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FINAL ENVIRONMENTAL IMPACT STATEMENT
NANUSHUK PROJECT

Lead Agency: U.S. Army Corps of Engineers
Alaska District
Post Office Box 6898
JBER, Alaska 99506-0898

Lead Agency Authorities: Section 10 of the Rivers and Harbors Act and 404 of the Clean Water Act

Cooperating Agencies:
State of Alaska
550 West 7th Avenue, Suite 1430
Anchorage, Alaska 99501
Environmental Protection Agency
Alaska Operations Office
222 West 7th Avenue, Box 19
Anchorage, Alaska 99513-7588

Native Village of Nuiqsut
2205 2nd Avenue
Nuiqsut, Alaska 99789
U.S. Fish and Wildlife Service
Fairbanks Fish and Wildlife Field Office
101 12th Avenue, Room 110
Fairbanks, Alaska 99701

Project Location: 6.6 miles northeast of Nuiqsut, Alaska (at Project's closest point)

For further information, contact: Ellen Lyons, Regulatory Project Manager
United States Army Corps of Engineers
Regulatory Division (1145)
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(907) 474-2169

Final Environmental Impact Statement (EIS) Available: www.nanushukeis.com and
https://cdxnodengn.epa.gov/cdx-enepa-public/action/eis/search

Final EIS Review Period: November 2, 2018 to December 3, 2018

Record of Decision: Mid-February 2019
NOTE TO THE READER

The U.S. Army Corps of Engineers (USACE) received a permit application from Armstrong Energy, LLC, on July 10, 2017, requesting authorization for the placement of fill in Waters of the U.S. for the Nanushuk Project. The Application proposed to develop hydrocarbon resources from the Alpine C and Nanushuk reservoirs on the east side of the Colville River approximately 6.6 miles northeast of Nuiqsut (at closest point). The Project would include construction of gravel roads and pads, pipelines, and production infrastructure. USACE, as part of its permit application review process, developed and released a Draft Environmental Impact Statement (EIS) in September 2017, in compliance with the National Environmental Policy Act. Though Armstrong Energy, LLC, was the Applicant in the Draft EIS, Oil Search Alaska, LLC (hereafter referred to as the Applicant) officially assumed the role of operator and applicant for the Project on March 15, 2018.

On the basis of over 1,730 individual comments received and considered by USACE, the four public meetings held during the Draft EIS review period, and other meetings held with cooperating agencies and stakeholders, USACE has refined the EIS, corrected errors, and edited text for clarity and accuracy. The Applicant submitted a revised permit application on October 5, 2018, which included the following changes since the Draft EIS (all changes are detailed in Chapter 2.0, Alternatives): 1) change the Applicant’s preferred alternative from Alternative 2 to Alternative 5; 2) change road side slopes from 3:1 to 2:1; 3) change road surface widths from 38 and 35 feet to 32 feet; 4) change fill volume from 2.8 to 2.9 million cubic yards; 5) relocate Drill Site 2 approximately 0.3 mile further east, away from the Colville River; and 6) add tundra access ramps on the gravel roads and a gravel boat ramp. These changes in Project description decreased the overall Project footprint by 77.6 acres; it also reduced other potential effects, which are detailed in Chapter 3.0, Environmental Analysis. These Project updates reduced Project effects across the action alternatives.

The Final EIS describes the proposed Nanushuk Project as detailed in the October 5, 2018 permit application. It analyzes potential impacts to the human and natural environments that could result from the Project and the alternatives considered. The Final EIS also presents the Applicant’s proposed avoidance and minimization measures that have been incorporated into the Project design, as well as the Applicant’s proposed compensatory mitigation plan for impacts to Waters of the U.S. The final determination of compensatory mitigation requirements will be made by USACE as part of the final permit decision and will be documented in the Record of Decision and permit decision document.

After the Final EIS is published, USACE will finalize its decision to issue or deny a permit. USACE’s decision will be documented in the Record of Decision and will be based on information contained in the Final EIS, an evaluation of compliance with the Clean Water Act Section 404(b)(1) Guidelines, a Public Interest Review, and other applicable laws and regulations.

The Final EIS review period will be November 2 to December 3, 2018. For additional information on the USACE permit process, please contact Ellen Lyons (see contact information on previous page).
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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>AAAQS</td>
<td>Alaska Ambient Air Quality Standards</td>
</tr>
<tr>
<td>ACP</td>
<td>Arctic Coastal Plain</td>
</tr>
<tr>
<td>Alpine</td>
<td>Colville River Unit</td>
</tr>
<tr>
<td>Applicant, the</td>
<td>Oil Search Alaska, LLC</td>
</tr>
<tr>
<td>ASRC</td>
<td>Arctic Slope Regional Corporation</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practice</td>
</tr>
<tr>
<td>bopd</td>
<td>barrels of oil per day</td>
</tr>
<tr>
<td>CPF</td>
<td>central processing facility</td>
</tr>
<tr>
<td>CRD</td>
<td>Colville River Delta</td>
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<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
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<td>DA</td>
<td>Department of the Army</td>
</tr>
<tr>
<td>DS</td>
<td>drill site</td>
</tr>
<tr>
<td>EFH</td>
<td>essential fish habitat</td>
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<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>EJ</td>
<td>Environmental Justice</td>
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<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
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<td>greenhouse gas</td>
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<tr>
<td>HAP</td>
<td>hazardous air pollutants</td>
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<tr>
<td>Kuparuk</td>
<td>Kuparuk River Unit</td>
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<tr>
<td>Kuukpik</td>
<td>Kuukpik Corporation</td>
</tr>
<tr>
<td>LEDPA</td>
<td>Least Environmentally Damaging Practicable Alternative</td>
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<tr>
<td>MG</td>
<td>million gallons</td>
</tr>
<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy</td>
</tr>
<tr>
<td>NSB</td>
<td>North Slope Borough</td>
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<tr>
<td>OHW</td>
<td>ordinary high water</td>
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<td>Oil Search Alaska, LLC</td>
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<td>Nanushuk Project</td>
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<tr>
<td>ROD</td>
<td>Record of Decision</td>
</tr>
<tr>
<td>TAPS</td>
<td>Trans-Alaska Pipeline System</td>
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<tr>
<td>USACE</td>
<td>U.S. Army Corps of Engineers, Alaska District, Regulatory Division</td>
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<td>VSM</td>
<td>vertical support member</td>
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<tr>
<td>WOUS</td>
<td>Waters of the United States</td>
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1.0 INTRODUCTION

The U.S. Army Corps of Engineers Alaska District (USACE) received a Section 404 permit application for the Nanushuk Project (the Project) from Oil Search Alaska, LLC (Applicant, OSA) on October 5, 2018, for the proposed placement of clean fill material into Waters of the United States (WOUS), including wetlands, and temporary discharges to WOUS. Under the USACE jurisdictional authority pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (CWA), USACE initiated the National Environmental Policy Act (NEPA) review of the Project and is the lead federal agency. The U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the State of Alaska, and the Native Village of Nuiqsut are cooperating agencies.

The Applicant proposes to develop hydrocarbon deposits from its oil and gas leasehold on the North Slope of Alaska in proximity to existing oil and gas development. The Project targets oil deposits in the Alpine C and Nanushuk reservoirs using up to 146 production and injection wells, and would include construction of gravel pads and roads, pipelines, and production infrastructure. Oil produced by the Project would be transported by pipeline to the Trans-Alaska Pipeline System (TAPS), which has experienced reduced throughput since peak production in 1988.

In 2016, TAPS throughput was approximately 500,000 barrels of oil per day (bopd), or about one-quarter of peak production. Declining North Slope oil production has marked ramifications on TAPS (e.g., corrosion, wax accumulation, etc.) and on the Alaska economy, where approximately 90% of the state budget consists of revenues from oil production. Additionally, North Slope oil production revenue is critical for supporting local communities within the North Slope Borough (NSB). The Project has the potential to provide up to an additional 120,000 bopd to TAPS and would contribute revenue to the State and NSB.

The Project area is located on Alaska’s Arctic Coastal Plain (ACP) at elevations ranging from sea level to 100 feet above sea level. The landscape of the ACP is generally flat with landforms between drainages dominated by patterned ground, shallow lakes and ponds, and wetlands resulting from poorly drained soils. As is typical on the North Slope, the Project is located on permafrost where the subsurface is perennially frozen.
to a depth of approximately 650 to 1,300 feet below ground surface in most areas.

At its closest point, the Project is approximately 6.6 miles northeast of the community of Nuiqsut on Applicant-operated oil and gas leases east of the East Channel of the Colville River (Figure ES-1). The Project would be situated between the Kuparuk River Unit (Kuparuk) and the Colville River Unit (Alpine). The Project would extend west from existing Kuparuk infrastructure in an area that has seen recent exploration and development activity by Caelus Natural Resources Alaska, LLC (Oooguruk and the proposed Nuna project, located northeast of the Project) and Brooks Range Petroleum Company (Mustang project, located southeast of the Project location).

**ES 1.1 Scope of Analysis**

The scope of analysis for the Environmental Impact Statement (EIS) has two distinct elements: 1) determining the USACE federal action area; and 2) determining how the USACE district will evaluate direct and indirect adverse environmental effects. For the purposes of NEPA, the scope of analysis should be limited to the specific activity requiring a USACE permit and any additional portions of the entire Project over which there is sufficient federal control and responsibility to warrant a NEPA review.

USACE regulatory jurisdiction over the Project includes the discharge of dredged and/or fill material into WOUS, including wetlands, and work in, over, and under navigable WOUS. Considering that the Project area is almost entirely located in WOUS, including wetlands, the USACE scope of analysis for the EIS includes the entire footprint of the Project, including dredge and/or fill placement associated with the construction of roads, pads, pipelines, and utilities; widening of existing roads; and screeding at Oliktok Dock. Additionally, the scope of analysis may be expanded in some instances if needed for permit decision-making purposes of a cooperating agency. Therefore, footprints of ice roads and ice pads are included within the NEPA scope of analysis.
Applicant's Proposed Action

Access Gravel Road
Infield Gravel Road
Mustang Road Upgrades

Other Infrastructure

Existing Gravel Road
Existing Pipeline
Existing Facilities
Proposed Gravel Road
Proposed Pipeline

Coordinate System: NAD 83 Alaska State Plane Zone 4 Feet

Figure ES-1
Location Vicinity Map

Nanushuk Project EIS

Coordinate System: NAD 83 Alaska State Plane Zone 4 Feet
The NEPA scope of analysis for the Nanushuk Project EIS includes all resource analysis areas described in EIS Chapter 3.0, Environmental Analysis. Geographically, the NEPA scope of analysis area contains the entire footprint of the Project, including the construction of roads, ice roads, pads, ice pads, pipelines, and utilities, as well as access road widening and screeding at Oliktok Dock. The analysis areas for each resource are described in each relevant resource section. The temporal scope of analysis for the Project is based on the duration of Project construction, drilling, and operations, currently estimated to be approximately 30 years. The scope of the cumulative impacts analysis is discussed in Chapter 3.1, Introduction and Analysis Methods. The scope of analysis for cumulative effects varies by resource.

USACE must consider the direct, indirect, and cumulative effects of the Project requiring USACE permit authorization (40 CFR 1508.7-8). USACE evaluates all of these categories of potential impacts and makes its final permit decisions and, to the extent appropriate, mitigation decisions based on this evaluation.

**ES 1.2 The Permit Decision**

The Applicant applied for a Department of the Army (DA) permit on October 5, 2018, for the proposed placement of clean fill material to construct the Project in WOUS, including wetlands. USACE will issue or deny a DA permit under the following regulatory authorities:

- Section 404 of the CWA (33 USC 1251). Discharges of dredged or fill material in WOUS, including wetlands.
- Section 10 of the Rivers and Harbors Act (33 USC 403). Work and/or structures constructed in, on, over, or under navigable WOUS, affecting the course, locations, condition, or capacity of such waters.
USACE is responsible for the sufficiency of the EIS to analyze and disclose potential impacts associated with the Applicant’s project and a range of alternatives. The potential impacts and associated mitigation analyzed and disclosed in the Final EIS are ultimately intended to inform the permit decision.

Following the Final EIS, USACE will prepare a Record of Decision (ROD) that documents its evaluation of the permit application under NEPA. The ROD will also document USACE’s evaluation of the permit application with regard to compliance with the CWA Section 404(b)(1) Guidelines (40 CFR 230), findings of the Public Interest Review (33 CFR 320.4), and compliance with other relevant federal laws and regulations. The ROD will document the USACE decision on whether or not to issue the DA permits for the Project under Section 404 and Section 10.

ES 1.3 Scoping and Public Outreach
Public and agency scoping occurred from February 4 through May 31, 2016. During this period, USACE held four public scoping meetings and one agency scoping meeting. Community scoping meetings were held in Nuiqsut, Utqiaġvik (Barrow), Anchorage, and Fairbanks, Alaska. During the scoping period, approximately 60 entities submitted or verbally provided a total of 231 comments covering 33 topics. The primary issues identified during the scoping period were subsistence, air quality, human health and safety, socioeconomics, oil spills, hydrology and water quality, wildlife, and fish. Chapter 5.0 (Consultation and Coordination) and Appendix II.1 (Scoping Summary Report) provide further information on the public and agency scoping process.

ES 1.4 Draft Environmental Impact Statement Comment Period
The public comment period for the Draft EIS was September 1, 2017, to November 14, 2017. Public meetings were held in Nuiqsut, Utqiaġvik, Anchorage, and Fairbanks. USACE also met with agencies and the Native Village of Nuiqsut during this time. USACE received approximately 1,730 communications, with 1,492 unique comments. The topics of comments received were similar to those received during scoping. Appendix XIII (Response to Comments on the Draft Environmental Impact Statement) includes responses to all comments received during the Draft EIS public review period.
2.0 PURPOSE AND NEED

NEPA guidelines require that an EIS “briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action” (40 CFR 1502.13). USACE defines the purpose and need for a project considering both the applicant’s and the public’s perspective (33 CFR 325 Appendix B). The USACE defined purpose and need establishes the framework from which a reasonable range of alternatives is developed for analysis in the EIS. Reasonable alternatives must be both feasible and accomplish the purpose and need of the project. The alternatives analysis will be thorough enough to inform agency decision making for permitting, including determinations of public interest and compliance with the 404(b)(1) guidelines (40 CFR 230).

ES 2.1 Applicant’s Stated Purpose and Need

The Applicant’s stated purpose and need, as referenced in their Section 404 (DA) application is:

“...to safely produce commercial quantities of liquid hydrocarbons in OSA’s State of Alaska and ASRC [Arctic Slope Regional Corporation] oil and gas leasehold by operating from a site east of the Colville River Delta; to process hydrocarbons on or near the drill sites; and to transport sales-quality oil through a new export pipeline to the Kuparuk sales oil pipeline, and then to TAPS."

A secondary stated purpose of the Project is:

“...to further delineate geologic features and hydrocarbon accumulations in OSA’s leasehold utilizing the proposed infrastructure."

The Applicant’s stated need is as follows:

“The primary need for the Project is to maximize economic benefit to OSA as lessee of record, the State of Alaska and ASRC as subsurface owners, and other parties having agreements with one or more subsurface owners. A secondary need is to provide workforce and business development opportunities in local, state, national, and international markets."
As discussed previously and documented through the scoping process for the Project, the State of Alaska has identified a public need to offset declining oil production on the North Slope, help maintain throughput of the TAPS, and provide needed revenues for the State of Alaska, NSB, and local communities and residents.

**ES 2.2 U.S. Army Corps of Engineers’ Overall Project Purpose and Need**

Consistent with USACE (33 CFR 325 Appendix B) and NEPA (40 CFR 1502.13) regulations, USACE has carefully considered the Applicant’s stated purpose and need and has determined the proposed activity’s underlying purpose and need to develop the alternatives, including the proposed action, evaluated in this EIS.

**USACE’s overall project purpose is:**

To construct infrastructure to safely produce, process, and transport commercial quantities of liquid hydrocarbons to market via pipeline from the Alpine C and Nanushuk reservoirs.

In general, production and transport of hydrocarbon resources do not require access or proximity to a special aquatic site. Therefore, the USACE finds the basic purpose of the Nanushuk Project is not water dependent.

The overall Project purpose and need allows for a robust consideration of alternatives while providing a foundation to determine practicability. The USACE need for federal agency action arises directly from USACE’s statutory permitting authorities as described in Chapter 1.5 (Lead and Cooperating Agency Roles).
3.0 APPLICANT’S PROPOSED PROJECT AND ALTERNATIVES CONSIDERED IN THIS ENVIRONMENTAL IMPACT STATEMENT

The EIS evaluates four action alternatives (including the Applicant’s proposed action). Each action alternative consists of several major components listed below and illustrated in Figure ES-2. A full description of Project elements is included in Chapter 2.0 (Alternatives) of the EIS.

- Ice roads and pads (during the construction of phase only)
- Three gravel drill site pads
- Central processing facility (CPF)
- Operations center
- A gravel access road with bridged river crossing(s)
- Improvements to existing roads between Oliktok Dock and the new gravel access road
- Gravel infield roads and infield pipelines between facilities
- A makeup water and makeup gas import pipeline and oil export pipeline
- A tie-in pad to connect the import and export pipelines to existing North Slope facilities
- Screeding at Oliktok Dock

An alternatives development process was designed to develop a reasonable range of alternatives to the Applicant’s proposed action that:

- Meet the overall purpose and need of the Project
- Are feasible and practicable
- Incorporate measures to address key issues identified during the scoping process
- Have the potential to result in less adverse environmental effects than the Applicant’s proposed action

The alternatives development process resulted in identification of three alternatives to the Applicant’s proposed action (Figure ES-3). NEPA also requires agencies to evaluate a No Action Alternative, where a DA permit would not be issued for the Project. In total, five alternatives are evaluated in the EIS: the No Action alternative and four action alternatives, including the Applicant’s proposed action (Alternative 5, Applicant’s Preferred). Alternatives considered, but dismissed from full
evaluation, are described in Chapter 2.0 (Alternatives) and Appendix III (Alternatives Development).

**Alternative 1: No Action Alternative.** NEPA requires the consideration of a No Action Alternative, which means the DA permit for the Project would not be issued and the Project would not be constructed. Under this alternative, development of the Project would not occur at this time, leaving the hydrocarbon deposits in the Applicant’s leasehold in place. This alternative would not meet the purpose and need of the Project.

**Alternative 2: Applicant’s Original.** This alternative represents the proposal the Applicant has submitted to the USACE for permit review. The applicant has proposed three drill sites. Under this alternative, the CPF would be collocated with Drill Site 1 (DS1) and would be 14.4 miles from Nuiqsut.

**Alternative 3: Southern Access.** The intent of this alternative is to maximize the use of existing infrastructure in the area by providing access from the south using the existing Mustang Road to the greatest extent practicable. This alternative would result in the CPF and operations center being moved south and west of the Applicant’s proposed sites. Under Alternative 3, the CPF would be 10.9 miles from Nuiqsut.

**Alternative 4: Northern Access.** The intent of this alternative is to maximize the use of existing infrastructure north of the Project by providing access from the existing and permitted (but not yet constructed) roads associated with the Nuna project. This alternative would result in the CPF and operations center being moved east of the Applicant’s proposed sites. Under this alternative, the CPF would be 15.6 miles from Nuiqsut.

**Alternative 5: Applicant’s Proposed.** The intent of this alternative is to move as much of the road and pipeline infrastructure as practicable out of the Colville River’s 50-year floodplain. This alternative also attempts to address local resident and agency concerns about creating a barrier to migrating caribou by making the infield roads less parallel to the East Channel of the Colville River. This alternative would result in the CPF and operations center being moved south and east of the Applicant’s proposed sites. Under Alternative 5, the CPF would be 12.1 miles from Nuiqsut.

Table ES 3-1 on the following page summarizes key elements of the four action alternatives.
Figure ES-2
Project Schematic for Alternative 5

Nanushuk Project EIS
Not to Scale
Figure ES-3
All Action Alternatives

Alternative Components
- Alternative 2 Pipelines
- Alternative 3 Pipelines
- Alternative 4 Pipelines
- Alternative 5 Pipelines
- Alternative 5 Gravel Pad
- Mustang Road Upgrades

Potential New Mine Site
Proposed Mine Site (Existing)

Other Infrastructure
- Existing Gravel Road
- Existing Pipeline
- Existing Facilities
- Other Existing Mine Site
- Proposed Gravel Road
- Proposed Pipeline
- Proposed Facilities

Coordinate System: NAD 83 Alaska State Plane Zone 4 Feet

Nanushuk Project EIS
All Action Alternatives
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## Table ES 3-1. Summary of Key Elements by Alternative

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<tr>
<td><strong>Gravel Pads</strong></td>
<td></td>
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<tr>
<td>Drill pads (DS1, DS2 and DS3) (acres)</td>
<td>64.4</td>
<td>53.7</td>
<td>53.7</td>
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<td>CPF (acres)</td>
<td>NA*</td>
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<td>Operations center (acres)</td>
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<td>16.4</td>
<td>16.4</td>
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<td>Tie-in pad and lake pump house pad (acres)</td>
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<td><strong>All Pads Total (acres)</strong></td>
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<td>89.1</td>
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<td><strong>Access Road</strong></td>
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<td>New gravel road length (miles)</td>
<td>10.7</td>
<td>11.8</td>
<td>6.8*</td>
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<td>New gravel road footprint (acres)</td>
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<td>84.1</td>
<td>48.4*</td>
<td>67.9</td>
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<td>3</td>
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<td>Bridge piles beneath the OHW (no.)</td>
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<td>8</td>
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<td><strong>Total access road footprint (acres)</strong></td>
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<td>85.2</td>
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<td><strong>Infield Roads</strong></td>
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<td>Drill site roads length (miles)</td>
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<td>Drill site roads footprint (acres)</td>
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<td>120.0</td>
<td>84.2</td>
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<td>Lake MC7903 pump house road (miles)</td>
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<td>0.6</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Lake MC7903 pump house road (acres)</td>
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<td>Boat ramp access road (miles)</td>
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<td>Boat ramp access road (acres)</td>
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<td>10.9</td>
<td>10.3</td>
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<tr>
<td>Tundra access ramps (no.)</td>
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<tr>
<td><strong>Total infield road length (miles)</strong></td>
<td>12.9</td>
<td>13.1</td>
<td>18.3</td>
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<td><strong>Total infield road footprint (acres)</strong></td>
<td>96.6</td>
<td>97.3</td>
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<td><strong>Pipelines</strong></td>
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<td>Length (miles)</td>
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<td>24.3</td>
<td>20.2</td>
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<td>River crossings (no.)</td>
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<td>1</td>
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<tr>
<td>VSM beneath the OHW (no.)</td>
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<td>18</td>
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<td>6</td>
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<tr>
<td><strong>Total Multiphase Pipeline Length (miles)</strong></td>
<td>14.1</td>
<td>15.3</td>
<td>27.1</td>
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<td>Multiphase river crossings (no.)</td>
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<td>1</td>
<td>4</td>
<td>1</td>
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<tr>
<td>Lake L9211 freshwater pipeline (miles)</td>
<td>4.8</td>
<td>6.3</td>
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<td>6.0</td>
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<td>Lake MC7903 freshwater pipeline (miles)</td>
<td>5.1</td>
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<td>0.2</td>
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<tr>
<td>VSM beneath the OHW (no.)</td>
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<td>7</td>
<td>11</td>
<td>9</td>
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<td><strong>Other</strong></td>
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<td>Streams or concentrated drainage crossing culverts/batteries (no.)</td>
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<td>265</td>
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<td>Ice road length (miles)</td>
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<td>226 to 350</td>
<td>190 to 280</td>
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<td>Ice road area (acres)</td>
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<td>1,096 to 1,697</td>
<td>921 to 1,358</td>
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<tr>
<td>Ice Pad Ice pad area (acres)</td>
<td>102</td>
<td>134</td>
<td>116</td>
<td>100</td>
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## Executive Summary

### Nanushuk Project

Final Environmental Impact Statement

November 2018

### Project Element

<table>
<thead>
<tr>
<th>Water</th>
<th>Total water consumption (millions of gallons)</th>
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<tr>
<td>Original</td>
<td>1,457</td>
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**Schedule**

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<th>Construction timing (Project years)</th>
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<tr>
<td>Original</td>
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<table>
<thead>
<tr>
<th>Construction activity (total number of years)</th>
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<tr>
<td>Original</td>
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<table>
<thead>
<tr>
<th>Drilling activity (years)</th>
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<tr>
<td>Original</td>
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<table>
<thead>
<tr>
<th>Operations activity (years)</th>
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<td>Original</td>
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**Dock**

<table>
<thead>
<tr>
<th>Oliktok Dock screening area (acres)</th>
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<td>Original</td>
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**Gravel**

<table>
<thead>
<tr>
<th>Gravel hauling roundtrips (no.)</th>
</tr>
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<tbody>
<tr>
<td>Original</td>
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</table>

Total hydrocarbon pipeline length (miles)

| Original | 38.4 | 39.6 | 47.3 | 36.4 |

Total pipeline length (miles)

| Original | 48.3 | 49.0 | 66.3 | 42.6 |

Total pipeline VSMs beneath the OHW (no.)

| Original | 10 | 25 | 11 | 15 |

Total new road bridges (no.)

| Original | 2 | 4 | 2 | 2 |

Total bridge piles beneath the OHW (no.)

| Original | 20 | 40 | 20 | 20 |

Total gravel road area (acres)

| Original | 173.4 | 182.5 | 182.4^a | 164.4 |

Total gravel footprint (acres)

| Original | 256.1 | 271.6 | 271.6^a | 253.4 |

Total gravel fill volume (mcy)

| Original | 2.8 | 2.9 | 2.9 | 2.8 |

Total fill of Waters of the U.S. (acres)

| Original | 255.7 | 269.9 | 270.7^a | 253.1 |

---

* Combined with CPF

Note: Subtotals may not add because of rounding values. CPF (central processing facility); no. (number); OHW (ordinary High water); NA (not applicable); VSM (vertical support member); mcy (million cubic yards)

^a This value includes the 3.2 miles (22.8 acres) of permitted but not constructed Nuna Road.

^b Infield roads include drill site roads, the water source access road, the boat ramp and boat ramp access road, and tundra access ramps.

^c For the life of the Project, including all freshwater and seawater.

^d Includes all pads, access road, infield roads, and existing road upgrades.

^e Alternative 4 impacts would be reduced by 22.8 acres if Nuna Road is constructed by Caelus Natural Resources Alaska, LLC before construction of the Project.
4.0 ENVIRONMENTAL ANALYSIS

Chapter 3.0 (Environmental Analysis) of the EIS describes the affected environment for social, physical, and biological resources and the potential environmental consequences associated with the construction and operation of each of the alternatives. The analysis contained within this chapter includes an examination of cumulative effects, which are impacts of the Project that, when combined with impacts from past, present, and reasonably foreseeable future actions (not necessarily related to the Project), may become cumulatively significant. Additionally, the impacts of climate change were evaluated for each relevant social, physical, and biological resource.

The sections below summarize some of the general types of effects that would occur from construction and operation of the Project. A more comprehensive discussion of effects, including cumulative effects, is presented in Chapter 3.0 (Environmental Analysis) of the EIS. That chapter also includes detailed explanations of the findings for each resource, including the likelihood, magnitude, and duration of anticipated effects. The EIS contains a detailed list of Applicant-proposed mitigation in Chapter 6.0 (Avoidance, Minimization, and Mitigation) to avoid, reduce, or mitigate Project effects.

Table ES 5-1 in Chapter 5.0 (Comparison of Impacts by Alternative) of this Executive Summary provides a summary and comparison of potential environmental consequences for each action alternative. Table ES 5-1 focuses primarily on probable and/or moderate to major effects. For more information on all potential effects, please refer to the Final EIS.

ES 4.1 Climate Change

Climate change describes major changes in temperature, precipitation, or wind patterns that occur over several decades or longer. Indicators of a changing climate include rising sea surface temperature, sea level, temperature over land accompanied by decreases in snow cover, glaciers, ice sheets, and sea ice.

The projected increase in atmospheric temperature in the Project area could alter hydrology and make the permafrost more prone to thawing, which could affect buildings and infrastructure, such as pipelines, due to
subsidence of the ground surface. These changes could require Project facilities to be redesigned or strengthened to minimize the potential for facility damage from permafrost thaw or higher flood levels.

Climate change can also increase stress on other resources (e.g., wildlife and wetlands) and make them more vulnerable to the effects of the Project.

Key Findings:

▪ Greenhouse gas (GHG) emissions would be the Project’s main contribution to climate change; the majority of direct emissions would occur during drilling and operations and the majority of indirect emissions would come from the combustion of produced hydrocarbons.

▪ GHG emissions would be similar under all action alternatives. Minor variations in direct GHG emissions could occur during construction, but once operations have begun, emissions would be the same under all action alternatives.

ES 4.2 Geology and Mineral Resources

Geology and mineral resources in the Project area include lithified sediments, such as sandstone and limestone, underlying unconsolidated sediments and bedrock. The Project’s target oil reservoirs are the Nanushuk and Alpine C sandstones. The bedrock and surficial unconsolidated sediments may be fossil-bearing, similar to other areas on the North Slope. Deep groundwater present beneath the permafrost is highly saline and not considered a drinking water source. The Project area is considered a low to moderate seismic risk zone, and no active faults are known in the Project area.

Bedrock formations and deep groundwater would be affected by drilling and injection of production fluids and waste fluids. Unconsolidated sediments overlying the bedrock would be used as a gravel source for roads and pads. Oil would be extracted from subsurface reservoirs, processed, and transported to market. Excavating the subsurface for gravel or drilling for oil could affect paleontological resources.
Key Findings:

- Impacts to bedrock formations would result from drilling and hydraulic fracturing and would be limited to within the radius of the borehole and surrounding bedrock. The impacts would be probable, minor, and long term and would not constitute a loss of the resource.

- Extraction and export of petroleum resources would result in a probable, major, and long-term impact on petroleum resources. No mitigation measures would be considered for these impacts because extraction and export of the resource is the purpose of the Project.

- Extraction and placement of gravel fill would have probable, moderate, and medium- to long-term effects on gravel resources; the volume of gravel fill required would vary by alternative.

Key Differentiators among the Action Alternatives:

- All of the action alternatives would have similar effects on geology and mineral resources, and there are no key differentiators among the action alternatives.

ES 4.3 Geomorphology, Permafrost, and Soils

The ACP is a relatively smooth plain rising from the Beaufort Sea. The entire ACP is underlain by continuous permafrost to depths of 650 to 1,300 feet below the ground surface in most areas. Permafrost is essential to development of the geomorphic landforms in the area, and most permafrost is hundreds to tens of thousands of years old. It can be altered by both natural and human causes. The dominant landforms are thaw lakes, thaw lake depressions, pingos, beaded streams, meandering rivers, and delta deposits (which generally consist of sand and gravel). The Colville River Delta (CRD) covers approximately 250 square miles before depositing into the Beaufort Sea.

Expansion of gravel sites would remove permafrost and soils and change the geomorphology (land surface) within gravel mine areas. Permafrost
may thaw around wells adjacent to the gravel mine boundaries and possibly under or adjacent to roads and culverts. Constructed roads and pads would change drainage patterns and could result in water ponding, which could cause permafrost to thaw in these areas. Placing a sufficient depth of gravel on permafrost insulates the permafrost and prevents it from melting. Accumulation of snow drifts can insulate the ground from the cold temperatures during winter, which increases overall soil temperatures and allows permafrost to degrade.

Compaction of vegetation and soils under gravel roads and pads, or from travel across tundra, can also degrade permafrost. Geomorphology is affected when permafrost thaws and the surface slumps, thus creating depressions in the ground surface.

**Key Findings:**
- Placement of gravel fill for new roads and pads would result in probable, moderate to major, and medium- to long-term impacts within the gravel fill footprint by changing the mineralogical composition and texture and limiting native soil exposure to natural chemical and physical weathering processes.
- Construction and use of new gravel pads and roads would result in indirect effects due to dust deposition and snow accumulation, resulting in probable, minor to moderate, and medium- to long-term impacts on soil chemistry and permafrost temperatures (i.e., thawing) adjacent to the footprint of the gravel infrastructure.
- Properly constructed and maintained ice roads and pads built for a single season could cause probable, minor, and short-term impacts on micro-landforms within the ice road or ice pad footprint.

**Key Differentiators among the Action Alternatives:**
- All action alternatives would have similar effects. Although the total road lengths, alignments, and fill volumes differ by alternative, the variations are not substantial enough to create notable differences in effect magnitudes among the action alternatives.
- Alternatives 2 and 5 would have a higher probability of generating snowdrifts than other action alternatives due to the orientation of the access road (perpendicular to the prevailing wind directions). This could insulate the underlying soil during the winter months and increase overall soil temperatures, which
would promote thermokarsting and permafrost thaw adjacent to Project infrastructure.

- Alternative 3 would have the greatest area affected by fugitive dust because of its alignment and configuration, with the dust shadow impacting 2,100.6 acres. This would reduce albedo (light reflection) and contribute to increased ground temperatures and ground subsidence from the melting of ice-rich sediments.

**ES 4.4 Air Quality**

Air quality can be affected by natural and human-made air pollutants. Air quality effects depend on the amounts, proximity of the release, and dispersion of the pollutant by atmospheric factors such as air temperature, precipitation, and wind speed. Air quality on the North Slope is considered to be good and meets all applicable national and Alaska standards in the Project area and Nuiqsut.

The Clean Air Act established standards for air quality to protect public health and the human environment. All projects are required to meet these air quality standards.

The Project would result in emissions of criteria air pollutants, hazardous air pollutants (HAPs), and GHGs. Project activities would also generate fugitive dust from roads and pads. Volatile organic compound emissions could occur from evaporative losses from tanks, pumps, compressor seals, and valves.

**Key Findings:**

- The ambient air quality impact evaluation within the Project area and for Nuiqsut demonstrates that air quality would meet all applicable National and Alaska Ambient Air Quality Standards (NAAQS and AAAQS, respectively).

- The modeled maximum annual HAP concentrations would be well below concentrations expected to cause adverse health
effects, by at least one order of magnitude, in the Project area and in Nuiqsut.

- The modeled maximum annual HAP concentrations would be below concentrations at which long-term adverse health impacts are expected, by at least one order of magnitude, in the Project area and in Nuiqsut.

- The maximum total inhalation cancer risk for a maximum exposed individual would be less than 1 in 1 million in Nuiqsut; this is considered a very remote risk.

- Air quality impacts in the Project area would be probable, moderate, and medium term. Stationary-source emissions would exceed 40 tons per year for some criteria pollutants (nitrogen oxides, carbon monoxide, and sulfur dioxide); modeled pollutant concentrations would exceed 50% of the NAAQS and AAAQS for some pollutants (24-hour particulate matter below 10 and 2.5 microns, 1-hour sulfur dioxide).

- Air quality impacts in Nuiqsut for all action alternatives would be probable, minor, and medium term because no modeled criteria pollutant concentration would exceed 50% of NAAQS or AAAQS.

Key Differentiators among the Action Alternatives:
- All action alternatives would have similar effects on air quality.

### ES 4.5 Hydrology and Floodplains

The Project would be located in the Colville River basin, which drains an area of about 20,700 square miles, from its headwaters in the Brooks Range to the Beaufort Sea. The Colville River is the largest north-flowing river in the United States and drains approximately 30% of the North Slope of Alaska. A large portion of the Project area is in the Colville River floodplain, and the Project would span two medium-sized tributaries to the Colville River. Annual flooding on these rivers occurs during spring breakup due to peak discharge from snowmelt and peak stage from high discharge, snow- or ice-choked channels, and ice jam effects.
Potential impacts to hydrology and floodplains could be caused by several circumstances. These include lake water withdrawals; activities that would affect the existing flow of water in the Project area, including activities that affect stream channels, primary conveyance paths, and/or sheet flow; and activities that would occur in the floodplain. For all action alternatives, the greatest impacts would result from gravel pads, gravel roads, and river crossings due to potential changes to natural drainage patterns, alterations in water flow, and water withdrawals for ice infrastructure and dust suppression.

**Key Findings:**
Use of ice roads and pads during construction may result in flow obstructions and water flowing around obstructions, resulting in the following effects:

- Increased depth and duration of water impoundment would be probable, moderate, and short term.
- Changes in flow direction would be possible, moderate, and short term.

Effects related to gravel roads and pads, bridges, and pipelines would include the following:

- Increased impoundments of water from flow obstructions would be probable, moderate, and short term.
- Changes in flow direction from insufficient or misplaced culverts in gravel roads or pads would be possible, moderate, and short term.
- Changes in channel stability or alignment from water overtopping a gravel pad or road would be unlikely, minor to major, and short to long term.
- Changes in channel stability or alignment from a washed-out culvert or backwater from bridge crossings would be possible, moderate to major, and medium to long term.
- Erosion of tundra or streams from road and bridge infrastructure in floodplains would be unlikely to possible, minor to major, and short to long term.
- Deposition of sediment on the tundra from washed-out culverts would be possible, moderate to major, and medium to long term.
- Deposition resulting from excessive velocity through bridges would be possible, moderate to major, and medium to long term.
Changes in lake-water volume due to water withdrawals would be probable, moderate, and short to medium term.

Increased depth and duration of impoundment, increased thermokarsting, changes in flow direction, and changes in channel stability and alignment resulting from gravel mining and creation of a gravel mine site would be probable, moderate, and long term.

Key Differentiators among the Action Alternatives:

- **Alternative 2** would have the second-lowest number of miles of new gravel roads (23.6), the lowest total number of vertical support members (VSMs) and bridge piles placed below ordinary high water (OHW), and the second-lowest number of cross-drainage culverts (249).

- **Alternative 3** would have the largest total number of bridges at river crossings (4), the most bridge piles and VSMs placed in the 50- and 200-year floodplains, and the longest length of road in the 50- and 200-year floodplains (9.9 and 12.0 miles, respectively).

- **Alternative 4** would have the highest number of streams requiring culvert batteries (10)

- **Alternative 5** would have the fewest direct effects to waterbodies and floodplains because it has the shortest length of road in the 50- and 200-year floodplains (8.6 and 9.9 miles, respectively) and the fewest VSMs and bridge piles placed in the 50- and 200-year floodplains.

**ES 4.6 Water Quality**

Water quality in the Project area generally meets the standards established by the Alaska Department of Environmental Conservation. These standards are intended to protect fresh and marine surface waterbodies from degradation. Fresh waterbodies include wetlands, lakes, streams, and rivers. Water quality standards consist of designated uses for each waterbody as well as criteria for specific pollutants to ensure the water is suitable for the designated...
uses. Water withdrawals and discharges into waterbodies can affect water quality.

Water withdrawal in the winter would potentially alter lake-water chemistry temporarily (until spring breakup and recharge) by depleting oxygen and increasing turbidity. Construction of gravel facilities could also affect water quality through changes in drainage patterns and resulting increases in erosion and sediment levels in water flows.

**Key Findings:**
- The primary potential impacts to water quality would include fugitive dust from gravel roads and pads, which could settle in adjacent waters and result in probable, minor, long-term impacts from increased turbidity.
- Impacts from screeding at Oliktok Dock would be probable, minor, and short term from increased suspended solids and turbidity.
- Water quality effects (decreased dissolved oxygen, increased conductivity, and changes to pH values) in lakes from which winter water withdrawal would occur would be possible, minor, and short term.

**Key Differentiators among the Action Alternatives:**
- Alternative 3 would require the highest volume of water withdrawal over the life of the Project (966 million gallons [MG]), due to the need for 1 additional year of ice roads.
- Alternative 4 would require the highest number of stream pipeline crossings (4), which could increase settleable solids and turbidity, and would increase the potential impacts from a pipeline spill or release.
- Alternative 5 would require the lowest volume of water withdrawal over the life of the Project (866 MG).
ES 4.7 Wetlands and Vegetation

Wetlands comprise over 82% of the ACP. The ACP’s arctic tundra is characterized by features formed by microrelief (small-scale variation in height and roughness of ground surface) and an impermeable layer of permafrost that creates a mosaic of wetlands and waterbodies. The largest expanse of arctic fens and thaw lakes in the world are in the ACP. The lack of subsurface drainage in the ACP is ideal for sedge and grass-dominated wetlands and waterbodies.

Effects to wetlands and vegetation would include loss of wetlands and wetland function; change in wetland function due to a decrease in water quantity; degraded wetland quality due to lower free-water levels in soils; change in hydrology, vegetation, and soils from dust deposition and the compression of plants; lower albedo; increased vectors from invasive species; vegetation mortality; and thermokarsting.

The magnitude and extent of direct and indirect effects would not vary among alternatives. Wetlands that are indirectly affected would remain functional, but functions would be degraded. Across all alternatives, the largest source of direct effects would be from construction of gravel roads and pads.

Key Findings:
- Loss of wetlands would be probable, minor, and long term for all action alternatives.
- Direct effects to wetlands and waterbodies would range from 253.1 acres (Alternative 5) to 270.7 acres (Alternative 4).
- For the action alternatives, new road fill would account for more than half of wetland effects, ranging from 58% (Alternative 4) to 67% (Alternative 2).
- Indirect changes to wetland composition would be probable, minor, and long term (because of changes in soil composition, changes in vegetation patterns, changes in local hydrologic
systems, and increased mechanisms for invasive and non-native species introduction and dispersal).

- Direct loss of wetland function and wetland diversity would be probable, minor, and long term.

**Key Differentiators among the Action Alternatives:**
- Alternative 5 would directly fill the least acres of wetlands and waterbodies (253.1 acres).
- Alternative 4 would directly fill the most acres of wetlands and waterbodies (270.7 acres).
- Alternative 5 would have the least indirect effects from dust generated from gravel roads (1,854.8 acres).
- Alternative 4 would have the greatest indirect effects from dust generated from gravel roads (2,105.8 acres).

**ES 4.8 Birds**

As many as 80 avian species may use the adjacent CRD and the nearshore waters of the Beaufort Sea; approximately 50 species regularly occur or are common. Ground nesting shorebirds are by far the most abundant breeding birds, followed by passerines (songbirds), waterfowl, seabirds, ptarmigan, and raptors.

The Project area may be used by species listed as threatened under the Endangered Species Act (ESA) (spectacled and Steller’s eider), as sensitive species by the Bureau of Land Management (yellow-billed loon, golden eagle, short-eared owl, and red knot), or as birds of conservation concern by the U.S. Fish and Wildlife Service (red-throated loon, yellow-billed loon, peregrine falcon, whimbrel, bar-tailed godwit, red knot, dunlin, buff-breasted sandpiper, and arctic tern).

Most birds on the ACP are migratory and use the analysis area seasonally for nesting, brood-rearing, molting, and fall-staging. Most species arrive in May and June to breed. Some species begin to migrate to wintering or molting grounds as early as July, with fall migration concluding by freeze-up in September or October. A few species overwinter on the ACP.
Effects on birds would be either moderated or accentuated by the season in which Project activities would occur. Summer actions would affect breeding birds during the nesting, brood-rearing, molting, and fall-staging seasons, when the number of species and individuals are most numerous in the Project area and when potential adverse effects could have the greatest impacts to reproduction and population dynamics. Winter activities would affect fewer species and lower numbers of year-round residents. Impacts would include the loss and alteration of habitat from the direct effects of gravel fill placement and indirect effects of dust, thermokarsting, and impoundments. These could intensify with time as dust and gravel spray accumulates, vegetation is slowly affected, and thermokarsting deepens or spreads. Drilling and operational traffic and activity would pose long-term sources of disturbance that would likely cause some behavioral changes and displacement, which would have the largest impact during summer.

Key Findings:

- Loss of habitat from gravel placement for roads and pads would result in probable, minor, and long-term effects to birds and bird habitat.
- Habitat alternation due to fugitive dust, thermokarsting, and impoundments would cause probable, minor, and long-term effects to birds.
- Vehicle traffic through all phases of the Project would cause probable, moderate, and long-term displacement from preferred feeding, nesting, staging, or brood-rearing habitats in localized areas near the Project area, but alternate areas of similar quality would be available.
- Bird mortality could result from collisions with vehicles, towers, buildings, pipelines, or other facilities. While collisions would be possible and occur over the long term, they would be a minor to moderate source of bird mortality.
- Most effects would be minor to moderate and would not cause population level decreases in abundance, survival, or reproduction. Major effects are not expected.

Key Differentiators among the Action Alternatives:

- Alternative 2 would result in the second lowest amount of bird habitat loss but the largest area of high-value habitats lost or altered; the second largest area of disturbance and
displacement of birds; and the second largest area of disturbance to high-value habitats.

- Alternative 2 would also locate the CPF (and facility lighting) closest to the East Channel of the Colville River (0.9 mile), a bird movement corridor. The location is more than three times closer than the other alternatives.

- Alternative 3 would result in the highest amount of habitat loss but the smallest loss of high-value habitats. Alternative 3 would also locate the CPF (and facility lighting) the farthest from the East Channel of the Colville River (3.7 miles).

- Alternative 4 would be the only alternative that would require helicopter flights through the drilling and operations phases, which would cause additional disturbance and displacement of birds.

- Alternative 5 would have the least negative impacts to birds overall due to the smallest area of habitat loss, second-smallest area of habitat alteration, smallest area of high-value habitats lost or altered, and second lowest disturbance and displacement of birds.

**ES 4.9 Terrestrial Mammals**

At least 18 species of terrestrial mammals are likely to use the Project area. These range from large land mammals such as caribou and bear, to small land mammals such as ground squirrels and hares. None are listed as threatened or endangered under the ESA. These species use the Project area for a variety of purposes and life stages, including foraging and migration. Habitat types are dominated by wetlands. The habitats that are used by the greatest diversity of species are Moist Sedge-Shrub Meadow; Tall, Low, or Dwarf Shrub; and Moist Tussock Tundra.

The potential direct and indirect effects on terrestrial mammals from construction, drilling, and operation of the Project include habitat loss, alteration of habitats, behavioral disturbance or reduced use of habitats,
injury or mortality, and attraction of wildlife to Project facilities. For some species, indirect effects of disturbance may include long-term avoidance of areas experiencing consistent or continuous disturbance. Areas directly affected by extraction or placement of gravel would be eliminated permanently as foraging habitats for mammals unless restoration is completed successfully following Project closure.

**Key Findings:**

- Alteration of and direct loss of habitat from gravel placement and use of gravel roads would be probable, minor to moderate, and long term.

- All action alternatives could cause displacement of maternal caribou within 2.5 miles (4 kilometers) of gravel infrastructure and associated human activity (including low-traffic roads) for 2 to 3 weeks during and immediately after calving, but reduced survival or reproduction of the population would be unlikely because suitable alternative habitats are available for displaced animals.

- No aspects of the Project would cause appreciable population decreases in terrestrial mammal species; the demographic effects of direct mortality from vehicle strikes and indirect mortality from possible augmentation of predator populations would be probable, minor, and long term.

- The effects of the Project on caribou distribution and movements would be minor to moderate because Project planning and design would incorporate effective mitigative measures based on research from the existing oilfields.

**Key Differentiators among Action Alternatives:**

- Alternative 4 would have the largest amount of terrestrial mammal habitat loss.

- Alternative 4 infrastructure (access roads, infield roads, and pipelines) would be encountered more frequently than infrastructure associated with other alternatives as caribou move to and from insect-relief habitat along the coast. Overall, the effects of the Alternative 4 infrastructure on caribou movements during the insect season would be the greatest among the action alternatives.

- Alternative 5 would have the smallest amount of terrestrial mammal habitat loss.
Alternative 5 would be the most favorable layout among the action alternatives for caribou movements during the insect season because it would minimize the potential to disrupt and delay caribou movement between Mustang Road and the East Channel of the Colville River.

**ES 4.10 Marine Mammals**

At least 15 species of marine mammals have been recorded or could potentially occur in the nearshore or onshore coastal areas of the Beaufort Sea coast near the Project. Marine mammals that regularly occur in the area include polar bear, bowhead whale, bearded seal, spotted seal, ringed seal, and beluga whale. Under the Marine Mammal Protection Act, all marine mammals are federally protected. The bowhead whale, polar bear, and bearded seal are also protected under the ESA. In the Arctic, most marine mammals are strongly associated with specific types of sea ice and sea movements. Ice conditions and actions affecting ice strongly influence the distribution, movements, and abundance of marine mammals.

Marine mammals could experience direct behavioral effects and indirect habitat loss from disturbance caused by human activities and noise associated with construction activities, drilling, screeding operations, human activity, road and barge transportation (vehicle passage and noise), and pile driving for bridge construction. Potentially disturbing activities also include off-pad activities, spill response planning and drills, and gas flaring. During the single season of open-water barge transport, large vessels would have the potential to disturb or displace whales and seals by the temporarily disturbing water and by creating strong low-frequency underwater sounds.

**Key Findings:**

- Placement of gravel fill would result in probable, minor, and long-term loss or alteration of potential denning habitat of polar bears on the ACP.
- The habitats most likely to be affected would be polar bear denning habitat within 1 mile of roads and pads, and seal haulouts along the CRD distributary channels.

- Noise from construction, drilling, and operations could cause probable, minor, and long-term disturbance and displacement of spotted seals.

- Noise and equipment from barging and screeding at Oliktok Dock could cause probable, minor, and short-term disturbance and displacement of seals and whales.

**Key Differentiators among the Action Alternatives:**

- Alternative 4 would be the only alternative to place fill in designated critical habitat for polar bears; it is also the only alternative that would place new infrastructure within 1 mile of designated critical habitat.

- Alternative 2 would have the greatest loss or alteration of potential terrestrial denning habitat for polar bears mapped within 1 mile of Project infrastructure.

- Alternative 2 would have the closest location of the CPF and operations center to the Colville and Miluveach rivers than any other alternative, leading to the highest potential level of disturbance to spotted seals in those rivers and at nearby haulouts in the CRD.

- Alternative 4 would have the most helicopter use and associated noise of all the action alternatives.

**ES 4.11 Fish and Invertebrates**

There are at least 28 species of fish documented from freshwater, brackish, and nearshore marine habitats in the Project area. The Colville River is designated essential fish habitat (EFH) for Pacific salmon (pink and chum) in accordance with the Magnuson-Stevens Fishery Conservation and Management Act. The
nearshore marine area (the mouth of the Colville River north to Oliktok Point) is also designated EFH for Pacific salmon, Arctic cod, and snow crab.

Impacts to fish and EFH would include, but not be limited to, loss and alteration of winter and summer habitat, injury or mortality, and disturbance or displacement. These impacts could be the result of multiple Project actions, including water withdrawal for ice roads, dust control, and water supply; delayed melt of ice roads and pads; gravel road construction and use; construction of facilities; off-road vehicle travel; and barge transportation.

**Key Findings:**

- Placement of gravel roads, culverts, and pipeline VSMs would cause a direct loss of fish habitat limited to the stream crossings where the infrastructure is placed. Because of the large amount of suitable habitat available in the Project vicinity, effects to fish and fish habitat would be probable, minor, and long term, and limited to the area of direct habitat loss.

- Fugitive dust would increase turbidity within ponds, lakes, creeks, streams, and rivers directly adjacent to roads and construction areas. Effects to fish and fish habitat would be probable, minor, and long term.

- Stormwater runoff from gravel infrastructure may affect water quality by transporting sediment and residues or contaminants from drips and leaks. Effects would be possible, minor, and long term.

- The Project would meet Alaska Department of Fish and Game Title 16 standards (AS 16.05.841 and 16.05.871) and would not block fish passage.

- Noise generated by vehicles and machinery could have localized impacts on fish and aquatic organisms (e.g., stress-induced fleeing related to loud noises). Effects would be possible, minor, and long term, and occur in waterbodies crossing or immediately adjacent to Project infrastructure.

**Key Differentiators among the Action Alternatives:**

- Alternative 2 would use the fewest number of VSMs and bridge piles below the OHW and therefore would have the smallest aquatic habitat loss.

- Alternative 3 would have the greatest number of bridge crossings and the greatest number of bridge piles and VSMs below the OHW, resulting in the greatest loss of aquatic habitat.
Alternative 4 would have the highest number of stream-crossing culverts.

Alternative 5 would have the lowest number of stream miles and the lowest number of lakes or ponds affected by fugitive dust from Project infrastructure.

**ES 4.12 Visual and Aesthetic Resources**

Visual and aesthetic resources are places or elements of the landscape that contribute to the character and public appreciation of the environment. Much of the Project area is undeveloped. The landscape is generally flat and the low vegetation provides expansive views. Residents of the area and subsistence users may be sensitive to changes in the visual environment.

All action alternatives would affect visual and aesthetic resources. Buildings and roads developed for the Project would stand out against the existing landscape. One of the primary differences among alternatives is the proximity and potential visibility of facilities—particularly the CPF—from Nuiqsut and subsistence use areas.

**Key Findings:**
- The overall impacts to sensitive visual resources for each action alternative would be similar: probable, minor to moderate, and short to long term.

**Key Differentiators among the Action Alternatives:**
- Under Alternative 4, the CPF would be farthest from Nuiqsut and under Alternative 3, the CPF would be the closest to Nuiqsut.
- Under Alternative 3, the CPF would be the farthest from subsistence use areas along the Colville and Miluveach rivers, and contrast created by the built features and flaring at the CPF would be less visible to sensitive users.
- Under Alternative 5, the crossing of the Kachemach River would be in an area of less concentrated subsistence use and the...
contrast created by the built features would be less visible to sensitive users.

**ES 4.13 Noise**

Although the Project area is relatively quiet, existing ambient noise occurs from both natural and human-produced sounds. Because the ACP is coastal and mostly flat, wind can be a main source of sound. Other noise sources include blasting at the existing ASRC mine site and activity at existing oil and gas facilities.

The Project would generate noise in and around the area of the proposed activities. Noise would occur during all Project phases and vary both spatially and temporally, as the location and duration of noise-generating activities would change throughout the life of the Project. For all action alternatives, the effects of noise would be similar; however, the location of sound effects would vary by alternative due to differences in the location of roads and other facilities. The greatest magnitude noise impacts would result from gravel mining and gravel fill placement, although the duration of those effects would be short term.

**Key Findings:**

- The greatest noise impacts from construction would occur during blasting and pile driving. Pile driving noise would be probable, moderate, and short term for Nuiqsut and Helmericks Homestead. Noise effects on subsistence users would be possible, moderate, and short term in areas more than 5 miles from the pile driver. Effects would be possible, moderate to major, and short term in areas less than 5 miles from the pile driver.

- Construction transportation noise (ground and air) would result in probable, moderate, short-term effects on residents in Nuiqsut and Helmericks Homestead, as well as on subsistence users within several miles of roadways.

- Non-impact construction noise would result in probable, minor, short-term effects on residents. Impacts on subsistence users more
than 0.5 mile from the noise source would be possible, minor, and short term; impacts would be possible, moderate to major, and short term for users within 0.5 mile from construction activities.

- Drilling and operations would have probable, minor, long-term effects on residents in Nuiqsut and Helmericks Homestead. Effects on subsistence users more than 0.5 mile from drill sites or more than 1 mile from the CPF would be possible, minor, and medium to long term. Effects on subsistence users within 0.5 mile of the drill sites or within 1 mile of the CPF would be possible, moderate to major, and medium (drill sites) to long term (CPF).

- Ground transportation–related noise during operations would result in probable, minor to moderate, long-term effects on local residents. Effects on subsistence users within 10 miles of roads would be possible, minor to moderate, and long term.

**Key Differentiators among the Action Alternatives:**

- Potential noise effects on Nuiqsut could be somewhat higher under Alternative 3 because the access road and the CPF would be the closest to Nuiqsut of all the action alternatives.

- Potential noise effects on Nuiqsut could be somewhat lower under Alternative 4 because the access road and the CPF would be the farthest from Nuiqsut of all the action alternatives.

- There would be additional helicopter noise during operations under Alternative 4 because helicopters would be needed for routine pipeline surveillance of a segment of the export/import pipeline that would not parallel a roadway.

**ES 4.14 Land Ownership, Management, and Use**

The majority of the surface land in the analysis area is owned by the Kuukpik Corporation (21%) and the State of Alaska (79%). Both the federal government and the NSB own less than 1%. Other surface landowners include individual Native allottees and a few private landowners. The State also owns the majority (79%) of
the subsurface rights in the analysis area. The remaining subsurface rights are owned by ASRC directly or are jointly owned by the State of Alaska and ASRC.

The Project could produce a combination of potential effects, including changes in land management, changes in zoning classification, displacement, and/or adverse effects on existing land uses.

Key Findings:

- Land ownership and the overall pattern of land ownership in the analysis area would not change. Any operations on lands in the Project area would be conducted in accordance with State or ASRC (or both) oil and gas lease provisions; applicable federal, state, and local land regulations; and all governing settlement agreements.

- Lands developed for drill sites, support facilities, and infield roads within the Project area would need to be rezoned to Resource Development. Portions of the access road that are south of the Nuna project and north or west of the Mustang project would also need to be rezoned to Resource Development. Under NSB zoning code, this would allow for development of the Project under an NSB development permit.

- State land management would continue under State-approved leases and operations plans consistent with its constitutional and statutory land management obligations.

- Land use in the Project footprint would change from oil and gas exploration activities, wildlife habitat, research, and subsistence uses to oil and gas development and operations. Most lands in the analysis area would continue to be used for wildlife habitat, subsistence uses, research, and further oil and gas exploration.

Key Differentiator among the Action Alternatives:

- All action alternatives would have similar effects on land ownership, land management, and land use.

**ES 4.15 Cultural Resources**

Cultural resources are elements of the environment (physical, intangible, natural, and human-wrought) that have cultural value to a group of people. Cultural sites represent a broad range of land uses and include, but are not limited to, archaeological sites relating to prehistoric human activities (such as tool manufacturing and game processing sites), Native
American lifeways, and European and Euro-American use of the landscape (including shipwrecks, historic mining sites, historic trails, homesteads, and military sites). Remnants of past oil and gas development, including access roads and military structures, have themselves become cultural resources.

Physical remnants of the past found on the North Slope include sites, objects, buildings, and structures from prehistoric, historic, Iñupiaq, European, and Euro-American periods. There are 9 recorded cultural resources within or overlapping the analysis area. These include archaeological, aboveground, and traditional land use cultural resources, some of which have been determined eligible for the National Register of Historic Places.

Ground-disturbing activities (conducted primarily during the construction phase) pose the greatest threat of direct impacts to cultural resources. These activities run the risk of damaging or destroying subsurface cultural resources and destabilizing aboveground cultural resources. Ground-disturbing and support activities, including the transport and staging of materials, heavy equipment, and personnel, can directly affect cultural resources through inadvertent ground disturbance and vibration.

Indirect impacts could result from auditory, visual, and vibration activities that can alter the setting of cultural resources, cause long-term deterioration of cultural resources, alter use of traditional use areas, or increase access to cultural resources. Increased access to cultural resource sites could lead to looting, inadvertent trampling, or damage of cultural resources.

**Key Findings:**
- Ground-disturbing activities (primarily during the construction phase) would pose the greatest threat of direct adverse impacts to cultural resources.
- All Project phases would include auditory, visual, and vibration activities that could cause indirect adverse impacts to cultural resources.
▪ All action alternatives would unavoidably and directly impact a historic property.

Key Differentiator among the Action Alternatives:
▪ All action alternatives would affect the same number and type of cultural resources; therefore, there are no differentiators among the action alternatives.

ES 4.16 Subsistence and Traditional Use

Subsistence and traditional use are key cultural elements in the Project vicinity. Subsistence is central to North Slope and Inupiat cultural identity and is the foundation for residents’ relationship with the land and its resources. Subsistence and traditional use include use of the land for hunting and harvesting resources, as well as for interconnected activities such as preparing for a hunt, processing and distributing resources through the community, participating in feasts and festivals, and transferring knowledge to younger generations. Important subsistence resources include caribou, bowhead whale, broad whitefish, Arctic cisco, and eiders. Resources are of both material importance (contributing toward the total edible pounds of the harvest) and cultural importance (contributing to transmission of skills, cohesion in the community and region, and satisfaction derived from eating traditional foods).

While direct effects would be most likely to occur within or near the Project footprint, indirect effects could occur over a much larger area and could affect subsistence land use patterns outside the Project area. Potential impacts include, but would not be limited to, short-term or long-term decreases in resource availability, short-term or long-term decreases in access to subsistence use areas, avoidance of traditional use areas and subsequent impacts to culture, increased costs associated with seeking out new subsistence areas, increased competition for subsistence resources, and potential for contamination of subsistence resources.
Key Findings:

- The duration of construction effects for all species and all impact types would be medium term for all of the action alternatives; the duration of impacts from Project infrastructure and drilling and operations activities would be long term.

- Impacts to caribou subsistence use areas would be minor magnitude (i.e., less than 12% of average annual harvest) and probable. Impacts to caribou harvester access would be major magnitude (i.e., any one alternative could affect 88% of caribou harvesters) and probable for construction. During operations, impacts would be probable for user avoidance and possible for other harvester access impacts. Impacts to caribou resource availability would be major magnitude (i.e., affects resource of high material and cultural importance) and probable for construction and during operations would be possible (drilling/operations) to probable (Project infrastructure).

- Impacts to fish (primarily Arctic grayling) subsistence use areas would be probable, and no data exist to inform the magnitude of fish harvest amounts that could be directly affected. Impacts to fish harvester access would be minor magnitude (i.e., alternatives could affect between 3 and 6% of Arctic cisco, Arctic char, or burbot harvesters) and possible for construction. During operations, impacts would be possible (user avoidance) to unlikely (other harvester access impacts). Arctic grayling are one of the primary fish harvested in the subsistence project area, but no data exist to inform the magnitude of harvester access impacts for Arctic grayling. Impacts to fish resource availability would be major magnitude (i.e., affects resource of major material and cultural importance) but only possible (construction) and in operations would be unlikely (drilling/operations) to possible (Project infrastructure).

- Impacts to birds (primarily eider) subsistence use areas would be probable, and no data exist to inform the magnitude of eider and other bird harvest amounts that could be affected. Impacts to eider harvester access would be moderate magnitude (i.e., alternatives could affect between 25 and 29% of eider harvesters) and probable in construction. During operations, impacts would be probable for user avoidance and possible for other harvester access impacts. Impacts to eider resource availability would be moderate magnitude (i.e., affects resource
of moderate material and cultural importance) and probable for construction and during operations would be possible (drilling/operations) to probable (Project infrastructure).

- Effects to moose and marine mammal subsistence use areas, harvester access, and resource availability would be of minor to moderate magnitude but would be unlikely throughout the life of the Project.

Key Differentiators among the Action Alternatives:
- Alternative 4 would result in the greatest impacts to subsistence due to the following:
  - The larger area of potential user avoidance in areas of higher overlapping subsistence use along the length of the East Channel of the Colville River, particularly for caribou
  - The greater potential to obstruct or divert caribou
  - A slightly higher number of eider harvesters affected

- Alternative 5 would result in the least impacts to subsistence because the alternative would result in the following:
  - Move some of the road infrastructure out of the Colville River floodplain
  - Reduce roads paralleling the East Channel of the Colville River
  - Places the most infrastructure farther inland (thereby reducing user avoidance)
  - Be the most conducive to caribou movement, which could reduce impacts to resource availability for caribou hunters

ES 4.17 Socioeconomics

Nuiqsut is the community closest to the Project. The U.S. census indicates the community has 345 residents: 90% of the residents identify themselves as American Indian or Alaska Native. Government is the largest employer (63% of employment), followed by Kuukpik Corporation (the
Alaska Native Claim Settlement Act village corporation) and its subsidiaries (19% of employment), and the oil industry (8% of employment). Approximately two-thirds of Nuiqsut residents are shareholders in Kuukpik Corporation or ASRC (or both) and receive dividend income from these corporations. Subsistence activities are especially important in supporting social and economic well-being in the community. Most Nuiqsut residents rely on subsistence resources for food.

Factors with the potential to affect community characteristics and culture include changes in employment or income; changes in community demographics; changes in funds available to support cultural, civic, and educational programs; and impacts to subsistence resources and activities.

Statewide economic benefits would also accrue from construction and operation of the Project. The benefits would include increased employment and wages, as well as increased taxes and other oil and gas payments to state and local governments. The economic impacts from Project development would create new economic activity statewide and extend the operating and economic life of TAPS.

Key Findings:

- Socioeconomic effects would be the same for any of the action alternatives considered. Effects on socioeconomics could include both impacts and benefits.

- Beneficial effects would be possible to probable, minor to major, and short to medium term and include increased employment and income for Nuiqsut, the NSB, and the state overall.

- Impacts on community cohesion and social character would be possible, minor to moderate, and medium term in Nuiqsut and possible, minor, and medium term in the NSB and the state.

Key Differentiator among the Action Alternatives:

- All of the action alternatives would have similar effects on socioeconomic resources and there are no key differentiators among the action alternatives.
ES 4.18 Contaminated Sites

Oil and gas exploration, development, and production activities on the North Slope began in earnest in the 1970s. The production and use of petroleum and hazardous materials can generate hazardous wastes that have, in some cases, resulted in spills, leaks, and contaminated sites in the Project area.

The EIS describes the potential to encounter contaminated sites when constructing or operating the Project. State and federal databases were reviewed to identify known contaminated sites in the Project area.

Key Findings:
- The likelihood of encountering known contaminated sites near any of the action alternatives would be very low to low.

Key Differentiators among the Action Alternatives:
- All of the action alternatives would have similar effects on socioeconomic resources and there are no key differentiators among the action alternatives.

ES 4.19 Human Health and Safety

While other NSB communities have the potential to be affected by the Project, the community of Nuiqsut is located closest to the Project. Nuiqsut residents self-report being in very good to excellent health in the NSB 2015 Census but have expressed concerns over potential health impacts associated with oil and gas.
development near their community, both in regard to the Project and to other recently completed and proposed projects in the area. The concerns raised are primarily related to potential effects of air emissions (EIS Chapter 3.5, Air Quality) on human health and water and soil pollution on subsistence resources (EIS Chapter 3.17, Subsistence and Traditional Use), with indirect effects on human health and changes in subsistence food resource availability.

Project effects on human health and safety could include both beneficial and adverse impacts. Implementation of any of the action alternatives would have mixed effects on food security, nutrition, and subsistence.

Key Findings:

- Effects on human health and safety would include both adverse impacts and benefits.
- Beneficial effects on food security, nutrition, and mental health from increased family incomes and increased revenues to Kuukpik, ASRC, NSB, and the State of Alaska would be probable, minor to moderate, and medium to long term.
- Impacts on health from changes in diet (particularly to subsistence foods) and from increased stress levels from concerns about subsistence resource availability and access would be possible to probable, minor to moderate, and medium to long term.
- Overall, the effects on human health and safety would be possible to probable, minor to moderate, and long term.

Key Differentiator among the Action Alternatives:

- All of the action alternatives would have similar effects on human health and safety and there are no key differentiators among the action alternatives.
ES 4.20 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to take appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal decisions on the health or environment of minority and low-income populations. The residents of Nuiqsut are a minority population. Approximately 90% of the population is Alaska Native and because of Nuiqsut’s proximity to the Project, impacts would be disproportionately experienced by them.

According to NSB census data, both the NSB and Nuiqsut household incomes are below the U.S. Department of Housing and Urban Development’s low-income limits. Although these census data are not robust due to problems with household income data collection, the NSB states that these data are more reflective of local conditions than U.S. Census data. Therefore, NSB data were used to determine low-income populations for the Environmental Justice (EJ) analysis. Since NSB residents would not experience common conditions of environmental exposure or effect, they are not considered a low-income population for this EJ analysis. However, Nuiqsut residents would likely experience common conditions of environmental exposure and, using NSB census data, would be considered a low-income population for this EJ analysis.

Key Findings:
- The community of Nuiqsut meets the criteria for a minority and a low-income population for this EJ analysis.
- The community of Nuiqsut relies principally on subsistence.
- Nuiqsut residents have expressed concerns regarding the potential for effects on human health, the environment, and subsistence.
- Effects to subsistence caribou harvests may be disproportionately high and adverse on Nuiqsut residents because Nuiqsut is the only community that regularly harvests caribou from the affected...
area and a higher proportion of households depend on subsistence (for at least 50% of their diet) than most other NSB communities.

- USACE has consulted with Nuiqsut residents, the Native Village of Nuiqsut, and Kuukpik regarding alternatives and measures to reduce or mitigate the potentially high and adverse effects.

**Key Differentiator among the Action Alternatives:**

- Although individual Project components vary by alternative, the differences are not substantial enough to create a difference in the EJ findings, which are the same for all action alternatives.

**ES 4.21 Evaluation of Gravel Resources**

The Applicant proposes to obtain gravel from one or more existing commercial mine sites near the Project: NSB Mine Site F or the ASRC Mine Site. If these existing mine sites are unavailable or do not contain adequate resources, a potential new mine site, Mine Area D, could be developed for the Project. Although not a part of the Project as proposed by the Applicant, the potential effects associated with development of Mine Area D are summarized in the resource sections of the EIS.

**5.0 COMPARISON OF IMPACTS BY ALTERNATIVE**

Effects to resources (Chapter 3.0, Environmental Analysis) are summarized and compared by alternative in Table ES 5-1. This summary of effects focuses primarily on probable effects but also includes possible effects when the magnitude of effect is major or if the issue is of particular interest based on scoping comments.
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<tr>
<td>3.2 Climate Change*</td>
<td>Greenhouse gas emissions would be the Project’s main contribution to climate change; the majority of direct emissions would come from the combustion of produced hydrocarbons. Project components could be affected by changing climate; facilities would be designed to accommodate these changes.</td>
<td>No substantial difference among alternatives: ▪ Construction emissions estimated at 103,800 tons per year (maximum potential carbon dioxide equivalents) ▪ Drilling operations emissions estimated at 66,900 tons per year (maximum potential carbon dioxide equivalents) ▪ Operations emissions estimated at 543,000 tons per year (maximum potential carbon dioxide equivalents)</td>
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<tr>
<td>3.3 Geology and Mineral Resources</td>
<td>Consumption of gravel resources would result in probable, moderate, and long-term effects on gravel resource availability. Placement of gravel fill for roads and pads would result in probable, moderate to major, medium- to long-term impacts on soil quality and permafrost within the Project footprint. Dust deposition and snow accumulation adjacent to gravel fill areas would result in probable, minor to moderate, medium- to long-term indirect impacts on geomorphology, permafrost, and soils. Disturbance and alteration of bedrock formations from drilling and hydraulic fracturing would result in probable, minor, and long-term effects. Depletion of petroleum resources would result in probable, major, and long-term effects.</td>
<td>2.8 million cubic yards</td>
<td>2.9 million cubic yards</td>
<td>2.9 million cubic yards</td>
<td>2.8 million cubic yards</td>
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<tr>
<td>3.4 Geomorphology, Permafrost, and Soils</td>
<td>Single-season ice roads would have probable, minor, short-term impacts on permafrost temperatures increasing thermokarsting potential within the facility footprint. Placement of gravel fill for roads and pads would result in probable, moderate to major, and medium- to long-term impacts on soil quality and permafrost within the Project footprint. Indirect impacts to permafrost from dust deposition and snow accumulation from the construction and use of new gravel roads and pads would be probable, minor to moderate, medium to long term.</td>
<td>Ice Roads: 190 to 280 miles [921 to 1,358 acres] Ice Pads: 102 acres</td>
<td>Ice Roads: 226 to 350 miles [1,096 to 1,697 acres] Ice Pads: 134 acres</td>
<td>Ice Roads: 190 to 280 miles [921 to 1,358 acres] Ice Pads: 116 acres</td>
<td>Ice Roads: 190 to 280 miles [921 to 1,358 acres] Ice Pads: 100 acres</td>
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<td></td>
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<td>256.1-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
<td>253.4-acre gravel footprint</td>
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<td></td>
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<td>1,970.6 acres of dust shadow</td>
<td>2,100.6 acres of dust shadow</td>
<td>2,105.8 acres of dust shadow</td>
<td>1,854.8 acres of dust shadow</td>
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<td>256.1-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
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<td>271.6-acre gravel footprint</td>
<td>253.4-acre gravel footprint</td>
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<tr>
<td></td>
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<td>23.6 miles [173.4 acres] of gravel roads</td>
<td>24.9 miles [182.5 acres] of gravel roads</td>
<td>25.1 miles [182.6 acres] of gravel roads</td>
<td>21.9 miles [164.4 acres] of gravel roads</td>
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### 3.4 Geomorphology, Permafrost, and Soils

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<tr>
<td>Drilling, production, and waste injection would have probable, minor, and long-term impacts on permafrost adjacent to well casings</td>
<td>No substantial difference among alternatives</td>
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### 3.5 Air Quality

<table>
<thead>
<tr>
<th>Air quality impacts</th>
<th>Alternative 2: Applicant’s Original</th>
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<tbody>
<tr>
<td>[criteria air pollutants] in Nuiqsut</td>
<td>No substantial difference among alternatives</td>
</tr>
<tr>
<td>Air quality impacts (hazardous air pollutants) in the Project area and Nuiqsut</td>
<td>No substantial difference among alternatives</td>
</tr>
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</table>

| CPF location would have no quantifiable difference on emissions; emissions would meet all applicable National and Alaska Ambient Air Quality Standards | 14.4 miles from CPF to Nuiqsut | 10.9 miles from CPF to Nuiqsut | 15.6 miles from CPF to Nuiqsut | 12.1 miles from CPF to Nuiqsut |

### 3.6 Hydrology and Floodplains

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<tr>
<th>Impact</th>
<th>Alternative 2: Applicant’s Original</th>
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<tr>
<td>Increased depth and duration of water impoundments from ice roads and pads would be probable, moderate, and short term</td>
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<tr>
<td>Change in flow direction from the natural direction of flow due to ice roads and pads would be possible, moderate, and short term</td>
<td>Ice Roads: 190 to 280 miles (921 to 1,358 acres)</td>
</tr>
<tr>
<td>Erosion of tundra or stream banks from ice roads and pads would be unlikely to possible, moderate to major, and medium to long term</td>
<td>Ice Pads: 102 acres</td>
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<tr>
<td>Deposition of sediment on the tundra or in nearby rivers from ice roads and pads would be unlikely to possible, moderate to major, and medium to long term</td>
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<td>Thermokarsting due to gravel infrastructure would be unlikely to possible, minor to moderate, and long term</td>
<td>256.1-acre gravel footprint</td>
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### 3.6 Hydrology and Floodplains

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<tr>
<td>Increased depth and duration of water impoundments due to gravel roads and pads located in floodplains would be probable, moderate, and short term</td>
<td>▪ 9.0 miles of roads in the 50-year floodplain</td>
<td>▪ 9.9 miles of roads in the 50-year floodplain</td>
<td>▪ 9.2 miles of roads in the 50-year floodplain</td>
<td>▪ 8.6 miles of roads in the 50-year floodplain</td>
<td></td>
</tr>
<tr>
<td>Change in water quantity in water withdrawal lakes would be probable, moderate, and short to medium term</td>
<td>▪ 10.8 miles of roads in the 200-year floodplain</td>
<td>▪ 12.0 miles of roads in the 200-year floodplain</td>
<td>▪ 11.0 miles of roads in the 200-year floodplain</td>
<td>▪ 9.9 miles of roads in the 200-year floodplain</td>
<td></td>
</tr>
<tr>
<td>No differences in pad acreage located in floodplains among alternatives</td>
<td>▪ No differences in pad acreage located in floodplains among alternatives</td>
<td>▪ No differences in pad acreage located in floodplains among alternatives</td>
<td>▪ No differences in pad acreage located in floodplains among alternatives</td>
<td>▪ No differences in pad acreage located in floodplains among alternatives</td>
<td></td>
</tr>
<tr>
<td>Change in flow direction from the natural direction of flow due to gravel roads and pads would be possible, moderate, and short term</td>
<td>▪ 23.6 miles of new gravel roads</td>
<td>▪ 24.9 miles of new gravel roads</td>
<td>▪ 25.1 miles of new gravel roads</td>
<td>▪ 21.9 miles of new gravel roads</td>
<td></td>
</tr>
<tr>
<td>▪ 9.0 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.9 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.2 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 8.6 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 5 culverts at streams and primary conveyances, including a fish-bearing tributary to Miluveach River</td>
<td></td>
</tr>
<tr>
<td>▪ 5 culverts at streams and primary conveyances, including a fish-bearing tributary to Miluveach River</td>
<td>▪ 4 culverts at streams and primary conveyances</td>
<td>▪ 1 bridge over Miluveach River</td>
<td>▪ 1 bridge over the Miluveach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
<td></td>
</tr>
<tr>
<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Change in channel stability or alignment (e.g., overtopping of gravel pad or road) from road infrastructure would be unlikely, minor to major, and short to long term</td>
<td>▪ 23.6 miles of new gravel roads</td>
<td>▪ 24.9 miles of new gravel roads</td>
<td>▪ 25.1 miles of new gravel roads</td>
<td>▪ 21.9 miles of new gravel roads</td>
<td></td>
</tr>
<tr>
<td>▪ 9.0 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.9 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.2 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 8.6 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 5 culverts at streams and primary conveyances, including a fish-bearing tributary to Miluveach River</td>
<td></td>
</tr>
<tr>
<td>▪ 5 culverts at streams and primary conveyances (including a fish-bearing tributary to Miluveach River)</td>
<td>▪ 4 culverts at streams and primary conveyances (including a fish-bearing tributary to Miluveach River)</td>
<td>▪ 1 bridge over Miluveach River</td>
<td>▪ 1 bridge over the Miluveach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
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<tr>
<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
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</tr>
<tr>
<td>Change in channel stability or alignment (e.g., washed-out culvert, backwater from bridge) from road and bridge infrastructure would be possible, moderate to major, and medium to long term</td>
<td>▪ 20 bridge piles beneath OHW</td>
<td>▪ 25 VSMs beneath OHW</td>
<td>▪ 20 bridge piles beneath OHW</td>
<td>▪ 15 VSMs beneath OHW</td>
<td></td>
</tr>
<tr>
<td>▪ 10 VSMs beneath OHW</td>
<td>▪ 25 VSMs beneath OHW</td>
<td>▪ 20 bridge piles beneath OHW</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>▪ 11 VSMs beneath OHW</td>
<td></td>
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</tr>
<tr>
<td>Change in channel stability or alignment (e.g., washed-out culvert, backwater from bridge) from road and bridge infrastructure would be unlikely to possible, minor to major, and short to long term</td>
<td>▪ 23.6 miles of new gravel roads</td>
<td>▪ 24.9 miles of new gravel roads</td>
<td>▪ 25.1 miles of new gravel roads</td>
<td>▪ 21.9 miles of new gravel roads</td>
<td></td>
</tr>
<tr>
<td>▪ 9.0 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.9 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 9.2 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 8.6 miles of new gravel road in the 50-year floodplain</td>
<td>▪ 5 culverts at streams and primary conveyances, including a fish-bearing tributary to Miluveach River</td>
<td></td>
</tr>
<tr>
<td>▪ 5 culverts at streams and primary conveyances (including a fish-bearing tributary to Miluveach River)</td>
<td>▪ 4 culverts at streams and primary conveyances (including a fish-bearing tributary to Miluveach River)</td>
<td>▪ 1 bridge over Miluveach River</td>
<td>▪ 1 bridge over the Miluveach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
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<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
<td>▪ 1 bridge over the Kachemach River</td>
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<tr>
<td>Deposition of sediment on the tundra or in nearby rivers from gravel infrastructure and bridges would be unlikely to possible, minor to major, and short to long term</td>
<td>▪ 891 million gallons</td>
<td>▪ 966 million gallons</td>
<td>▪ 885 million gallons</td>
<td>▪ 866 million gallons</td>
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</tbody>
</table>

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**Executive Summary**
November 2018
### 3.7 Water Quality

- **Increased turbidity due to dust deposition from gravel infrastructure would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - 256.1-acre gravel footprint
    - 1,970.6 acres of dust shadow
  - Alternative 3: Southern Access
    - 271.6-acre gravel footprint
    - 2,100.6 acres of dust shadow
  - Alternative 4: Northern Access
    - 271.6-acre gravel footprint
    - 2,105.8 acres of dust shadow
  - Alternative 5: Applicant’s Preferred
    - 253.4-acre gravel footprint
    - 1,854.8 acres of dust shadow

- **Increased settleable solids and turbidity from screeding of marine sediment at Oliktok Dock would be probable, minor, and short term**
  - No difference among alternatives

### 3.8 Wetlands and Vegetation

- **Loss of wetlands and vegetation from gravel fill for roads and pads would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - 255.7 acres of direct wetland loss
  - Alternative 3: Southern Access
    - 269.9 acres of direct wetland loss
  - Alternative 4: Northern Access
    - 270.7 acres of direct wetland loss
  - Alternative 5: Applicant’s Preferred
    - 253.1 acres of direct wetland loss

- **Loss of wetland function and diversity due to gravel fill would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - 1,970.6 acres of wetlands within dust shadow
  - Alternative 3: Southern Access
    - 2,100.6 acres of wetlands within dust shadow
  - Alternative 4: Northern Access
    - 2,105.8 acres of wetlands within dust shadow
  - Alternative 5: Applicant’s Preferred
    - 1,854.8 acres of wetlands within dust shadow

- **Change in soil and wetland composition from gravel fill would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 102 acres
  - Alternative 3: Southern Access
    - Ice Roads: 226 to 350 miles (1,096 to 1,697 acres)
    - Ice Pads: 134 acres
  - Alternative 4: Northern Access
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 116 acres
  - Alternative 5: Applicant’s Preferred
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 100 acres

- **Degraded wetland functions in the dust shadow of new gravel fill would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - 1,970.6 acres of wetlands within dust shadow
  - Alternative 3: Southern Access
    - 2,100.6 acres of wetlands within dust shadow
  - Alternative 4: Northern Access
    - 2,105.8 acres of wetlands within dust shadow
  - Alternative 5: Applicant’s Preferred
    - 1,854.8 acres of wetlands within dust shadow

- **Vegetation damage and soil compaction from ice infrastructure would be probable, minor, and short to medium term**
  - Alternative 2: Applicant’s Original
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 102 acres
  - Alternative 3: Southern Access
    - Ice Roads: 226 to 350 miles (1,096 to 1,697 acres)
    - Ice Pads: 134 acres
  - Alternative 4: Northern Access
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 116 acres
  - Alternative 5: Applicant’s Preferred
    - Ice Roads: 190 to 280 miles (921 to 1,358 acres)
    - Ice Pads: 100 acres

### 3.9 Birds

- **Habitat loss from gravel infrastructure would be probable, minor, and long term**
  - Alternative 2: Applicant’s Original
    - 256.1 acres
  - Alternative 3: Southern Access
    - 271.6 acres
  - Alternative 4: Northern Access
    - 271.6 acres
  - Alternative 5: Applicant’s Preferred
    - 253.4 acres

- **Habitat alteration from dust deposition, thermokarsting and water impoundment, as well as screeding would be probable, minor, and short term (screeding) to long term (other effects)**
  - Alternative 2: Applicant’s Original
    - 1,970.6 acres of dust shadow
    - 5.7 acres of screeding
  - Alternative 3: Southern Access
    - 2,100.6 acres of dust shadow
    - 5.7 acres of screeding
  - Alternative 4: Northern Access
    - 2,105.8 acres of dust shadow
    - 5.7 acres of screeding
  - Alternative 5: Applicant’s Preferred
    - 1,854.8 acres of dust shadow
    - 5.7 acres of screeding

- **Disturbance and displacement due to summer construction activities would be probable, moderate, and short term**
  - Alternative 2: Applicant’s Original
    - 7,825.6 acres behavioral disturbance
  - Alternative 3: Southern Access
    - 7,832.5 acres behavioral disturbance
  - Alternative 4: Northern Access
    - 8,029.7 acres behavioral disturbance
  - Alternative 5: Applicant’s Preferred
    - 7,496.4 acres behavioral disturbance

- **Disturbance and displacement due to vehicles and machinery year-round during drilling and operations would be probable, moderate, and long term**
  - Alternative 2: Applicant’s Original
    - 7,825.6 acres behavioral disturbance
  - Alternative 3: Southern Access
    - 7,832.5 acres behavioral disturbance
  - Alternative 4: Northern Access
    - 8,029.7 acres behavioral disturbance
  - Alternative 5: Applicant’s Preferred
    - 7,496.4 acres behavioral disturbance
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<tbody>
<tr>
<td><strong>3.9 Birds</strong></td>
<td>Disturbance and displacement due to helicopter traffic would be probable, minor to moderate, and short term (long term for Alternative 4)</td>
<td>No planned helicopter trips during operations</td>
<td>No planned helicopter trips during operations</td>
<td>Planned helicopter use for routine pipeline monitoring</td>
<td>No planned helicopter trips during operations</td>
</tr>
<tr>
<td></td>
<td>Attraction of predators to human facilities that could increase predation on birds near those facilities would be probable, minor to moderate, and long term</td>
<td></td>
<td></td>
<td></td>
<td>No substantial difference among alternatives</td>
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<tr>
<td></td>
<td>Attraction of nonpredatory birds to human facilities (negative and positive effects) would be probable, minor, and long term</td>
<td></td>
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</tr>
<tr>
<td><strong>3.10 Terrestrial Mammals</strong></td>
<td>Habitat loss from gravel fill would be probable, minor, and long term</td>
<td>▪ Direct loss: 237.4 acres</td>
<td>▪ Direct loss: 247.1 acres</td>
<td>▪ Direct loss: 253.3 acres</td>
<td>▪ Direct loss: 234.5 acres</td>
</tr>
<tr>
<td></td>
<td>Habitat alteration from fugitive dust, thermokarsting, and water impoundment would be probable, minor, and long term</td>
<td>▪ Habitat alteration: 1,791.6 acres</td>
<td>▪ Habitat alteration: 1,874.8 acres</td>
<td>▪ Habitat alteration: 1,895.3 acres</td>
<td>▪ Habitat alteration: 1,688.4 acres</td>
</tr>
<tr>
<td></td>
<td>Habitat alteration from ice roads and pads would be probable, minor, and short term</td>
<td>▪ Ice Roads: 190 to 280 miles (921 to 1,358 acres)</td>
<td>▪ Ice Roads: 226 to 350 miles (1,096 to 1,697 acres)</td>
<td>▪ Ice Roads: 190 to 280 miles (921 to 1,358 acres)</td>
<td>▪ Ice Roads: 190 to 280 miles (921 to 1,358 acres)</td>
</tr>
<tr>
<td></td>
<td>Disturbance and displacement of maternal caribou due to Project activities and noise would be probable, minor to moderate, and long term</td>
<td>76.6 square miles</td>
<td>90.8 square miles</td>
<td>86.9 square miles</td>
<td>76.7 square miles</td>
</tr>
<tr>
<td></td>
<td>Disturbance and displacement of caribou due to Project infrastructure and traffic would be probable, minor to moderate, and long term</td>
<td>Road alignment could cause delays or deflections in caribou movement</td>
<td>The access road area is usually traversed by caribou early in the post-calving period and does not receive as much use as areas farther north during the insect season</td>
<td>The greatest effects on caribou movements would occur during the insect season because the roads would be closest to the Colville River and coastal insect-relief habitat</td>
<td>The most favorable road layout for caribou movements would occur during the insect season because it would minimize the potential to disrupt and delay caribou movement between Mustang Road and the proposed access road</td>
</tr>
<tr>
<td></td>
<td>Disturbance and displacement of muskoxen, bears, fur bearers, and small mammals from Project infrastructure and activities would be probable, minor, and long term</td>
<td></td>
<td></td>
<td></td>
<td>No substantial difference among alternatives</td>
</tr>
</tbody>
</table>
## Terrestrial Mammals

### 3.10 Small mammal injury or mortality from ice road or gravel compaction

- Ice roads: 190 to 280 miles (921 to 1,358 acres)
- Ice pads: 102 acres
- Gravel infrastructure: 256.1 acres

**Ice Roads:** 190 to 280 miles (921 to 1,358 acres)
**Ice Pads:** 102 acres
**Gravel infrastructure:** 256.1 acres

### 3.11 Loss of polar bear terrestrial denning habitat due to gravel fill

- 49.5 acres of potential terrestrial denning habitat within 1 mile of gravel infrastructure
- 0.1 acre of potential terrestrial denning habitat within Project footprint
- No acres of designated critical habitat within the project footprint or within 1 mile of gravel infrastructure

**Ice roads:** 190 to 280 miles (921 to 1,358 acres)
**Ice pads:** 102 acres

### Attraction of terrestrial mammals to human activity and facilities

- No substantial difference among alternatives

## Marine Mammals

### 3.11 Alteration of polar bear denning habitat due to ice infrastructure

- Ice roads: 190 to 280 miles (921 to 1,358 acres)
- Ice pads: 102 acres

**Ice roads:** 190 to 280 miles (921 to 1,358 acres)
**Ice pads:** 102 acres

### Disturbance or displacement of whales and seals from barging

- No substantial difference among alternatives

### Disturbance or displacement of seals from screeding at Oliktok Dock

- Differences among alternatives vary by haulout site; see chapter for details

### Disturbance or displacement of spotted seals at haulouts due to noise and human activity (all Project phases)

- Differences among alternatives vary by haulout site; see chapter for details
|-------------|--------|-----------------------------------|-------------------------------|-------------------------------|-----------------------------------|
| 3.12 Fish and Invertebrates | Habitat loss from placement of fill or infrastructure in waterbodies would be probable, minor, and long term | - 10 VSMs below OHW  
- 20 bridge pilings below OHW  
- 318 square feet of river habitat lost  
- 5 creek-crossing culverts  
- Habitats lost in two lakes and in Miluveach and Kachemach rivers | - 25 VSMs below OHW  
- 40 bridge pilings below OHW  
- 699 square feet of river habitat lost  
- 4 creek-crossing culverts  
- Habitats lost in two lakes and in Miluveach and Kachemach rivers | - 11 VSMs below OHW  
- 20 bridge pilings below OHW  
- 331 square feet of river habitat lost  
- 10 creek-crossing culverts  
- Habitats lost in two lakes and in Miluveach and Kachemach rivers, and Kalubik Creek | - 15 VSMs below OHW  
- 20 bridge pilings below OHW  
- 381 square feet of river habitat lost  
- 5 creek-crossing culverts  
- Habitats lost in three lakes and in Miluveach and Kachemach rivers |
| | Habitat alteration from dust deposition and gravel spray in waterbodies due to gravel infrastructure would be probable, minor, and long term | 0.7 stream mile in dust shadow | 0.7 stream mile in dust shadow | 0.7 stream mile in dust shadow | 0.4 stream mile in dust shadow |
| | Habitat alteration, as well as disturbance or displacement, due to screening at Oliktok Dock would be probable, minor, and short term | No substantial difference among alternatives | | | |
### 3.13 Visual and Aesthetic Resources

Contrast or changes to the visual environment due to gravel roads and pads and pipelines would be probable, minor to moderate, and long term.

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<tbody>
<tr>
<td>1 bridge over the Miluveach River</td>
<td>1 bridge over the Miluveach River</td>
<td>1 bridge over the Miluveach River</td>
<td>1 bridge over the Miluveach River</td>
<td>1 bridge over the Miluveach River</td>
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<tr>
<td>1 bridge over the Kachemach River</td>
<td>3 bridges over the Kachemach River</td>
<td>1 bridge over the Kachemach River</td>
<td>1 bridge over the Kachemach River</td>
<td>1 bridge over the Kachemach River</td>
</tr>
<tr>
<td>256.1-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
<td>271.6-acre gravel footprint</td>
<td>253.4-acre gravel footprint</td>
<td>253.4-acre gravel footprint</td>
</tr>
<tr>
<td>23.6 miles of new gravel road</td>
<td>24.9 miles of new gravel road</td>
<td>25.1 miles of new gravel road</td>
<td>21.9 miles of new gravel road</td>
<td>21.9 miles of new gravel road</td>
</tr>
<tr>
<td>48.3 miles of pipeline²</td>
<td>49.0 miles of pipeline²</td>
<td>66.3 miles of pipeline²</td>
<td>42.6 miles of pipeline²</td>
<td>42.6 miles of pipeline²</td>
</tr>
</tbody>
</table>

### 3.14 Noise

Noise from construction activities (equipment, vehicles, air traffic, pile driving, etc.) would be probable, minor to moderate, and short term for residents of Nuiqsut and Helmericks Homestead (also known as Colville Village). Effects would be possible, minor to major, and short term for subsistence users, depending on the distance to the noise source.

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<tbody>
<tr>
<td>71,300 gravel hauling vehicle trips</td>
<td>74,300 gravel hauling vehicle trips</td>
<td>74,500 gravel hauling vehicle trips</td>
<td>71,700 gravel hauling vehicle trips</td>
<td>71,700 gravel hauling vehicle trips</td>
</tr>
<tr>
<td>13.7 miles from Nuiqsut to access road at closest point</td>
<td>10.2 miles from Nuiqsut to access road at closest point</td>
<td>15.7 miles from Nuiqsut to access road at closest point</td>
<td>11.5 miles from Nuiqsut to access road at closest point</td>
<td>11.5 miles from Nuiqsut to access road at closest point</td>
</tr>
<tr>
<td>5.2 miles from Helmericks Homestead to access road at closest point</td>
<td>9.7 miles from Helmericks Homestead to access road at closest point</td>
<td>3.7 miles from Helmericks Homestead to access road at closest point</td>
<td>8.5 miles from Helmericks Homestead to access road at closest point</td>
<td>8.5 miles from Helmericks Homestead to access road at closest point</td>
</tr>
<tr>
<td>112 helicopter trips</td>
<td>112 helicopter trips</td>
<td>112 helicopter trips</td>
<td>112 helicopter trips</td>
<td>112 helicopter trips</td>
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</table>

Noise from drilling and operations activities (drilling, CPF, vehicles, air traffic, etc.) would be probable, minor to moderate, and long term for residents of Nuiqsut and Helmericks Homestead. Effects would be possible, minor to major, and short to long term for subsistence users, depending on the noise source.

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<tr>
<td>14.4 miles from Nuiqsut to CPF</td>
<td>10.9 miles from Nuiqsut to CPF</td>
<td>15.6 miles from Nuiqsut to CPF</td>
<td>12.1 miles from Nuiqsut to CPF</td>
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<tr>
<td>5.2 miles from Helmericks Homestead to CPF</td>
<td>9.6 miles from Helmericks Homestead to CPF</td>
<td>5.9 miles from Helmericks Homestead to CPF</td>
<td>8.3 miles from Helmericks Homestead to CPF</td>
<td></td>
</tr>
<tr>
<td>No planned helicopter trips during drilling and operations phase</td>
<td>No planned helicopter trips during drilling and operations phase</td>
<td>Routine helicopter use for pipeline monitoring during operations phase</td>
<td>No planned helicopter trips during drilling and operations phase</td>
<td>No planned helicopter trips during drilling and operations phase</td>
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### 3.15 Land Ownership, Management, and Use

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<tbody>
<tr>
<td>No change would occur in land ownership or status</td>
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<tr>
<td>Changes to land use on state lands would be probable, minor, and long term</td>
<td>No substantial difference among alternatives</td>
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<tr>
<td>Changes to land use on Kuukpik lands would be probable, moderate to major, and long term</td>
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<tr>
<td>Changes to land management on state, Kuukpik, and NSB lands would be probable, minor to moderate, and long term</td>
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### 3.16 Cultural Resources

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<tbody>
<tr>
<td>Construction activities would have possible to unavoidable, moderate to major, medium-to-long-term effects on cultural resources</td>
<td>▪ 256.1-acre gravel footprint &lt;br&gt; ▪ 48.3 miles of pipeline</td>
<td>▪ 271.6-acre gravel footprint &lt;br&gt; ▪ 49.0 miles of pipeline</td>
<td>▪ 271.6-acre gravel footprint &lt;br&gt; ▪ 66.3 miles of pipeline</td>
<td>▪ 253.4-acre gravel footprint &lt;br&gt; ▪ 42.6 miles of pipeline</td>
</tr>
<tr>
<td>Transportation infrastructure would have possible to probable, minor to moderate, medium-to-long-term effects on cultural resources</td>
<td>▪ Ice roads: 190 to 280 miles &lt;br&gt; (921 to 1,358 acres) &lt;br&gt; ▪ New gravel roads: 23.6 miles</td>
<td>▪ Ice Roads: 226 to 350 miles &lt;br&gt; (1,096 to 1,697 acres) &lt;br&gt; ▪ New gravel roads: 24.9 miles</td>
<td>▪ Ice Roads: 190 to 280 miles &lt;br&gt; (921 to 1,358 acres) &lt;br&gt; ▪ New gravel roads: 25.1 miles</td>
<td>▪ Ice Roads: 190 to 280 miles &lt;br&gt; (921 to 1,358 acres) &lt;br&gt; ▪ New gravel roads: 21.9 miles</td>
</tr>
</tbody>
</table>

| Drilling and operations activities would have unlikely to unavoidable, moderate to major, medium-to-long-term effects on cultural resources | No substantial difference among alternatives |                                                                                                   |                                                                                                   |                                                                                                   |

### 3.17 Subsistence and Traditional Use

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Impacts to caribou subsistence use areas, harvester access, and resource availability from construction activities would be probable, minor (use areas) to major (access and availability), and medium term</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): No &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: Yes</td>
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</tr>
<tr>
<td>Impacts to furbearer and small land mammal subsistence use areas, harvester access, and resource availability from construction activities would be unlikely (access) to possible (use areas) and availability, moderate, and medium term</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): No &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: Yes</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
</tr>
<tr>
<td>Impacts to fish subsistence use areas, harvester access, and resource availability from construction activities would be possible (access and availability) to probable (use areas), minor (access) to major (availability), and medium term</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): No &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
<td>▪ Access Roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: Yes</td>
<td>▪ Access Roads parallel East Channel (more impact): No &lt;br&gt; ▪ Infield roads parallel East Channel (more impact): Yes &lt;br&gt; ▪ Miluweach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Kachemach River crossing farther downstream (more impact): Yes &lt;br&gt; ▪ Gravel infrastructure between Miluweach River and Lake MC7903 (more impact): Yes &lt;br&gt; ▪ Disturbance from routine use of helicopters during operations: No</td>
</tr>
</tbody>
</table>
---|---|---|---|---|---
#### 3.17 Subsistence and Traditional Use
Impacts to bird subsistence use areas, harvester access, and resource availability from construction activities would be probable, moderate, and medium term
- CPF to East Channel: 0.9 miles
- CPF to Miluveach River: 0.4 miles
- CPF to Kachemach River: 3.1 miles

Impacts to caribou subsistence use areas, harvester access, and resource availability from drilling and operations would be possible to probable, minor (use areas) to major (access and availability), and long term
- CPF to East Channel: 3.7 miles
- CPF to Miluveach River: 3.2 miles
- CPF to Kachemach River: 1.5 miles

Impacts to furbearer and small land mammal subsistence use areas, harvester access, and resource availability from drilling and operations would be unlikely (access and availability) to possible (use areas), moderate, and long term
- CPF to East Channel: 3.6 miles
- CPF to Miluveach River: 0.7 miles
- CPF to Kachemach River: 5.5 miles

Impacts to caribou subsistence use areas, harvester access, and resource availability from drilling and operations would be unlikely to probable, minor (access) to major (availability), and long term
- CPF to East Channel: 3.0 miles
- CPF to Miluveach River: 2.1 miles
- CPF to Kachemach River: 2.6 miles

#### 3.18 Socioeconomics
Direct and indirect benefits from employment would be possible (Nuiqsut, NSB) to probable (Alaska), minor to moderate (Nuiqsut, NSB) or moderate to major (Alaska), and medium term

Direct and indirect benefits from income would be probable, moderate (Nuiqsut) or moderate to major (NSB, Alaska), and medium term

Beneficial increases in revenues would be probable, moderate (ANCSA) or moderate to major (NSB, Alaska), and medium term

No substantial difference among alternatives

#### 3.19 Contaminated Sites
Likelihood of encountering existing contamination near Project facilities or activities would be very low to low

No substantial difference among alternatives
### EIS Section

#### 3.20 Human Health and Safety

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<tbody>
<tr>
<td>Changes to subsistence diet, as well as indirect effects on mental health from increased stress from concerns about subsistence resource availability and access, would be possible to probable, minor to moderate, and medium term (construction) to long term (operations)</td>
<td></td>
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<tr>
<td>Indirect effects on mental health from increased stress from concerns about spill potential and about potential contamination of subsistence resources would be probable, minor to moderate, and medium term (construction) to long term (operations)</td>
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<tr>
<td>Increase in injury rates due to increased conflicts with industrial traffic or changes in travel routes to avoid the Project area would be possible to probable, minor to moderate, and medium term (construction) to long term (operations)</td>
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<tr>
<td>Beneficial effects on food security, nutrition, and mental health from increased family incomes would be probable, minor to moderate, and medium term (construction) to long term (operations)</td>
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<tr>
<td>Impacts on community cohesion due to disparity in income benefits would be probable, minor to moderate, and medium (construction) to long term (operations)</td>
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</tbody>
</table>

No substantial difference among alternatives

#### 3.21 Environmental Justicea

<table>
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<tbody>
<tr>
<td>Nuiqsut meets the criteria for a minority and a low-income population that would experience common effects of the Project</td>
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<tr>
<td>Effects to subsistence, particularly subsistence harvest of caribou, may be high and adverse and disproportionately experienced by Nuiqsut residents, since they are the only residents who regularly harvest caribou in the affected area</td>
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</table>

No difference among alternatives

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Note: Applicant (Oil Search Alaska, LLC); CO2e (carbon dioxide equivalent); VSM (vertical support member); CPF (central processing facility); OHW (ordinary high water); Kuukpik (Kuukpik Corporation); NSB (North Slope Borough); ANCSA (Alaska Native Claims Settlement Act)
a These resource chapters evaluate effects differently than other chapters due to other federal regulations (Clean Air Act, Clean Water Act, executive order on Environmental Justice, etc.) or other resource-specific reasons.
b Total includes miles of water pipeline.
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6.0 OIL SPILL RISK ASSESSMENT

All action alternatives evaluated in the EIS have the same number of drill sites, wells, flow lines, and flow volumes. As a result, the risk for accidental releases or spills is similar for all of them. Very small- (less than 10 gallons) to medium- (100 to 999.9 gallons) sized oil spills are likely to occur over the life of the Project. Based on the historic performance of operators on the North Slope, these spills would mostly be contained on or near Project work areas. Large to very large spills would be very unlikely to occur over the 30-year life of the Project.

During the construction phase, very small to large spills of refined oils could occur; however, these accidental spills would be expected to occur on gravel or ice pads, along gravel or ice roads, or into secondary containment structures (Table ES 6-1). The very high likelihood spills noted in the table would be small spills typically occurring during vehicle or equipment maintenance and repair on gravel pads, and would likely be noticed and cleaned up in a short period. This type of spill would be expected to have very limited to no impact to tundra or waterbodies adjacent to these facilities. Crude oil spills would not occur during construction.

During the drilling and operations phases, very small- to medium-sized spills may occur. Accidental oil spills that could occur from leaking wellheads, facility piping, or process piping would likely be contained to and cleaned up on gravel pads and not be expected to result in damage to adjacent tundra or waterbodies. Facility piping and process piping leaks would be highly likely to occur but again would be detected and addressed quickly, which would limit the amount spilled and the extent of the area impacted (i.e., these spills would not likely extend beyond the gravel infrastructure). Accidental spills that may originate along infield gathering pipelines or the export/import pipeline would likely be detected and responded to quickly and have limited geographic extent. In the very unlikely event of a large or very large pipeline spill at a river crossing or during periods of high water flow, the extent of the accidental release could be larger.
Table ES 6-1. Spill Likelihood and Likely Geographic Extent Over Life of Project

<table>
<thead>
<tr>
<th>Spill Size</th>
<th>Likelihood of Spill</th>
<th>Likely Geographic Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very small to small spills (less than 100 gallons)</td>
<td>Very low to very high</td>
<td>On developed gravel pads and road embankments; unlikely to enter environment off gravel areas</td>
</tr>
<tr>
<td>Medium to medium large spills (100 gallons to 10,000 gallons)</td>
<td>Very low to low</td>
<td>On developed gravel pads and road embankments; limited potential to enter environment off gravel areas</td>
</tr>
<tr>
<td>Large to very large spills (greater than 10,000 gallons)</td>
<td>Very low</td>
<td>On developed gravel pads and road embankments; potential to enter environment off gravel pads</td>
</tr>
</tbody>
</table>

Key Findings:

- All North Slope oil projects, including the Project, would likely encounter (or continue to encounter) small spills in the future, despite continued improvements in engineering design; a greater emphasis placed on clean and safe operations; adherence to the use of BMPs; continued improvements in, and awareness of, spill prevention; and improvements in spill response capabilities.

- The likelihood, size, and extent of spills would be similar for all action alternatives. Very small- to medium-sized accidental oil spills could occur on or in the immediate proximity of gravel or ice pads or roads. Medium large to very large spills would have a very low to low likelihood of occurring over the 30-year Project life. These conclusions are supported by analyses of past oil spills from North Slope oil production activities and are demonstrated by the history of spills on the North Slope.

As discussed previously, most types of spills would be small and would be contained on gravel roads and pads, with little potential to affect off-site resources. Pipeline spills, while unlikely, would have the potential to affect off-site resources if the spill occurred at a water crossing or if the spill went undetected for a long period of time. Since pipeline spills would have the most potential to affect off-site resources, the potential effects of pipeline spills on various resources are addressed in each of the resource sections in the EIS and are summarized in Table ES 6-2 below.
Table ES 6-2. Potential Effects of Pipeline Spills on Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Very Small to Small (less than 100 gallons)</th>
<th>Medium to Medium Large (100 gallons to 10,000 gallons)</th>
<th>Large to Very Large (greater than 10,000 gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology and Mineral Resources</td>
<td>No effects</td>
<td>Unlikely, minor, short term</td>
<td>Unlikely, minor, short term</td>
</tr>
<tr>
<td>Geomorphology, Permafrost, and Soils</td>
<td>Possible, minor, short to medium term</td>
<td>Possible, minor to moderate, short to medium term</td>
<td>Probable, moderate to major, short to medium term</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Unlikely, minor, short term</td>
<td>Unlikely, minor, short term</td>
<td>Unlikely to possible, minor to moderate, short term</td>
</tr>
<tr>
<td>Hydrology</td>
<td>Unlikely, minor, short to medium term</td>
<td>Unlikely to possible, minor to moderate, short to medium term</td>
<td>Unlikely to possible, minor to moderate, short to medium term</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Unlikely to possible, minor to moderate, short term</td>
<td>Possible to probable, minor to moderate, short to long term</td>
<td>Probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Wetlands and Vegetation</td>
<td>Probable, short term</td>
<td>Probable, short to medium term</td>
<td>Probable, short to medium term</td>
</tr>
<tr>
<td>Birds</td>
<td>Unlikely to possible, minor, short to medium term</td>
<td>Possible, minor to major, short to long term</td>
<td>Possible to probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Terrestrial Mammals</td>
<td>Unlikely to possible, minor, short to medium term</td>
<td>Possible to probable, minor to major, short to medium term</td>
<td>Possible to probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Marine Mammals</td>
<td>Unlikely, minor, short to medium term</td>
<td>Unlikely to probable, minor to major, short to medium term</td>
<td>Unlikely to probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Fish and Invertebrates</td>
<td>Unlikely, minor, short term</td>
<td>Unlikely to probable, minor to major, short to medium term</td>
<td>Unlikely to probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Visual and Aesthetic Resources</td>
<td>Probable, minor, short term</td>
<td>Probable, minor, short term</td>
<td>Probable, major, medium to long term</td>
</tr>
<tr>
<td>Noise</td>
<td>Probable, minor, short term</td>
<td>Probable, minor to major, short term</td>
<td>Probable, minor to major, short term</td>
</tr>
<tr>
<td>Land Ownership, Management, and Use</td>
<td>No effect to unlikely, minor, short term</td>
<td>Possible, moderate, short term; no effect on land ownership</td>
<td>Possible, moderate, short term; no effect on land ownership</td>
</tr>
<tr>
<td>Cultural Resources</td>
<td>Possible, minor to major, short to long term</td>
<td>Possible, minor to major, short to long term</td>
<td>Probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Subsistence and Traditional Use</td>
<td>Unlikely to possible, minor to moderate, short to medium term</td>
<td>Possible to probable, minor to major, short to medium term</td>
<td>Probable, minor to major, short to long term</td>
</tr>
<tr>
<td>Socioeconomics</td>
<td>Possible, minor to moderate, short term</td>
<td>Possible, minor to moderate, short term</td>
<td>Probable, minor to major, short to long term</td>
</tr>
</tbody>
</table>
### 7.0 FINAL ENVIRONMENTAL IMPACT STATEMENT AND NEXT STEPS

The Final EIS summarizes the potential environmental effects of the No Action Alternative and four action alternatives. The Final EIS is available for the public and agencies to review these potential effects. USACE will publish a notification of the availability of the Final EIS in the *Federal Register*, as well as in relevant newspapers, through radio announcements, and through fliers posted in Nuiqsut. The public and agencies will have 30 days to review the Final EIS.

USACE will not make a decision on which alternative it considers to be the least environmentally damaging practicable alternative (LEDPA) until after the Final EIS is published. Once the Final EIS 30-day waiting period is complete, USACE will make a final permit decision and determine which alternative it considers to be the LEDPA. USACE uses the information in the Final EIS to complete the 404(b)(1) analysis and public interest review as part of its permit decision process. The LEDPA decision will be summarized in the ROD, which will clearly identify whether the Project is the LEDPA, as well as document the USACE DA permit decision on the Project.

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### Table: Likelihood of Effects to Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Very Small to Small (less than 100 gallons)</th>
<th>Medium to Medium Large (100 gallons to 10,000 gallons)</th>
<th>Large to Very Large (greater than 10,000 gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Health and Safety</td>
<td>Direct effects: unlikely, minor, short term</td>
<td>Direct effects: unlikely, minor to moderate, short to long term</td>
<td>Direct effects: unlikely, minor to moderate, short to long term</td>
</tr>
<tr>
<td></td>
<td>Indirect effects: Possible, minor, short term</td>
<td>Indirect effects: possible to probable, minor to moderate, short to long term</td>
<td>Indirect effects: Probable, minor to moderate, short to long term</td>
</tr>
</tbody>
</table>

**Note:** Table describes the likelihood of effects to resources should a spill occur. The likelihood of a pipeline spill occurring is summarized in Table ES 6-1 and discussed further in EIS Chapter 4.0, Spill Risk Assessment, Prevention, and Planning. Tables includes potential pipeline spills off gravel infrastructure.
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