possible cultural resources in the immediate areas of the proposed ice roads.	Cultural/archaeological resource surveys are conducted prior to ground-disturbing activity. CPAI routes ice roads to avoid archaeological sites where possible.
Economics			CPAI strives to hires qualified Nuiqsut residents for jobs in the oil fields. CPAI has an internship program (Career Quest) to introduce Nuiqsut high school students to jobs in the oil fields and in their community. CPAI's philanthropy program from the Alpine field provide income and other benefits to residents of Nuiqsut.
Environmental Justice	H-1 – see Subsistence		
Subsistence	A-4 through A-7, A-11, A-12, B-1, B-2, C-3, 4, and 5, E-1, 2, 6, 7, and 19, F-1, H-1, H-3, I-1, K-1, K-2, M-1	Roads will be available for subsistence use	CPAI employees and contractors receive cultural awareness training. Hunting and fishing by non-local employees and contractors is prohibited. CPAI consults with the Kuukpik Subsistence Oversight Panel (KSOP), the NVN, and Kuukpik Corporation to ensure operations do not adversely affect subsistence activities, and holds public community meetings frequently and well in advance of future projects. Projects have been rescheduled or travel has been rerouted to avoid subsistence use and hunting areas during seasonal periods.
	A-4 through A-7, A-11, A-12, B-1, B-2, C-3, 4, and 5, E-1, 2, 6, 7, and 19, F-1, H-1, H-3, I-1, K-1, K-2, M-1		CPAI consults with the local community (Nuiqsut) on locations of road and pipelines.
Land Use	A-1, A-3, A-4, A-5, A-10, C-2, C-3, E-1, E-5, E-8, F-1, I-1, K-1e, K-1g		

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Transportation	E-1, E-5, F-1		CPAI Aircraft Transportation Plan
Recreation	A-1 through A-7, A-9, B-1, B-2, C-2, C-3, C-4, E-5, E-6, E-7, E-8, F-1, H-3, E-17, I-1, M-2		
Visual	A-1 through A-7, C-2, C-3, E-1, E-5, E-15, E-17, F-1, I-1, M-2	All permanent painted structures, including emergency spill containers located along watercourses, will be painted to blend with the natural environment. All colors will be pre-approved by the Authorized Officer. BLM will use computer generated colors and on-site testing to determine the color for structures that will blend in best with the background colors of the natural landscape. Self-weathering steel, non-specular surfaces, or BMPs shall be used on all metal structures not otherwise painted. Use a non-reflective finish on all pipelines.	
Wilderness	A-1 through A-7, B-2, C-2, C-3, E-1, E-4, E-5, E-13, F-1, I-1, M-2		
Spill Prevention	A-2 through A-5	Install pipeline valves on either side of the Tiŋmiaqsiġvik (Ublutuoch) River and place spill containment equipment below each valve. Pipeline monitoring and surveillance program. Locate roads near to and parallel the pipelines, facilitating leak detection and spill response. Valves will be placed in the produced fluids pipeline on both sides of the Tiŋmiaqsiġvik (Ublutuoch) River and spill containment equipment will be installed below each valve.	CPAI uses an improved weld pack design. CPAI has an ice road liner and spill kit policy. CPAI's practice is to immediately and completely clean up spills, recovering 100% of the spilled product for recycling when possible. Fuel Transfer SOP in place.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Spill Prevention (Continued)	A-2 through A-5		Mutual Aid agreement among North Slope operators to supply manpower and equipment for spill response. Spill drills to ensure response readiness and awareness are scheduled each year and involve Production, Drilling and Pipeline scenarios. Well cellars are designed to catch drips and leaks. Alpine Spill Response Team (SRT) and Hazardous Materials Response Team (HMRT) - trained, volunteer spill and hazardous materials response personnel on-site at Alpine. Pipelines are inspected and maintained regularly using pigs (where possible) and other standard operating procedures including the Twin Otter-mounted FLIR technology. Pipelines in the Colville delta are designed to withstand a 200-year (Q200) return flood event plus 3 feet of freeboard. Pipelines are designed to American Society of Mechanical Engineers (ASME) Codes B31.4 (oil and water) and B31.8 (gas). In the Colville Delta, pipelines are designed to be placed downstream from roads so the roads would help protect the pipeline from ice; elsewhere pipelines are designed to be upstream from roads so that roads would serve as a containment barrier in the event of a pipeline spill. Fluids in pipelines are treated periodically with chemicals to limit the potential of corrosion. CPAI has an extensive corrosion inspection program. Pipelines undergo hydrostatic testing prior to operation. Petroleum storage tanks have secondary containment and spill prevention and detection technology as required by regulations. These tanks are inspected regularly in accordance with industry standards.

Table 4.7-1. Mitigation Associated with the GMT1 Development Project (Continued)

Resource	2013 ROD BMPs and CPAI Lease Stips	2004 ASDP ROD	CPAI Design Features and Other Agency Permit Requirements
Spill Prevention (Continued)	A-2 through A-5		"Target Zero" Spill prevention program designed to raise awareness around spill prevention and pass on lessons learned. CPAI has an Incident Investigation Program. CPAI audits contractors' HSE performance. Pipelines are constructed above ground.
General		All research and monitoring activities by the permittee will follow protocols described by the Authorized Officer that will be designed to minimize disturbance and mortality. CPAI will do the required monitoring and studies, though to enhance cooperation among research and monitoring entities and to avoid duplication, the Authorized Officer may waive this requirement of CPAI if the monitoring or study is being done by another entity. Substantial infrastructure would be removed from the Fish Creek 3-mile setback. Consistent with the exception clause provision of the IAP/EIS, CD6 (GMT1) and some infrastructure would be allowed to be located as requested by CPAI within the setback.	CPAI audits each field on a scheduled basis to ensure compliance with all environmental laws, regulations and local requirements, company policies and procedures and other regulations regarding safety, fire codes, etc. CPAI employs Field Environmental Coordinators to monitor compliance with permits and other requirements. The Green Star program encourages field personnel to reduce, reuse and recycle materials. Cuttings from borings may be hauled to gravel source locations and deposited there as part of the reclamation plan, or may be used as fill for another project. CPAI recycles hydrocarbons to the extent possible.

Additional federal, state, and local permit requirements and mitigation measures will be implemented for gravel extraction from the ASRC Mine as per the Corps permit including the following:

- Imposing a 500-foot buffer along the Colville River, and a 200-foot buffer around large lakes.
- Limiting gravel extraction to winter only.
- Developing and implementing a Long-Term Adaptive Management Plan to ensure the long-term sustainability of the reclamation and the enhanced waterfowl habitat resource values that are created (Corps 2012).
- Maintaining a minimum 200-foot buffer of undisturbed tundra between a gravel mining cell that has been fully excavated and left to fill with water naturally and an adjacent cell.

4.8 Unavoidable Adverse Impacts

Adverse impacts from oil and gas activities, resulting from construction, operation, and abandonment of the proposed project and alternatives were described in BLM (2004, § 4H.1) and in BLM (2012, § 4.9). Many adverse impacts could be lessened by mitigation, but would not be completely eliminated or reduced to negligible levels. Some are short-term impacts, while others may be long-term impacts. These have been described for each resource in Sections 4.2 through 4.5. Depending on the preferred alternative and adopted mitigation, these impacts potentially include:

- Loss of soil productivity and sand and gravel resources largely from construction of roads and pads and gravel mine development;
- Loss of petroleum resources;
- Change in surface drainage due to construction of roads and pads;
- Increased air emissions, including fugitive dust, pollutants, and GHG;
- Loss of wetlands and associated functions largely from construction of roads and pads and gravel mine development;
- Loss or fragmentation of wildlife habitat;
- Continued change in access to and availability of subsistence resources; and
- Increased risk of spills.

To assist with abandonment and reclamation, BLM has a bonding process in place for leases which are issued within NPR-A. The bond is held by BLM, and certifies that the company will cover the full cost of reclamation. This bond provides monetary assurance to BLM that the company will reclaim the pads, wells, and any associated surface disturbance to the standards of the BLM authorized officer. This is determined at the time of reclamation, thus allowing BLM to take an adaptive management approach. Upon abandonment, BLM will consider current data, technologies available, and the current resource situation in its determinations on specific reclamation. Additionally, BLM retains the ability to increase the bond amount at any time during the lease based on a recalculation of liability (i.e., increased number of wells, or a history of non-compliance with BLM's operational standards).

Bonding for the right-of-way grant would be very similar to what is done for BLM leases. When BLM processes a ROW application, BLM determines if a bond is necessary and the amount of the bond. BLM discusses potential bond amounts with clients, and estimates the amount based on how much it would cost the BLM to remove all infrastructure associated with the ROW grant, including roads. When BLM requires a bond, it is connected to a particular stipulation, of which the requirement for reclamation would be an example. The ROW bond for the current project wouldn't cover reclamation of the portion of road that is on Kuukpik land or the small portion of the road that is located on CPAI's lease.

4.9 Relationship between Local Short-Term Uses and Long-Term Productivity

The short term uses of the study area for hydrocarbon development and production activities versus the maintenance and enhancement of potential long-term productivity of environmental resources of the area were discussed in BLM (2004, § 4H.2) and in BLM (2012, § 4.10). In this SEIS, "short-term" refers to the duration of hydrocarbon development and production activities at GMT1; "long-term" refers to an unspecified period beyond hydrocarbon production at GMT1. Long-term productivity is the capability of the land to provide natural resources indefinitely.

The proposed GMT1 Project is consistent with terms of federal oil and gas lease AA-081798. Hydrocarbons developed from the GMTU would help offset declines in production from the Alaska North Slope and maintain throughput of the Alpine Sales Pipeline and ultimately, TAPS. Hydrocarbon production would help meet the U.S. domestic energy demand. At some future date, the GMT1 Project will be abandoned, and elements of lost productivity may be restored.

4.10 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitments of resources were described in Section 4H.3 of the ASDP EIS (BLM 2004) and in BLM (2012, § 4.11). An irreversible or irretrievable commitment of resources refers to the consumption, commitment, or loss of resources due to project development. These distinctions refer primarily to non-renewable resources. No irreversible or irretrievable impacts are expected on air quality, water quality, or noise. Depending on the final abandonment plan, irreversible and irretrievable commitments of gravel resources, vegetation, bird habitat, and visual resources may be reduced. Lease Stipulation G-1 includes requirements for site restoration at abandonment. There would be some irreversible or irretrievable commitments of resources. These include:

- Removal of hydrocarbons from the reservoir;
- Energy consumption associated with construction and operation of the project;
- Ground disturbance/change resulting from gravel removal;
- Surface water consumption for drilling and other industrial purposes with wastewater disposal via underground injection;
- Loss or change in vegetation and wetlands where gravel is placed, regardless of whether it is removed at abandonment;
- Increased access to resources of the NPR-A; and

Loss or change in subsistence use of the area, depending on final abandonment plans.

CHAPTER 5: CONSULTATION AND COORDINATION

Exploration and potential development at the GMT1 site have been subject to various NEPA analyses in the past, involving a wide array of stakeholders. This chapter summarizes the public and agency outreach the BLM has engaged in as it has developed the SEIS, including keeping the public and other federal, state and local agencies informed of the process and offering opportunities for the public and agencies ask questions and provide input. The section also identifies the individuals who prepared the SEIS.

Early in the process, BLM conducted public scoping to identify the range of issues and alternatives to address in the Draft SEIS, as described in Section 1.5.

In addition to the consultation described below, BLM-Alaska sought input from the local community in a variety of ways, including the NPR-A SAP, NPR-A Working Group, and regular contact and outreach by BLM's Arctic Field Office. The SAP is comprised of seven representatives from communities on the North Slope. The panel makes recommendations to the BLM regarding issues, concerns, and possible impacts to subsistence resources or harvesting due to oil industry activities. The SAP held its most recent meeting in September 2014 and included presentations by the BLM on this SEIS. The NPR-A Working Group, established by the BLM (2013), held its initial meeting in August 2013, which also included a presentation on the GMT1 SEIS. The Working Group's purpose is to provide BLM with information and recommendations on a range of issues in the NPR-A, including oil and gas leasing.

Additional public outreach will take place as the project moves through its permitting phases. For example, the North Slope Borough will hold public hearings for issuance of its rezoning permit for the project, described in Section 1.4.2.1.

5.1 SEIS Consultation and Coordination

5.1.1 Coordination and Consultation with Local, State, and Federal Agencies

The BLM consulted and coordinated with various stakeholders in setting the scope of analysis and alternatives for the SEIS. Collaboration with the cooperating agencies greatly informed the range of the alternatives and the issues analyzed in the Draft SEIS. BLM also worked closely with its Air Quality MOU Working Group which provided feedback on air quality modeling and the subsequent Air Quality Impact Analysis, and reviewed the air quality impacts language for Chapter 4 of the SEIS.

Development of the SEIS involved consultation and coordination with the following government agencies:

- U.S. Army Corps of Engineers;
- U.S. EPA;
- U.S. USFWS;
- U.S. BOEM Office of Environmental Programs;

- U.S. National Park Service;
- U.S. Forest Service;
- Alaska Department of Natural Resources;
- Alaska Department of Environmental Conservation;
- NSB Department of Iñupiat History, Language, and Culture (IHLC)
- NSB Department of Law
- NSB Planning Department; and
- Native Village of Nuiqsut.

5.1.2 Tribal Consultation

The BLM initiated the government-to-government consultation process as required by Presidential Executive Memorandums dated April 29, 1994 and November 5, 2009, and Department of the Interior Policy on Consultation with ANCSA Corporations, with letters sent on August 29, 2013, to the following tribes and ANCSA corporations whose members could be affected by the proposed development of GMT1:

- Native Village of Nuiqsut;
- Village of Anaktuvuk Pass;
- Village of Atqasuk;
- Iñupiat Community of the Arctic Slope;
- Native Village of Barrow;
- Kuukpik Corporation;
- Atqasuk Corporation;
- Ukpeagvik Iñupiat Corporation;
- Arctic Slope Regional Corporation; and
- Nunamiut Corporation.

Government-to-government consultation meetings were held on a weekly basis with the NVN. Kuukpik Corporation and the ASRC also engaged in government-to-government consultation with BLM-Alaska during the NEPA process.

5.1.3 Applicant Coordination

The Applicant met with various stakeholders specifically about the proposed GMT1 development plan and schedule, as summarized in Table 5.1-1. Issues resulting from those meetings have been addressed by CPAI, with minor changes and alternatives described in this document.

Additional information meetings by the Applicant with the NVN, Kuukpik Subsistence Oversight Panel (KSOP), the City of Nuiqsut, and a public community meeting in Nuiqsut were held in March 2014. Issues resulting from these consultation meetings were evaluated by CPAI and the regulatory agencies for potential changes to the proposed project, mitigation, or alternatives that should be considered.

Table 5.1-1. Summary of Applicant Coordination Meetings

Stakeholder Meetings	Date(s)
Arctic Slope Regional Corporation	10/21/2013
City of Atqasuk	11/20/2013
Community Meeting - Anaktuvuk Pass	11/19/2013
Community Meeting – Atqasuk	11/20/2013
Community Meeting – Barrow	12/2/2013
Community Meeting - Nuiqsut	1/15/2013; 2/17/2013; 11/6/2013
Community Meeting - Point Lay	11/13/2013
Community Meeting – Wainwright	12/5/2013
Cully Corporation	11/13/2013
Iñupiat Community of the Arctic Slope	12/2/2013
Kuukpik Corporation Board	1/15/2013; 7/23/2013; 11/18/2013
Kuukpik Subsistence Oversight Panel	11/6/2013
Native Village of Barrow	12/3/2013
NSB Assembly	12/3/2013
NSB Planning Commission	3/28/2013; 9/26/2013
Wainwright Tri-lateral Council (Wainwright Traditional Council, City of Wainwright, Olgoonik Corporation)	12/5/2013
Agency Meetings	
Pre-Application meetings, Anchorage	7/16/2013
Pre-Application meeting, Fairbanks	7/18/2013
GMT1 SEIS Protocol Meetings	9/12/2013; 9/16/2013; 9/18/2013; 9/27/2013; 10/24/2013; 10/30/2013

5.2 List of Preparers

This SEIS was prepared by the BLM, with input from all of the cooperating agencies, the Air Quality Working Group, and technical support from a third-party contractor, SLR International Corporation (SLR). BLM employees are listed with their office, including AFO for Arctic Field Office, FDO for Fairbanks District Office, AKSO for Alaska State Office, and NOC for the National Operations Center in Denver. Technical input was provided by CPAI. In addition, numerous employees of the cooperating agencies reviewed portions the SEIS and provided constructive suggestions for improvement. Following is a list of BLM Team members involved in the preparation of this SEIS and their area of responsibility.

Name	Project Responsibility
Stewart Allen (BLM-AKSO)	Economics Sociocultural Systems
Ethan Aumann (BLM-NOC/U.S. NPS)	Air Quality Climate Change
Larisa Ford (BLM-WO)	Noise
Stacey Fritz (BLM-AFO)	Subsistence Sociocultural Systems Environmental Justice
Eric Geisler (BLM-AKSO)	Soils Vegetation Wildland Fire
Cindy Hamfler (BLM-AFO)	Physiography GIS
Steve Hartmann (BLM-FDO)	Fairbanks District Office Manager
Lon Kelly (BLM-AFO)	Arctic Field Office Manager Wild and Scenic Rivers
Richard Kemnitz (BLM-AFO)	Water Resources Wetlands and Floodplains
Robert King (BLM-AKSO)	Paleontology Archaeology Cultural Resources
Stacie McIntosh (BLM-AFO)	Arctic Field Office Interdisciplinary Supervisor Environmental Justice Public Health
Craig Nicholls (BLM-NOC)	Air Quality Climate Change
Debbie Nigro (BLM-AFO)	Birds Threatened and Endangered Species BLM-Special Status Species ESA Section 7 Consultation

Name	Project Responsibility
Dave Maxwell (BLM-NOC)	Air Quality Climate Change Noise
Justin Miller (BLM-AKSO)	Petroleum Resources Oil and Gas Scenario
Alan Peck (BLM-AKSO)	Climate and Meteorology Air Quality
Bridget Psarianos (BLM-AKSO)	SEIS Project Manager
Roger Sayre (BLM-AFO)	NEPA
Josh Sidon (BLM NOC)	Economics
Serena Sweet (BLM-AKSO)	Supervisory Planner
Darrel VandeWeg (BLM-AFO)	Geology and Minerals Sand and Gravel Resources
Matthew Whitman (BLM-AFO)	Fish
Donna Wixon (BLM-AFO)	Land Use/Land Ownership Recreational Resources Transportation Wilderness Resources Visual Resources
Dave Yokel (BLM-AFO)	Vegetation Terrestrial Mammals Threatened and Endangered Species BLM-Special Status Species
Mike Wrabetz (BLM-AKSO)	Spills

Technical support was provided by the following members of the SLR Team:

Name	Project Responsibility	Education and Experience
Brian Hoefler, PE	Principal In Charge Technical Review	MS Civil Engineering BS Civil and Environmental Engineering 22 years experience
Sandra Hamann	Project Team Co-Lead Technical Review	MS Botany / Plant Physiology BS General Science/Education 33 years experience
Pat Athey	Project Team Co-Lead Soils and Permafrost Climate Change Vegetation Fish	MS Botany BS Botany 25 years experience

Name	Project Responsibility	Education and Experience
Stan Flagel, PG	Water Resources Hydrology	Prof. Degree Hydrogeology MS Geology BA Geology 22 years experience
Christina Bentz	Water Resources	MS Geology BS Geosciences 9 years experience
Karen Cougan	Water Quality	BS Watershed Mgmt / Environmental Studies AAS Ecology/ Environmental Technology 27 years experience
Al Trbovich, CCM	Climate and Meteorology Air Quality	MS Meteorology BS Meteorology 30 years experience
Jessica Stark, PE	Climate and Meteorology Air Quality	BS Environmental Resources Engineering 13 years experience
Allison Erickson	Birds Terrestrial Mammals Threatened and Endangered Species	BA Biology 16 years experience
Erin Donmoyer	Birds Terrestrial Mammals Threatened and Endangered Species Marine Mammals Public Involvement	BS Marine Biology BS Environmental Science 7 years experience
Mark Stelljes, PhD	Community Health	PhD Environmental Toxicology / Pharmacology MS Wildlife Biology BS Zoology 23 years experience
Stephen Braund (Stephen R. Braund & Associates)	Subsistence Cultural Resources	MA Anthropology BA Northern Studies/English 36 years experience
Leah Cuyno, PhD (Northern Economics)	Economics	Ph.D. Agricultural / Applied Economics MS Agricultural Economics BS Agricultural Economics 12 years experience

Name	Project Responsibility	Education and Experience
Deborah Moore	Project Team Co-Lead Solid and Hazardous Waste Spills and Hazardous Substances	MSEL Environmental Law BS Environmental Planning 15 years experience
Michelle Turner	Public Involvement Technical Review	MS Environmental Quality Science BA Chemistry 20 years experience
Jules Tileston	Recreational Resources Technical Review Transportation Visual resources Wild and Scenic Rivers Wilderness	MS Ecology / Wildlife Management BA Biology and Geology 52 years experience
Don Meares	Land Use Technical Review	BA Geography 35 years experience
Jenny Matter	Project Coordination	MAA Applied Anthropology BA Anthropology 10 years experience

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