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

# Willow Master Development Plan

## Supplemental Environmental Impact Statement

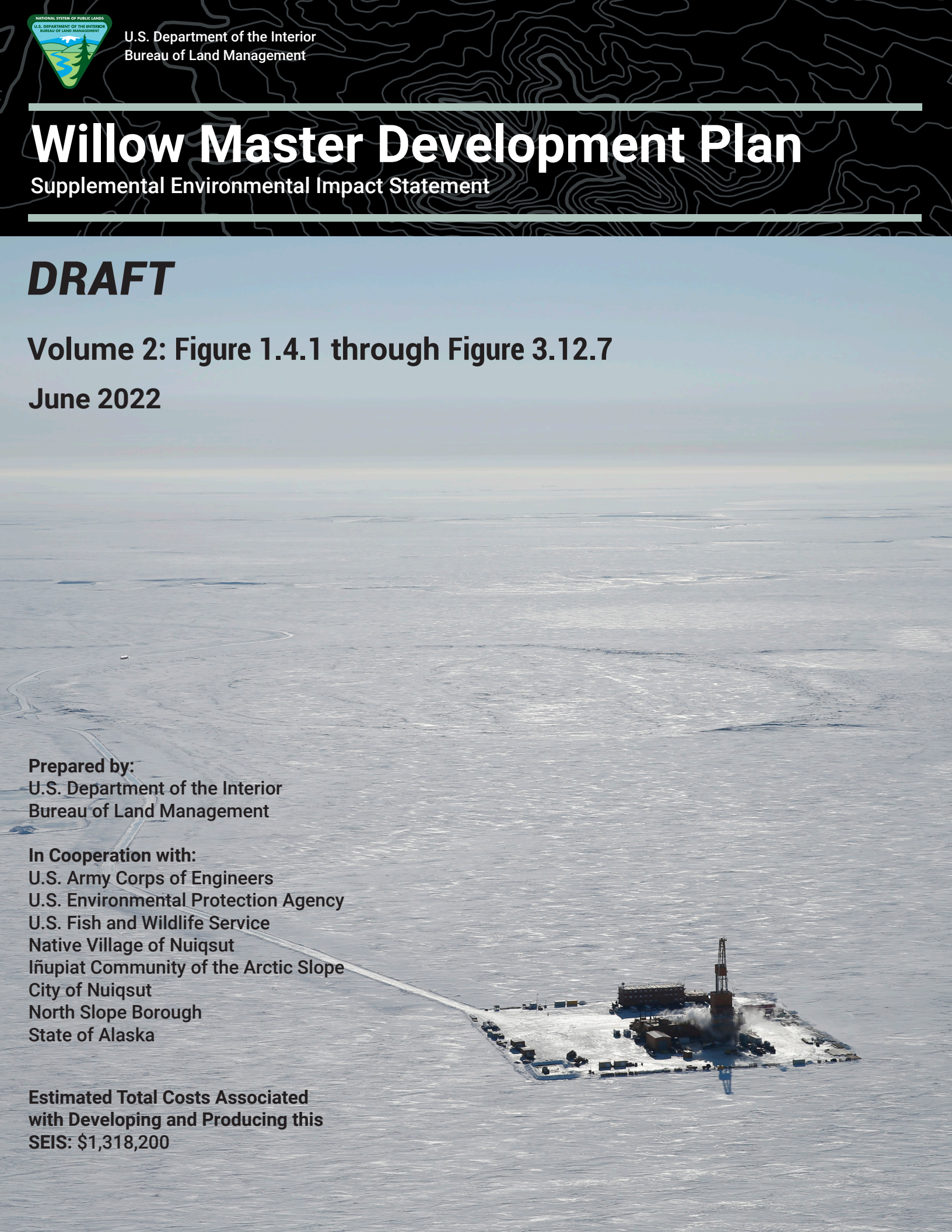
***DRAFT***

**Volume 2: Figure 1.4.1 through Figure 3.12.7**

**June 2022**


**Prepared by:**
U.S. Department of the Interior
Bureau of Land Management

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

**Estimated Total Costs Associated with Developing and Producing this SEIS:** $1,318,200

## Mission

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

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



DOI-BLM-AK-0000-2018-0004-EIS
BLM/AK/PL-22/032+1610+F010

# Willow Master Development Plan

## Appendix A - Part 1
## Figures

**June 2022**

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# LIST OF FIGURES

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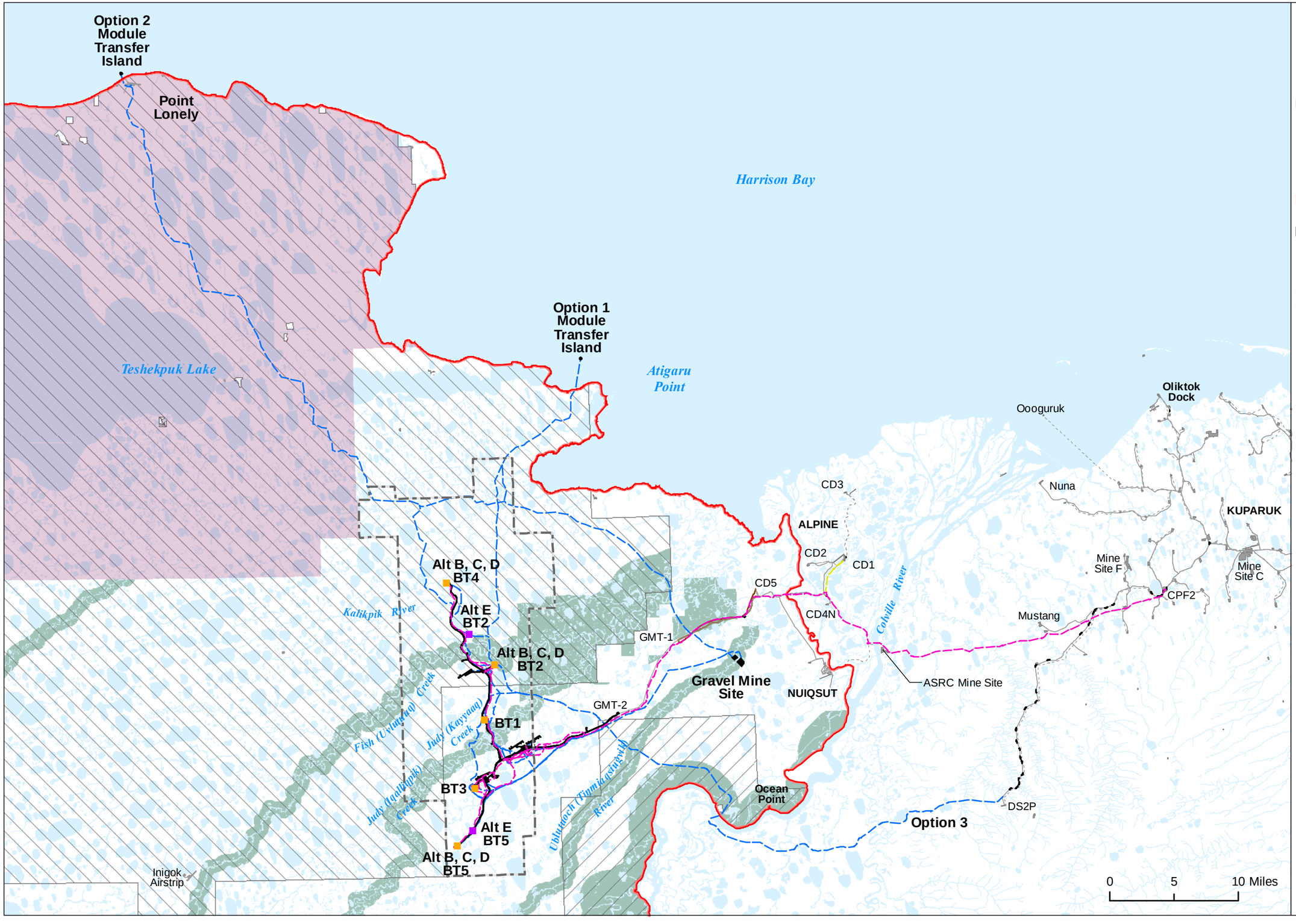




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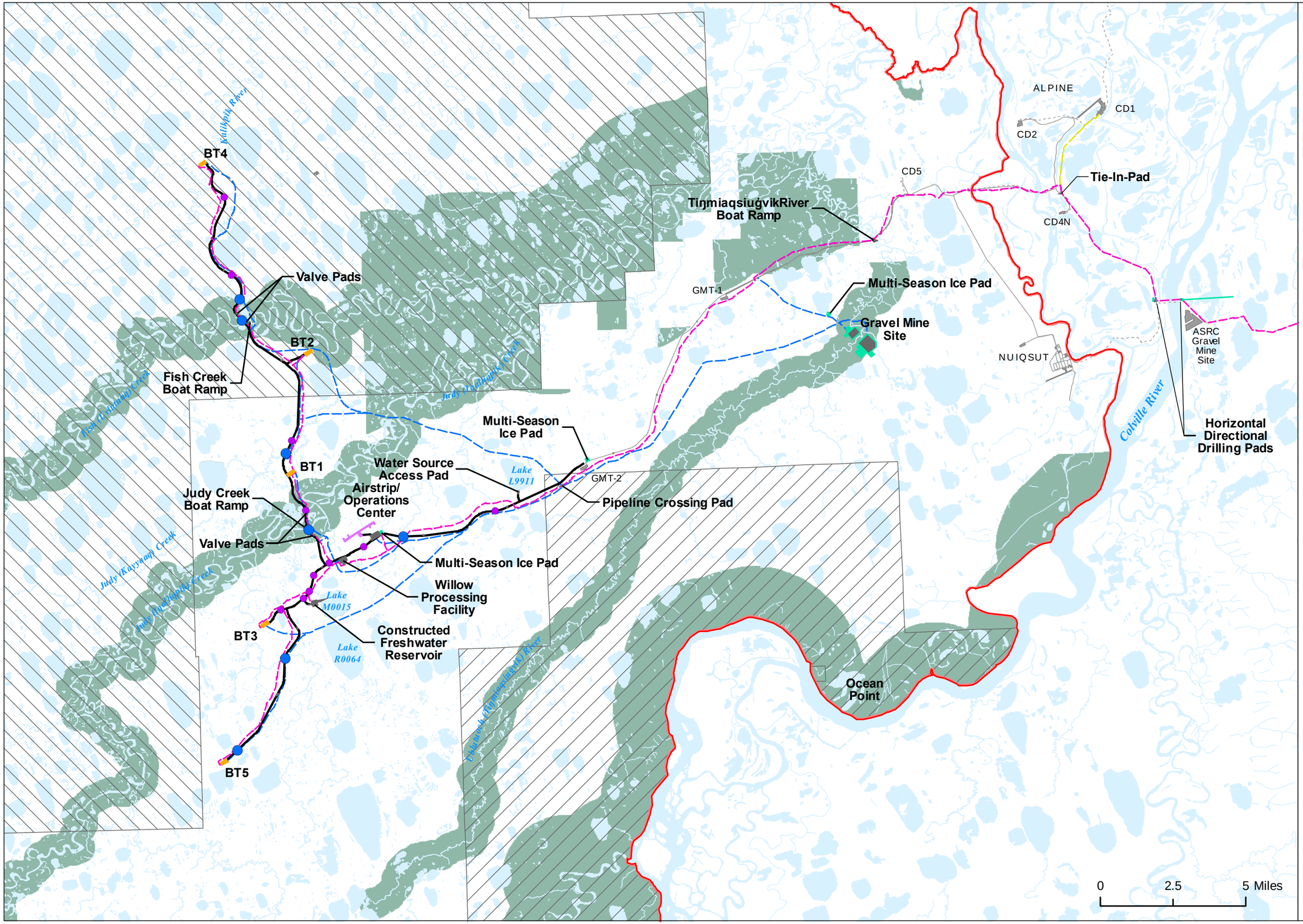



**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- New Pipeline New VSM
- New Pipeline Existing VSM
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

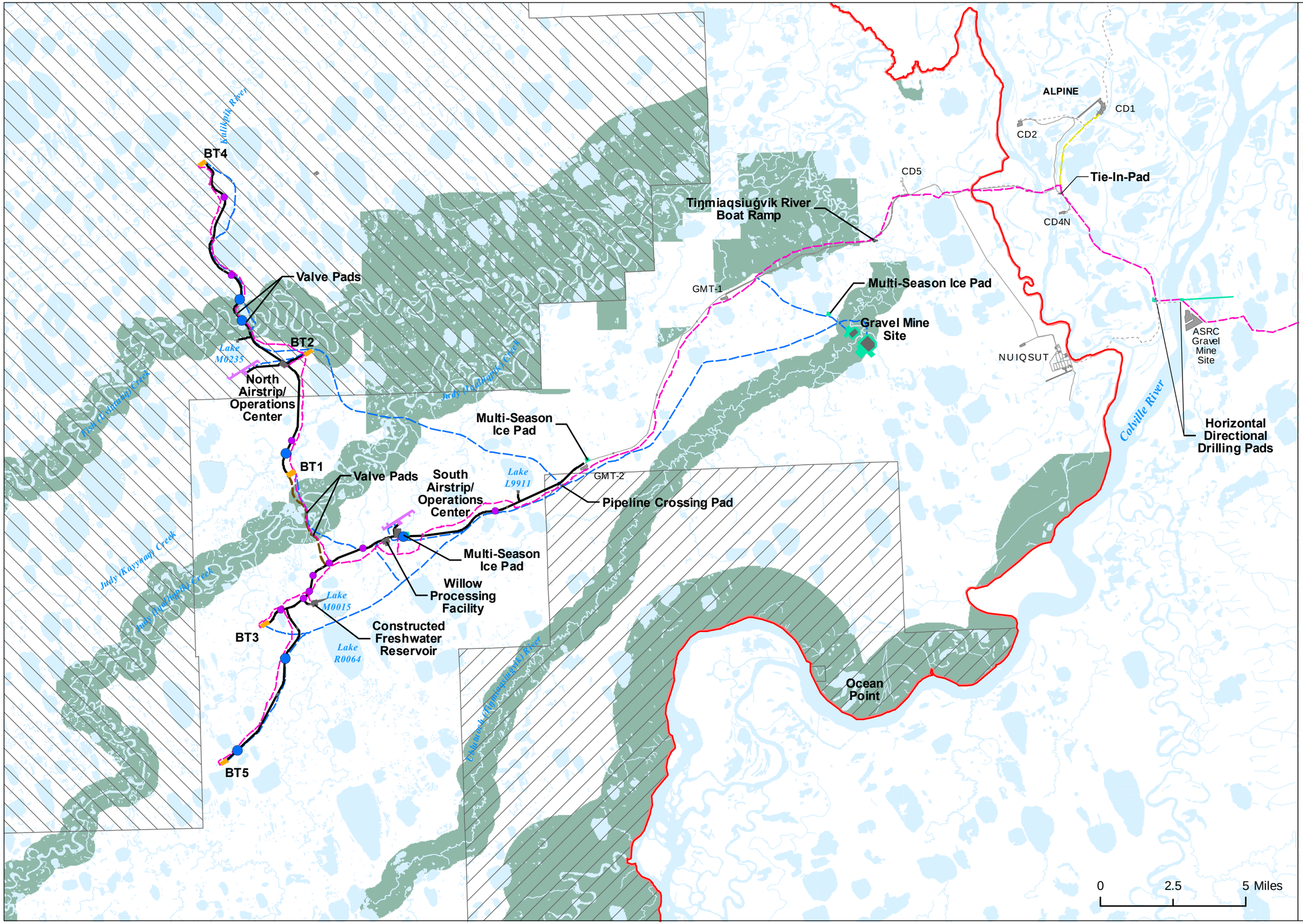
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.1




**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- New Pipeline New VSM
- New Pipeline Existing VSM
- Ice Road
- Annual Resupply Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

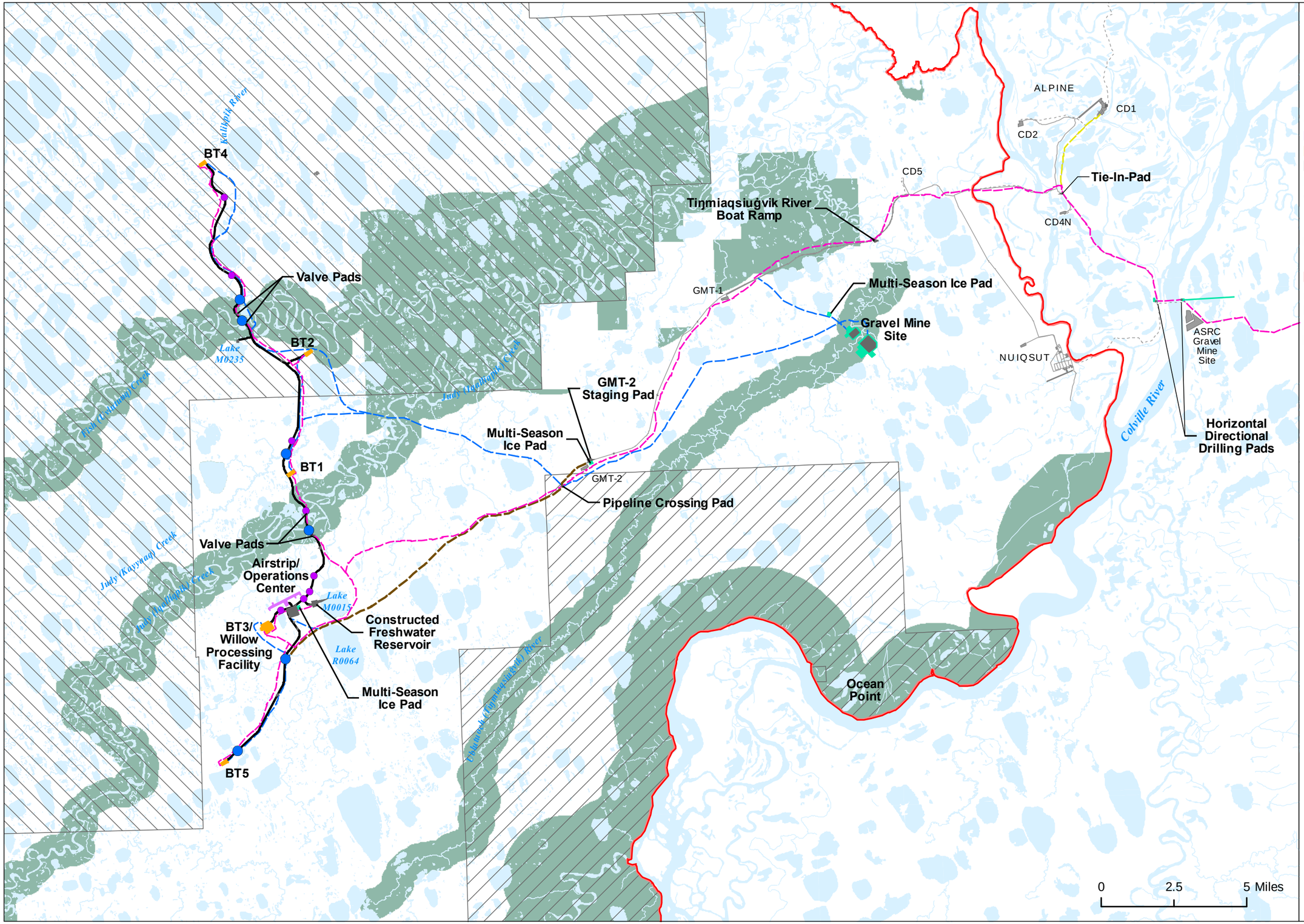
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.2




**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- New Pipeline New VSM
- New Pipeline Existing VSM
- Ice Road
- Annual Resupply Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

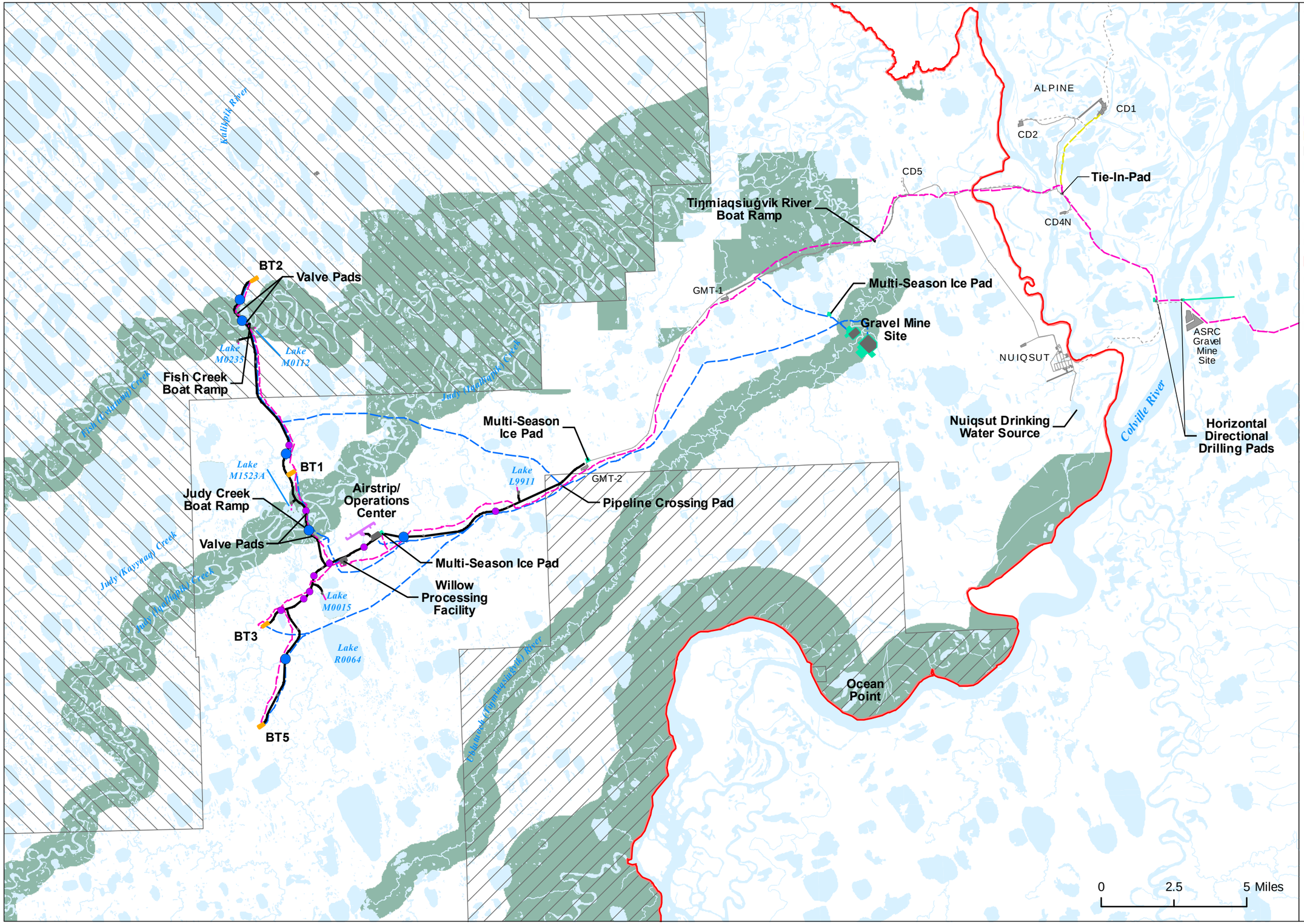
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.3




**Willow Proposed Development Features**
- Culvert
- Bridge
- Gravel Road
- New Pipeline New VSM
- New Pipeline Existing VSM
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

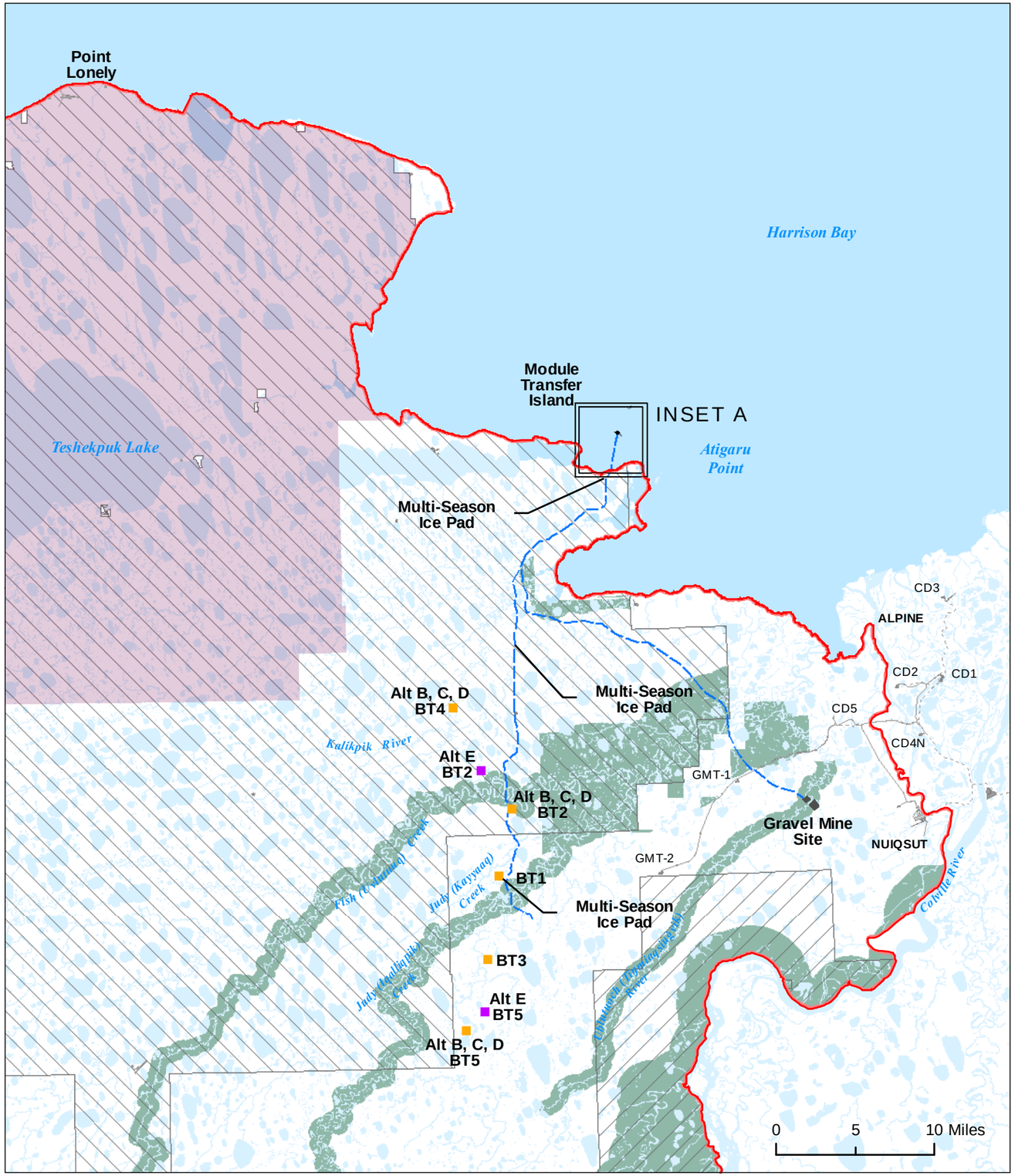
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

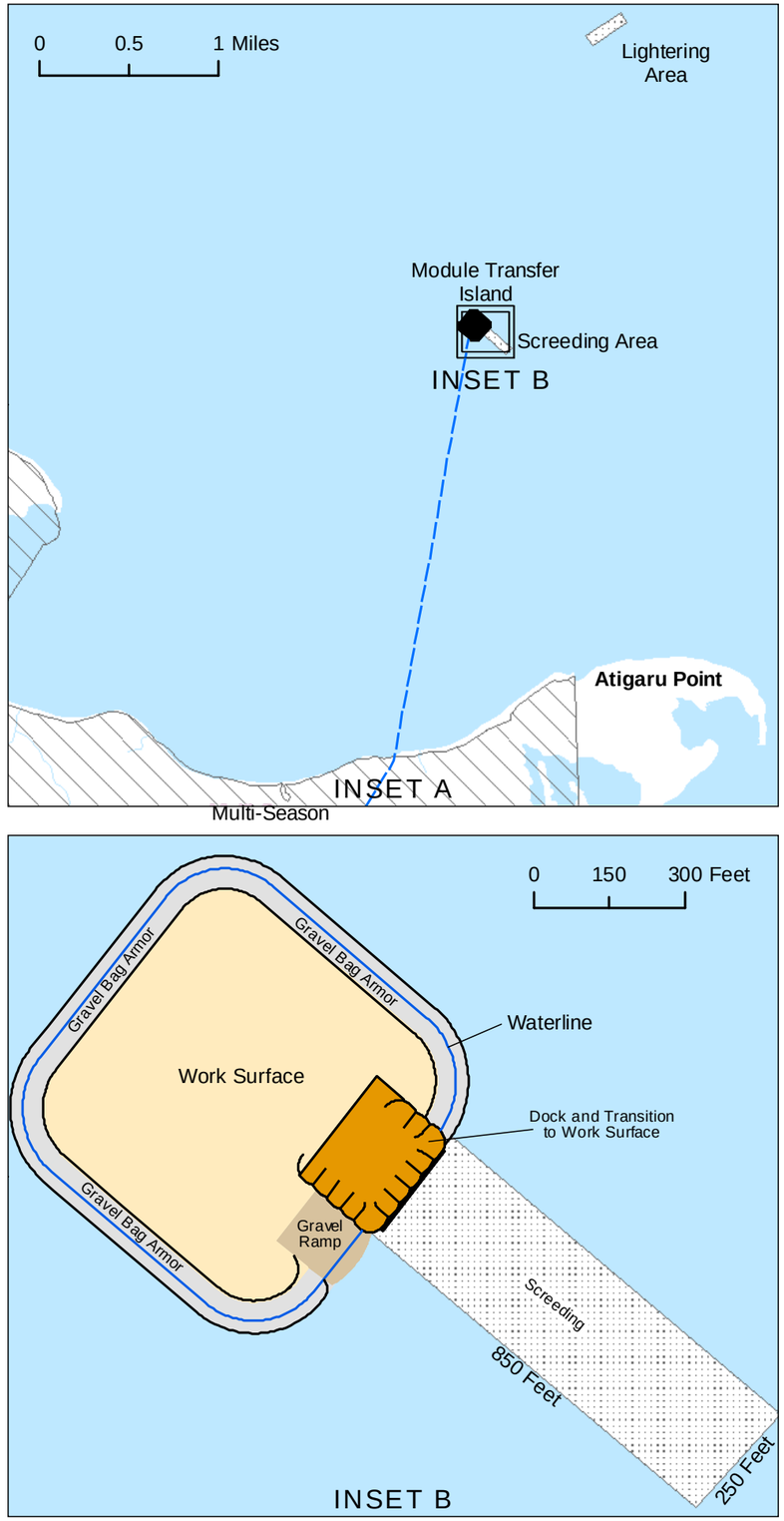
**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.4







**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Module Transfer Island
- Gravel Mine Site
- Screeding
- Ice Pad

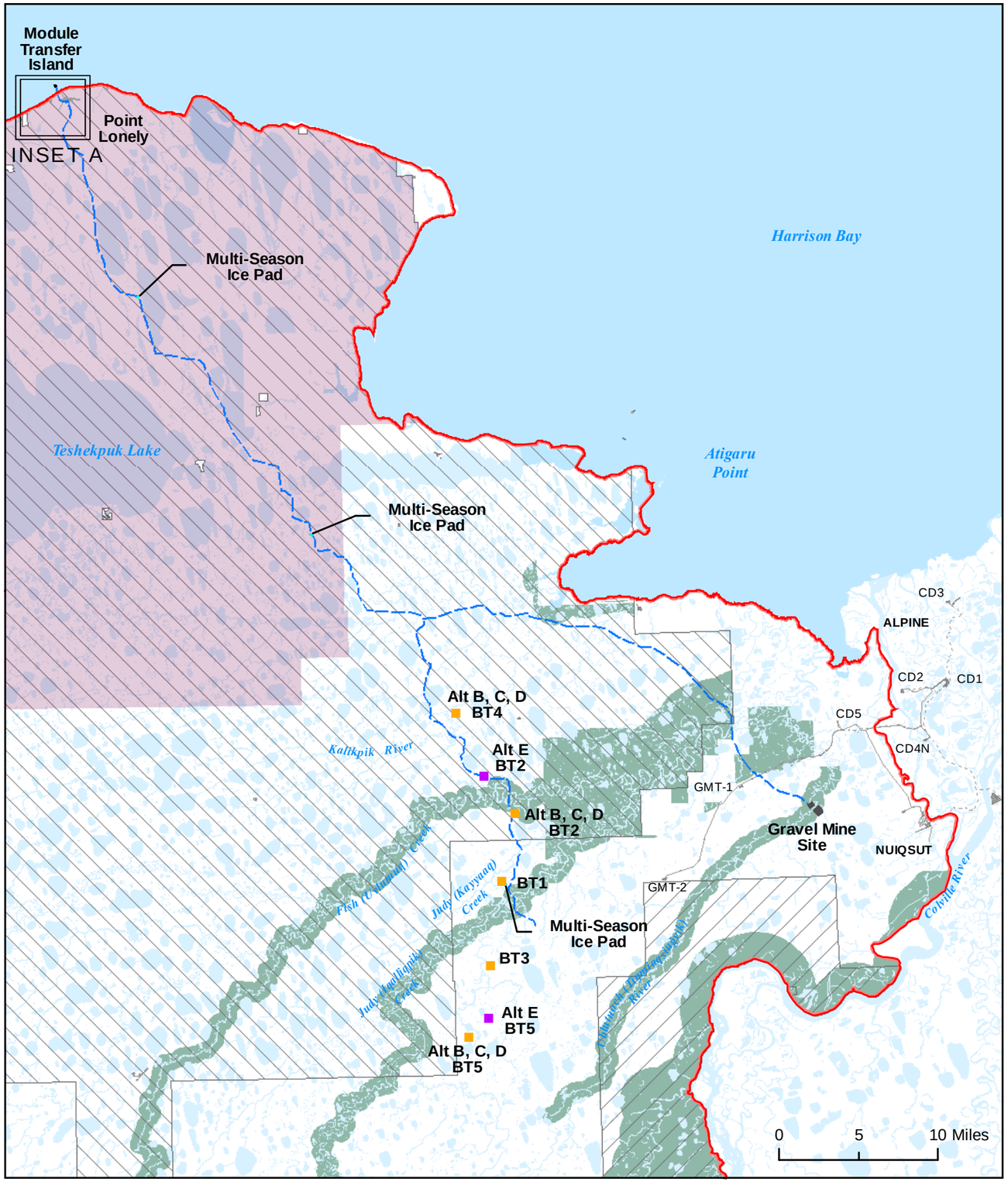
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

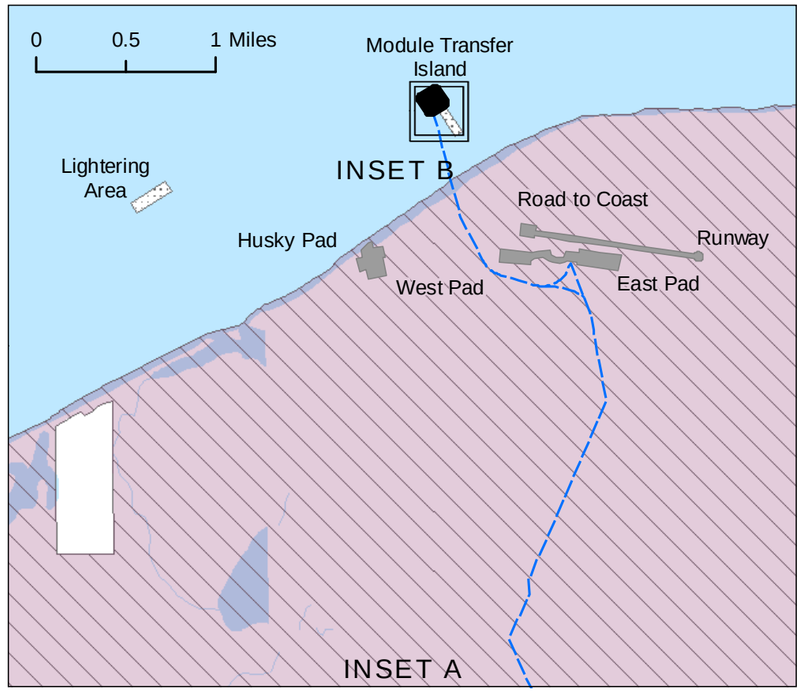
**Land Designation**
- National Petroleum Reserve in Alaska

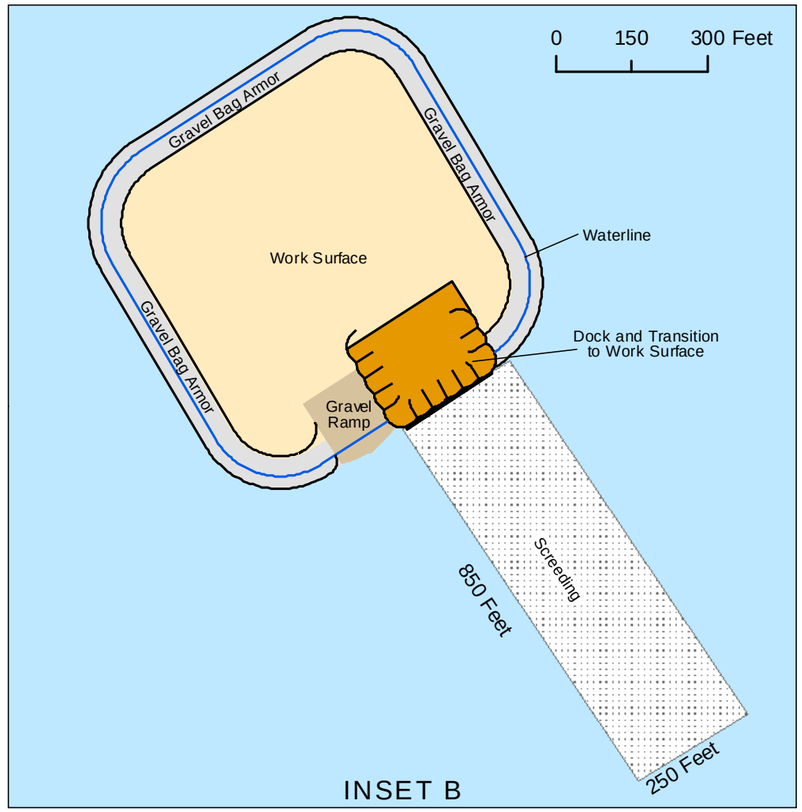
**Required Operating Procedure**
- K-1: River Setbacks
- K-9: No New Infrastructure
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.5




**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Lonely Nearshore Staging Area
- Gravel Mine Site
- Screeding
- Ice Pad

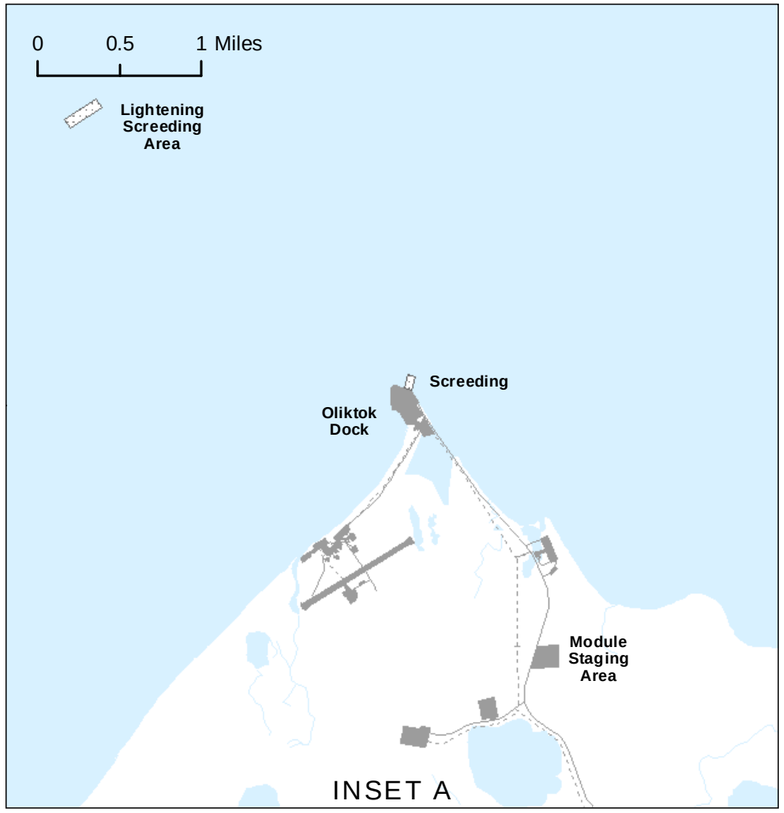
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

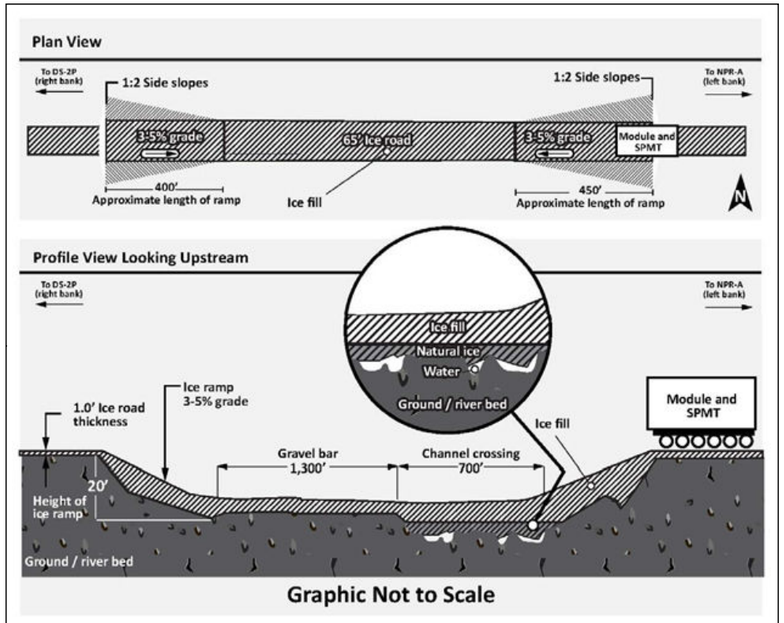
**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- K-9: No New Infrastructure
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.6


DETAIL A - Colville River Ice Bridge

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Screeding

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-1: River Setbacks
- Colville River Special Area
- Teshekpuk Lake Special Area



Figure 2.4.7

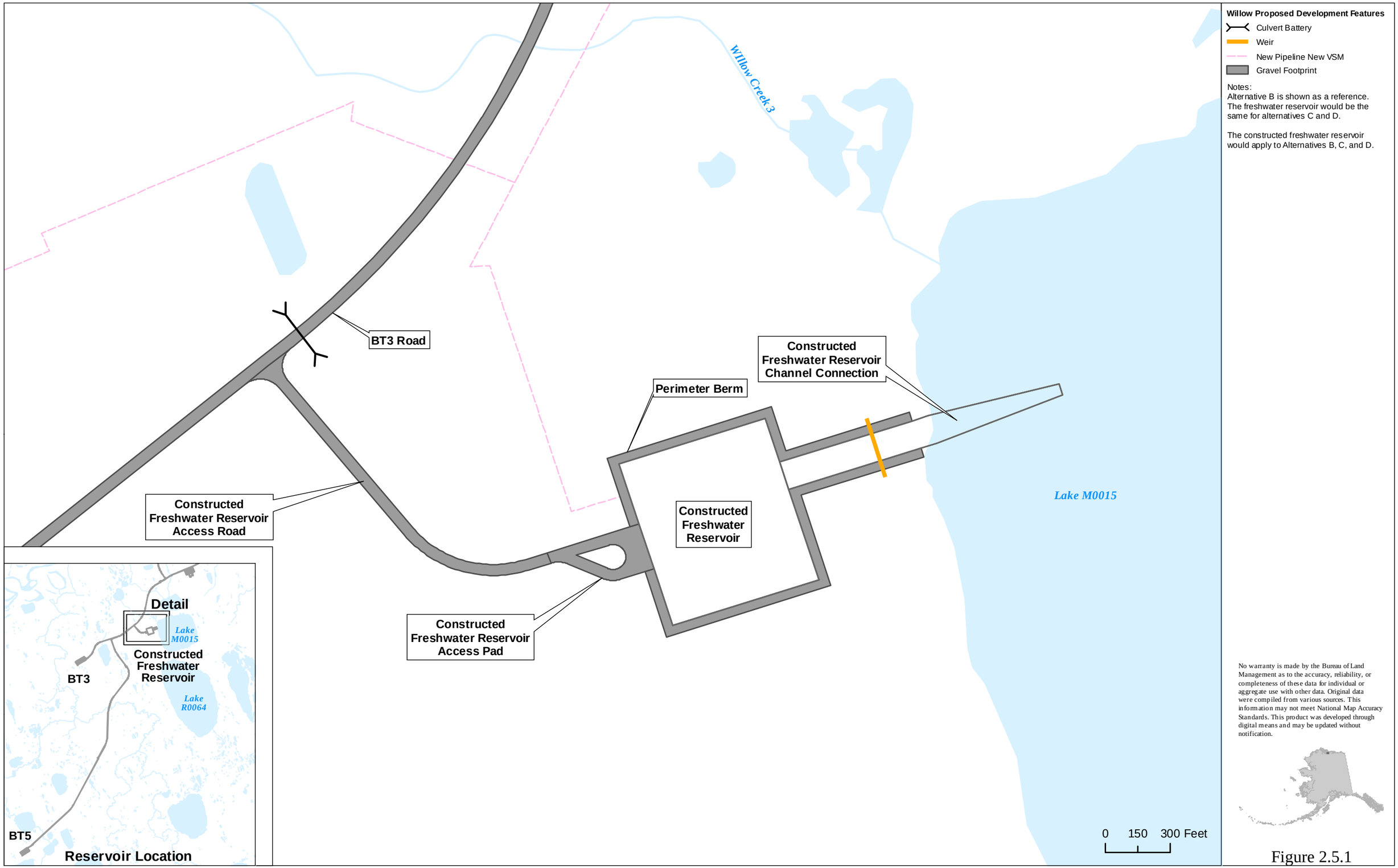





Figure 2.5.1

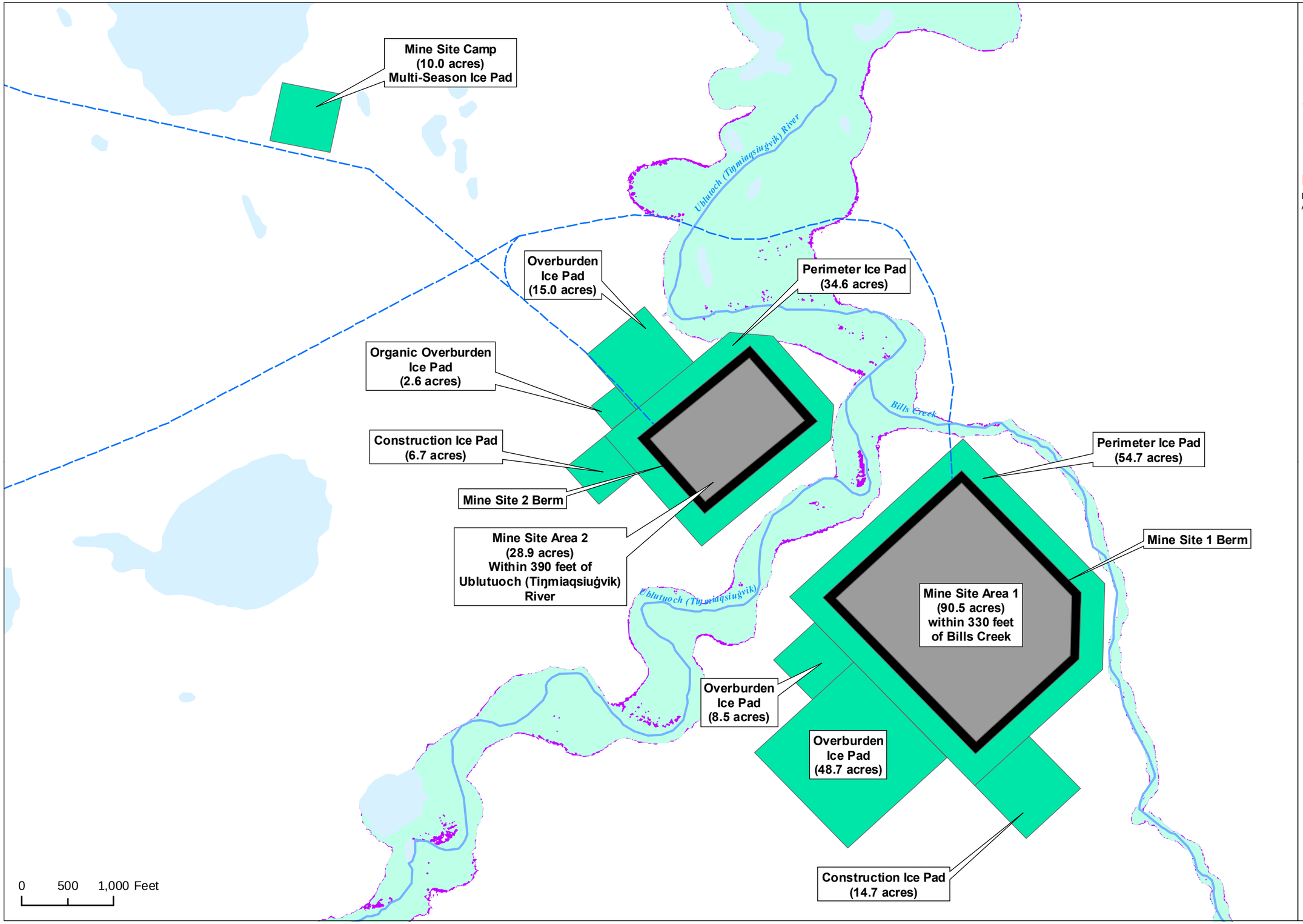





Figure 2.5.2A

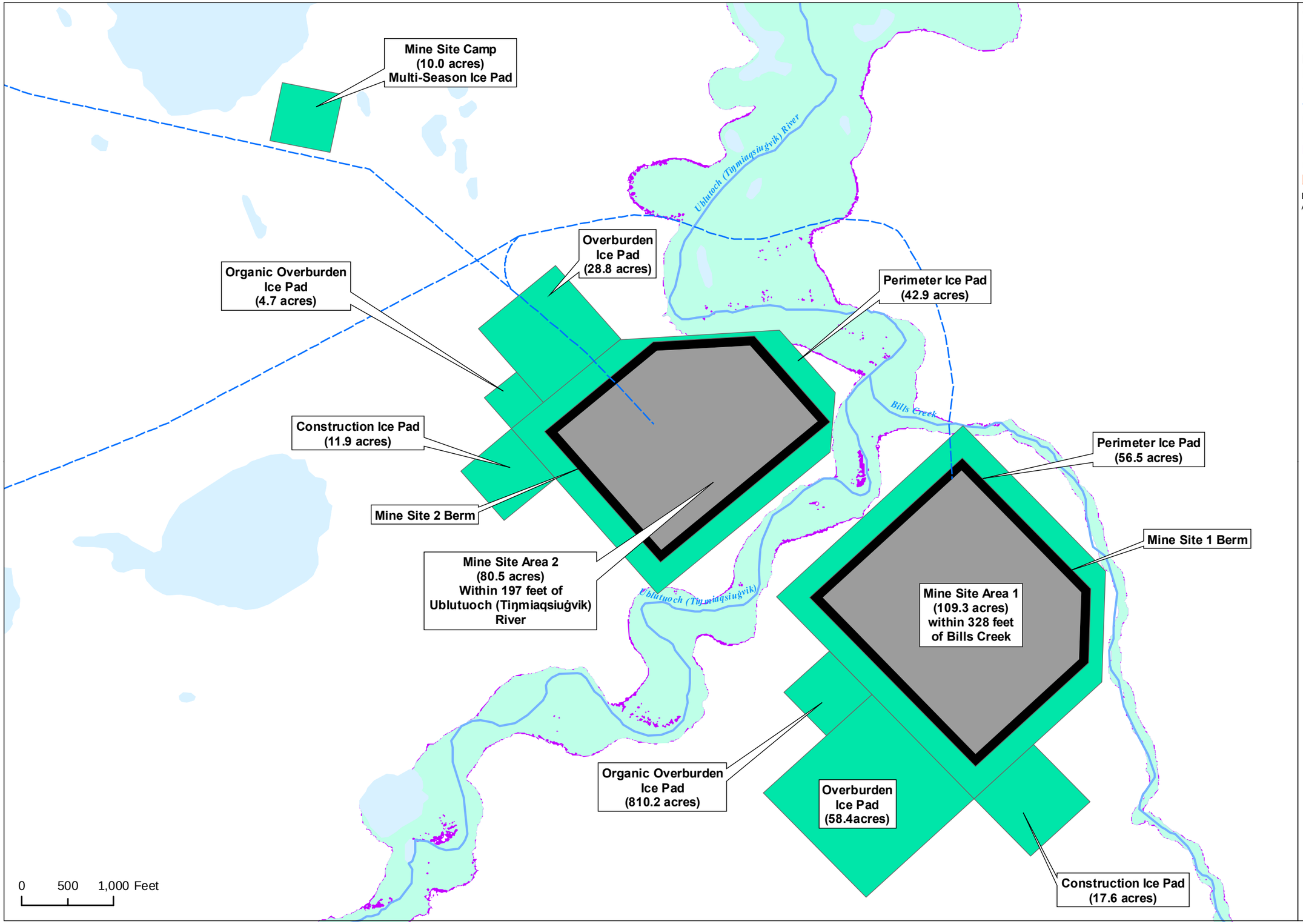





Figure 2.5.2B

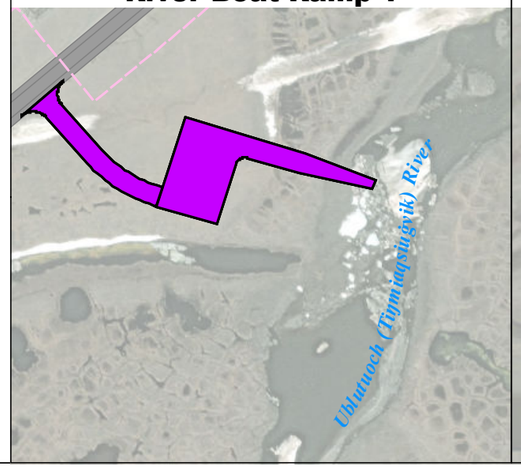
Kalikpik River
Alt B, C, D
BT4
Alt E
BT2
Boat Ramp 3
Alt B, E
Lake
M0235
Alt B, C, D
BT2
Fish (Uvlutuuq) Creek
Judy (Iqalliqpik) Creek
BT1
Boat Ramp 2
Alt B, E
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Lake
M0015
BT3
Lake
R0064
Alt E
BT5
Alt B, C, D
BT5
Lake
L9911
GMT-2
Boat Ramp 1
Alt B, C, D, E
CD5
GMT-1
Gravel Mine
Site
Ublutuoch (Tiŋmiaqsiuġvik) River
ALPINE
CD1
CD2
CD4N
NUIQSUT
ASRC
Gravel
Mine
Site
Colville River
0
2
4 Miles

**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- New Pipeline Existing VSM
- New Pipeline New VSM
- Ice Road
- Drill Site
- Alt E Drill Site
- Gravel Footprint
- Boat Ramp

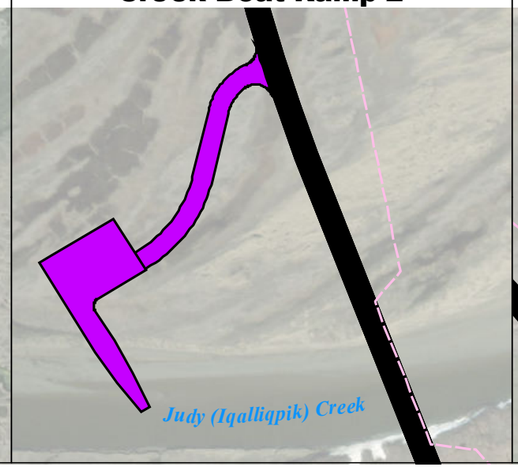
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Ublutuoch (Tiŋmiaqsiuġvik) River Boat Ramp 1**




**Judy (Iqalliqpik) Creek Boat Ramp 2**




**Fish (Uvlutuuq) Creek Boat Ramp 3**

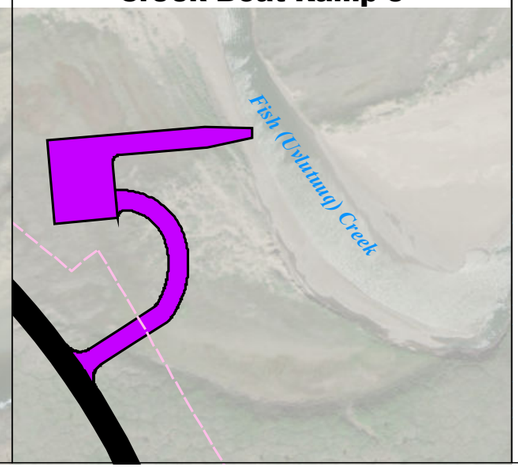
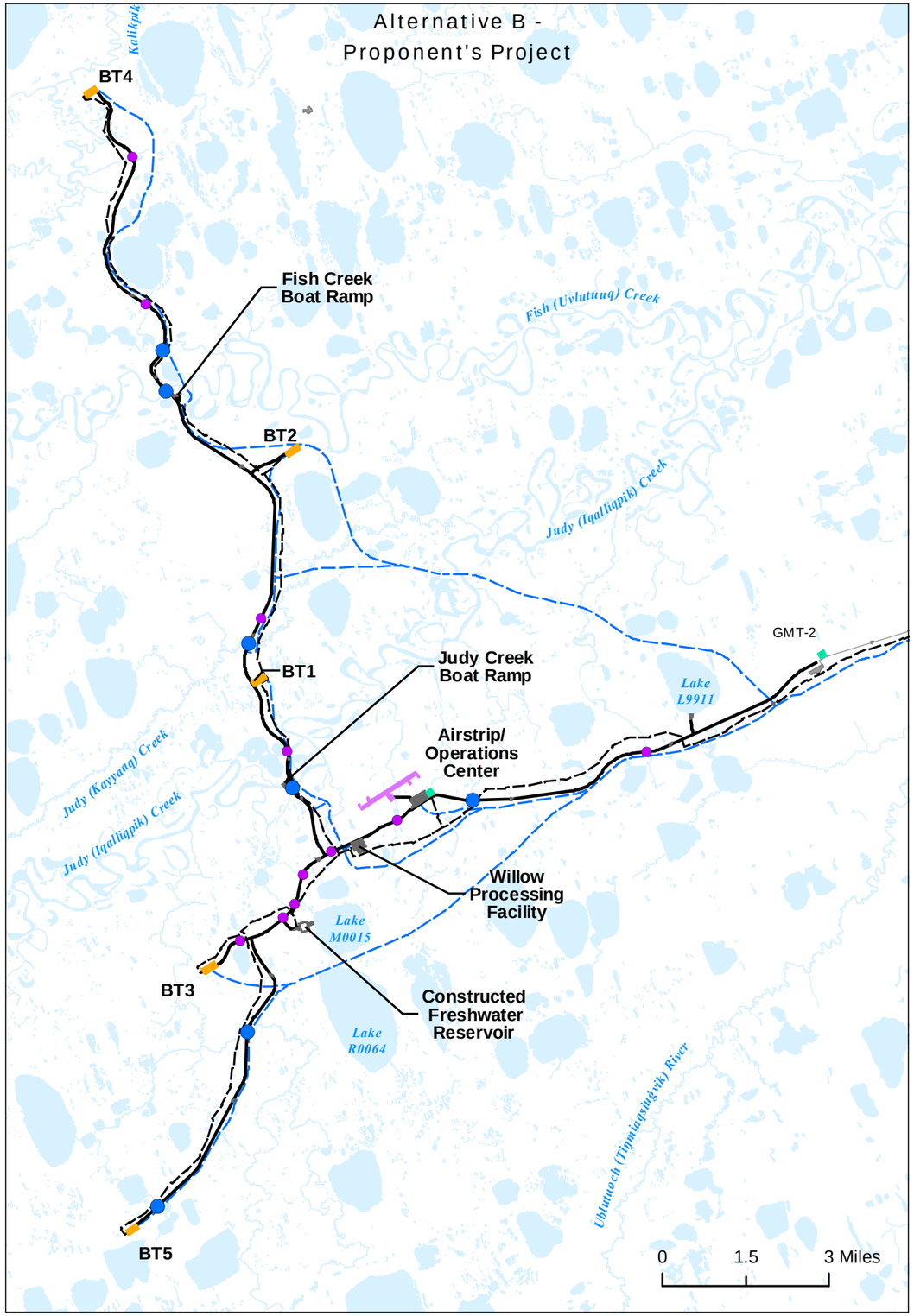
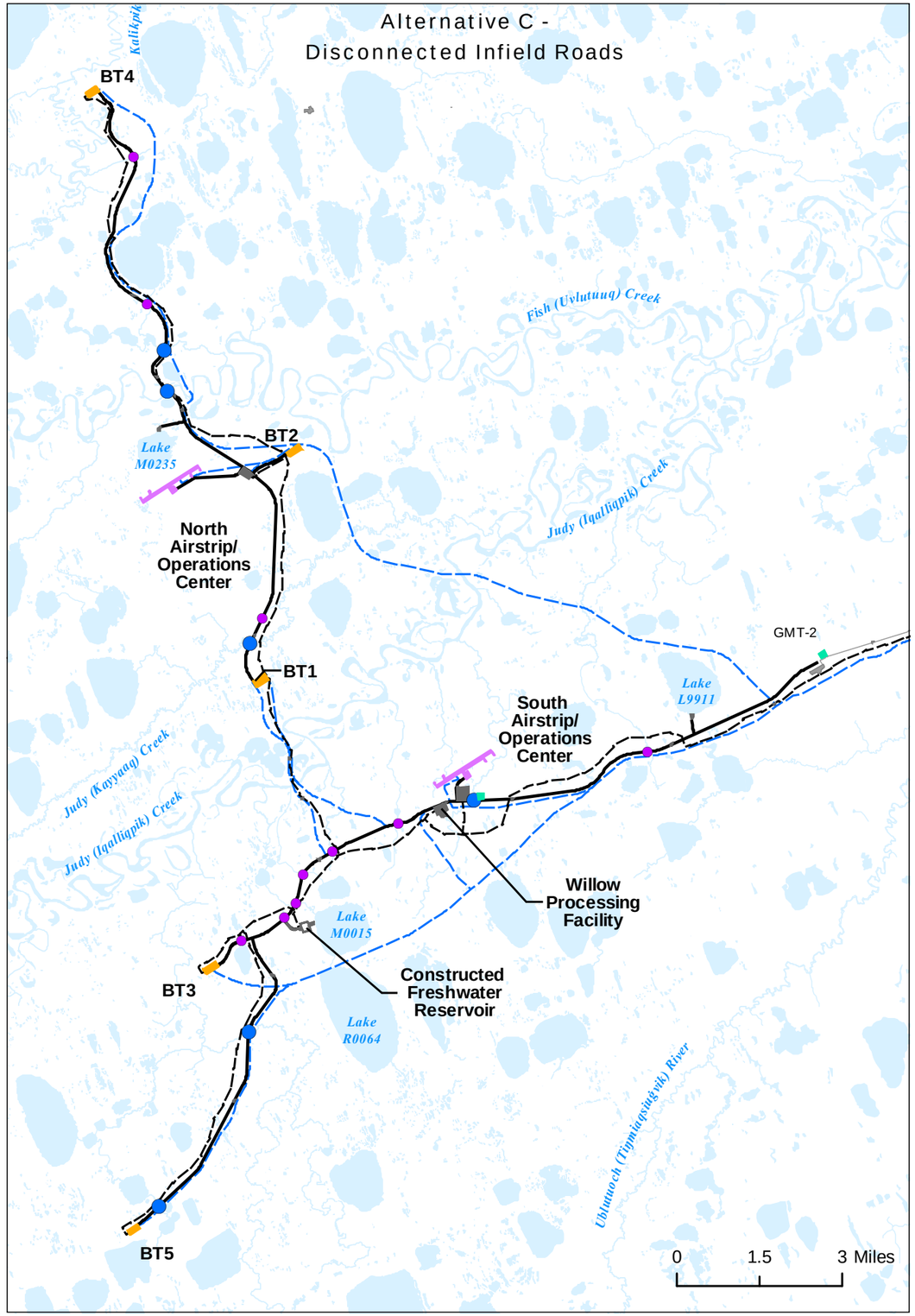





Figure 2.5.3




**Willow Proposed Development Features**

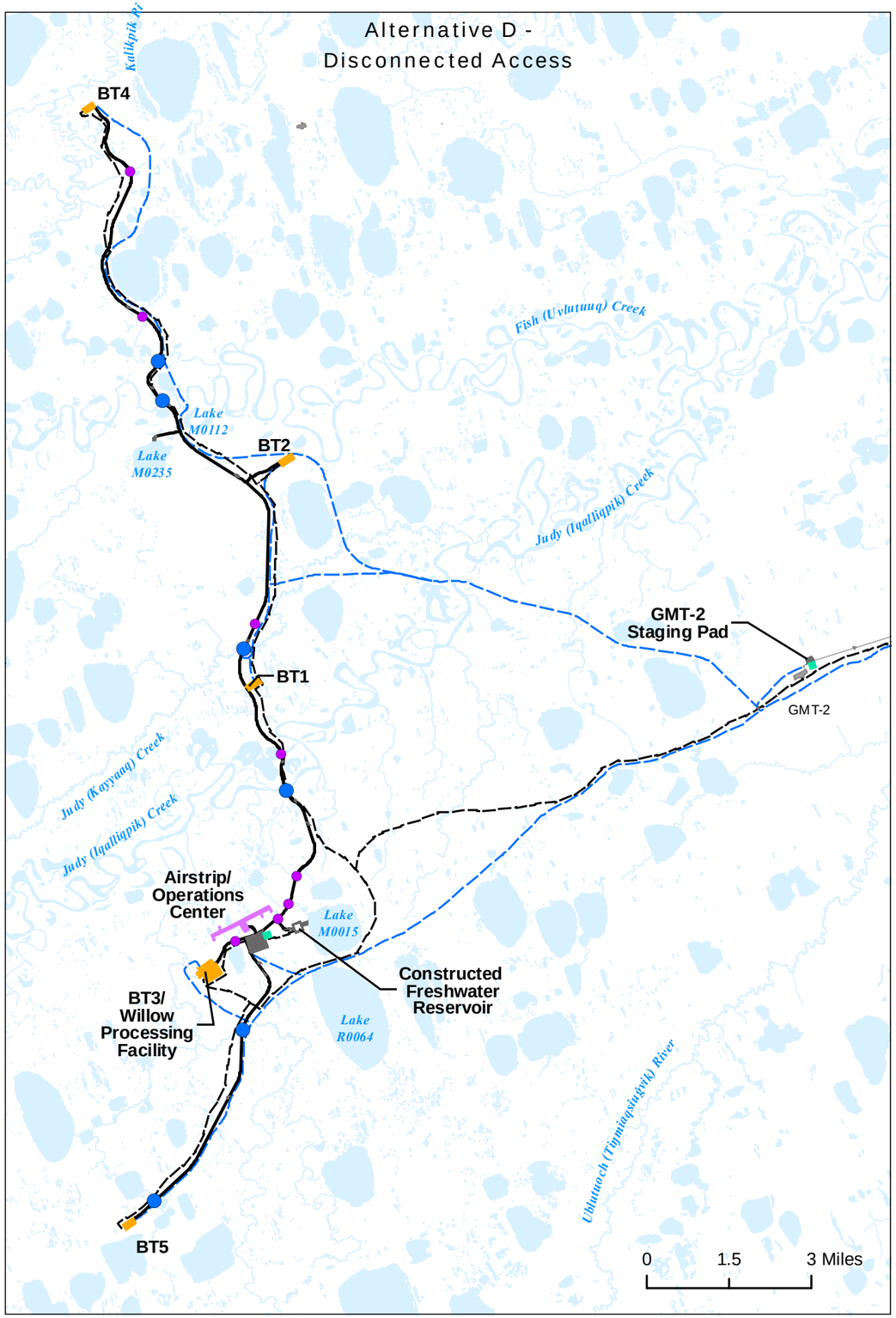
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

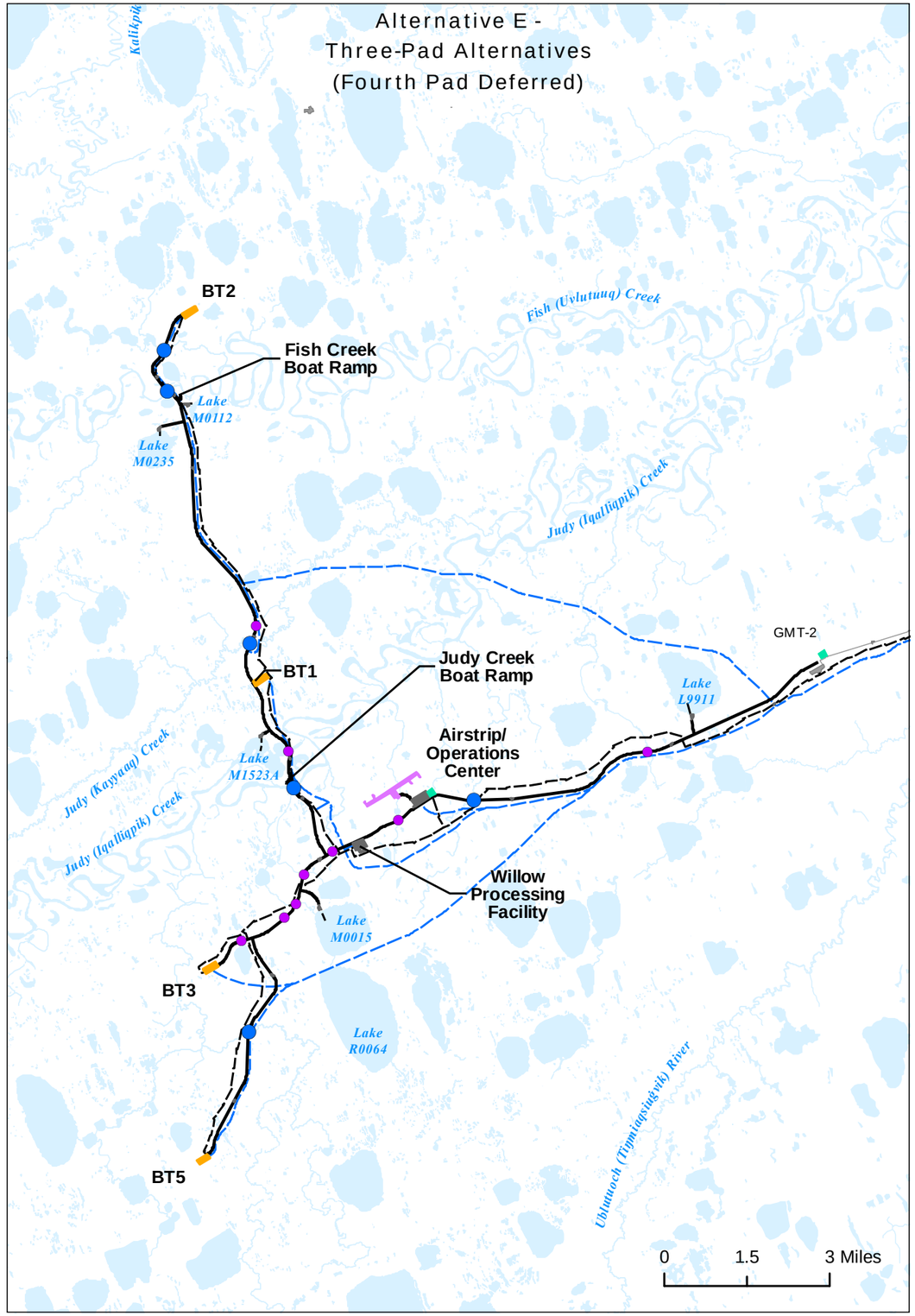
**Other Infrastructure**

- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 2.7.1A




**Willow Proposed Development Features**
- Culvert
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 2.7.1B

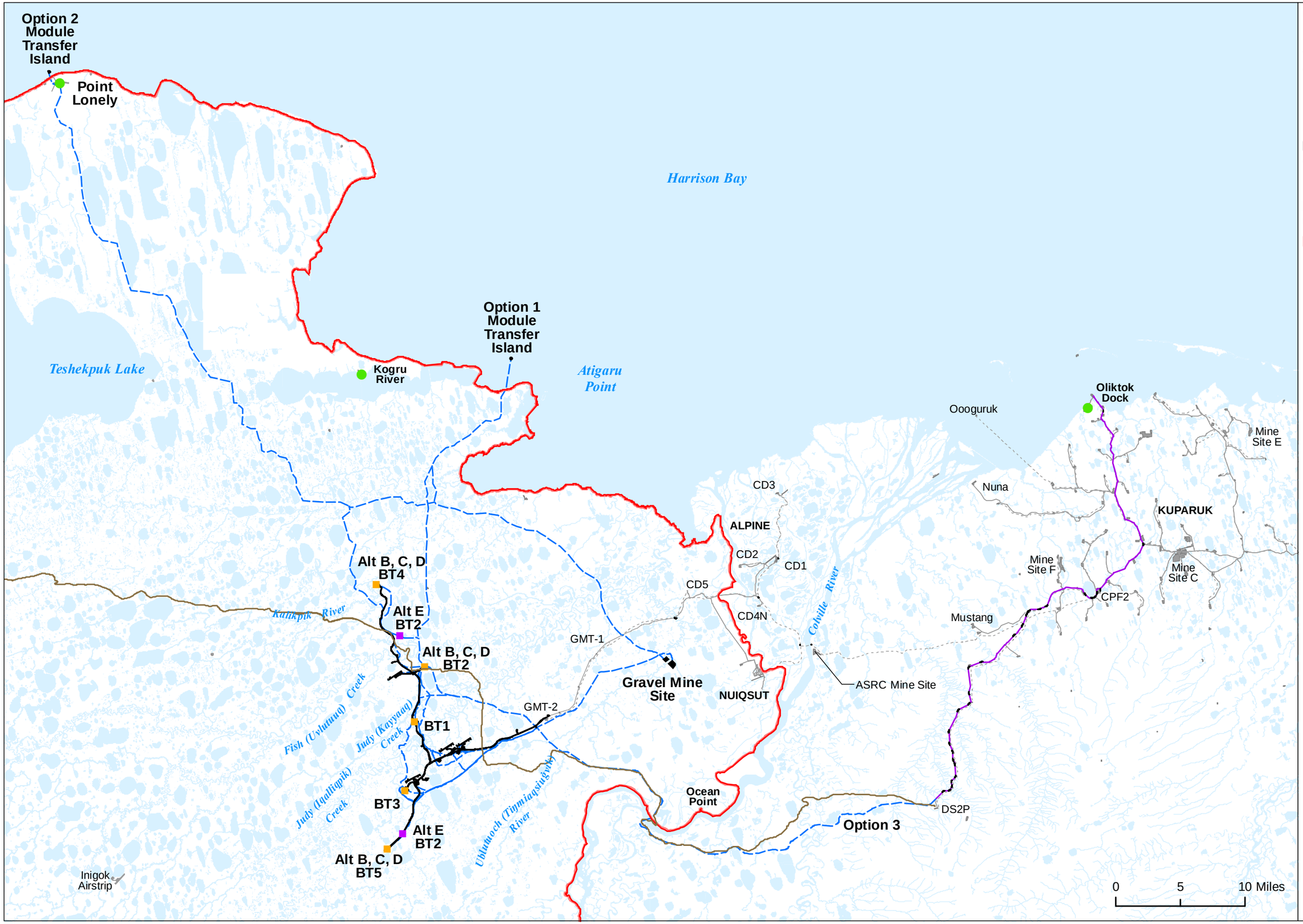



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Figure 3.1.1

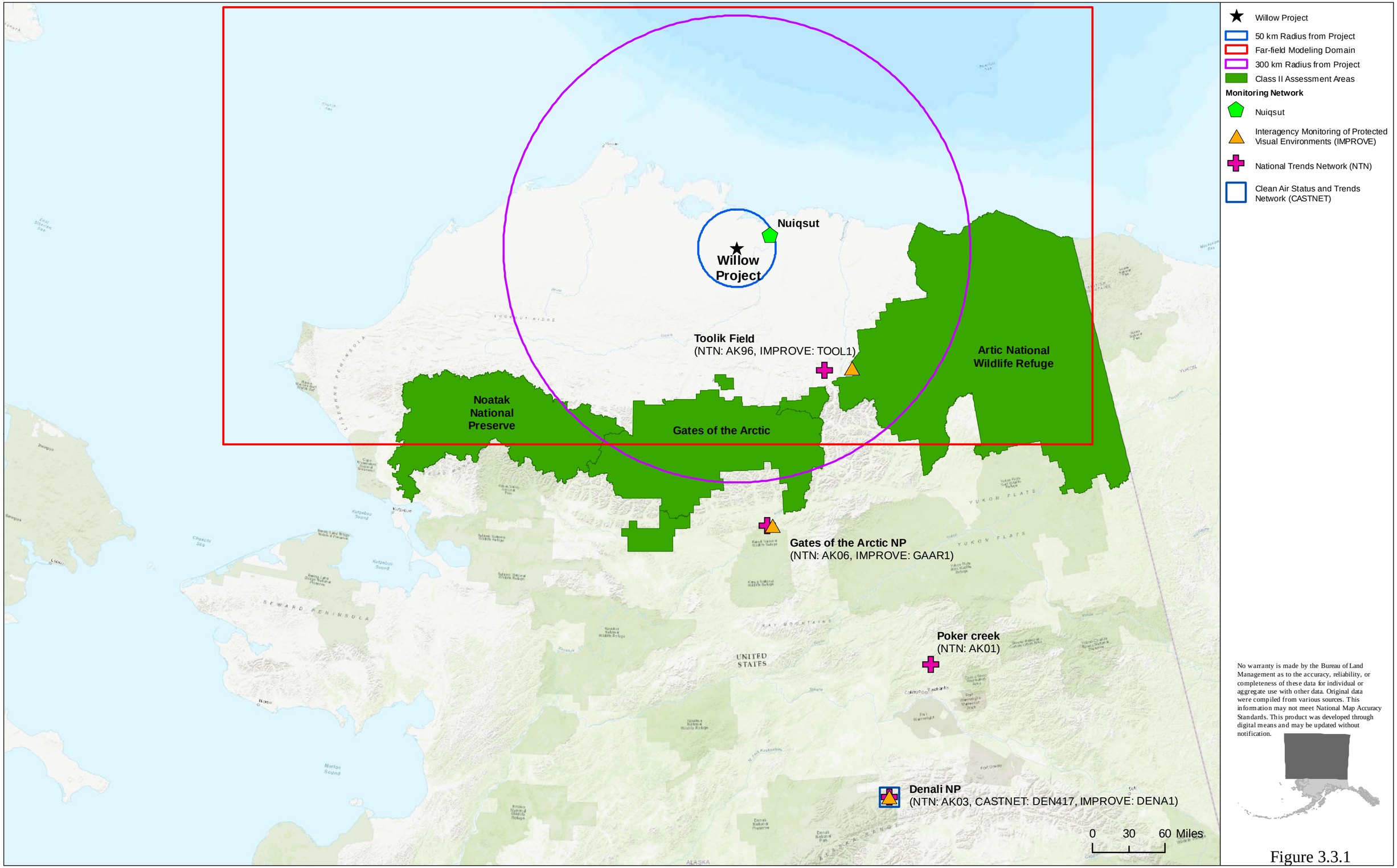
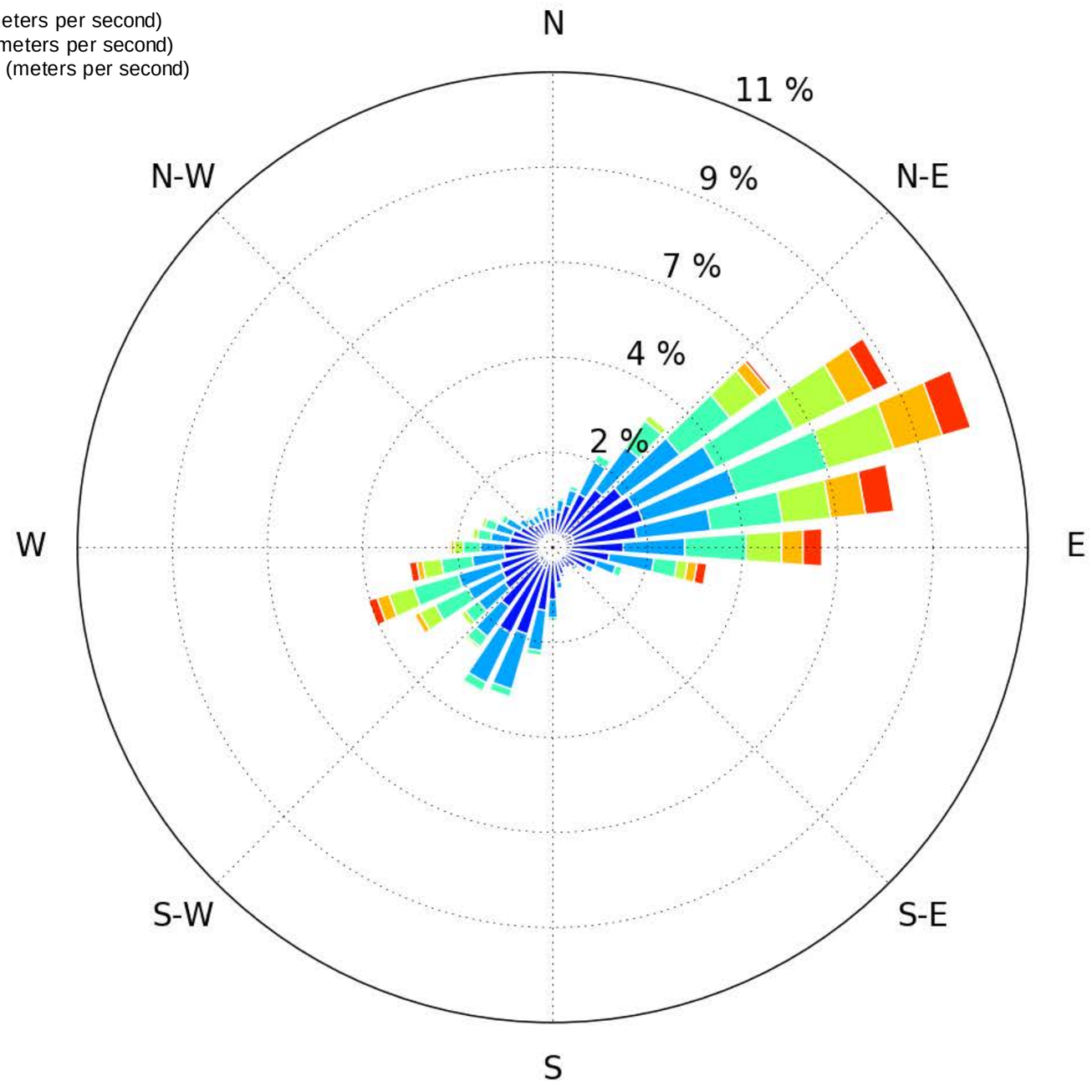





Figure 3.3.1

**Wind Speed**
**Total Count:** 43,824
**Total Calm:** 414
**Calm:** 0.9%
**Missing:** 1,321
**Wind Speed Average:** 5.0 (meters per second)
**Minimum Wind Speed:** 0.5 (meters per second)
**Maximum Wind Speed:** 22.4 (meters per second)

**Nuiqsut Monitoring Station Wind Rose 2013 through 2017**




**Wind Speed (meters per second)**
- 0.5 to 2.0
- 2.0 to 4.0
- 4.0 to 6.0
- 6.0 to 8.0
- 8.0 to 10.0
- 10.0 to 12.0
- 12.0+

Figure 3.3.2

Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Mine Site F
CPF2
Mine Site C
Alt B, C, D BT4
Alt E BT2
Kalikpik River
GMT-1
Alt B, C, D BT2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
GMT-2
BT1
BT3
Judy (Iqulliqpik) Creek
Alt E BT5
Alt B, C, D BT5
Ublutuoch (Tigmiaqsiugvik) River
Ocean Point
DS2P
0 5 10 Miles

INSET A
Gravel Mine Site
Ublutuoch (Tigmiaqsiugvik) River
Bill's Creek

**Willow Proposed Development FeaturesB**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Option 3 Existing Road
- Gravel Footprint
- Mine Site Excavation

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

Note:
The analysis area is the area within 328 f eet (100 meters) of proposed ground disturbances and ice inf rastructure.



Figure 3.4.1

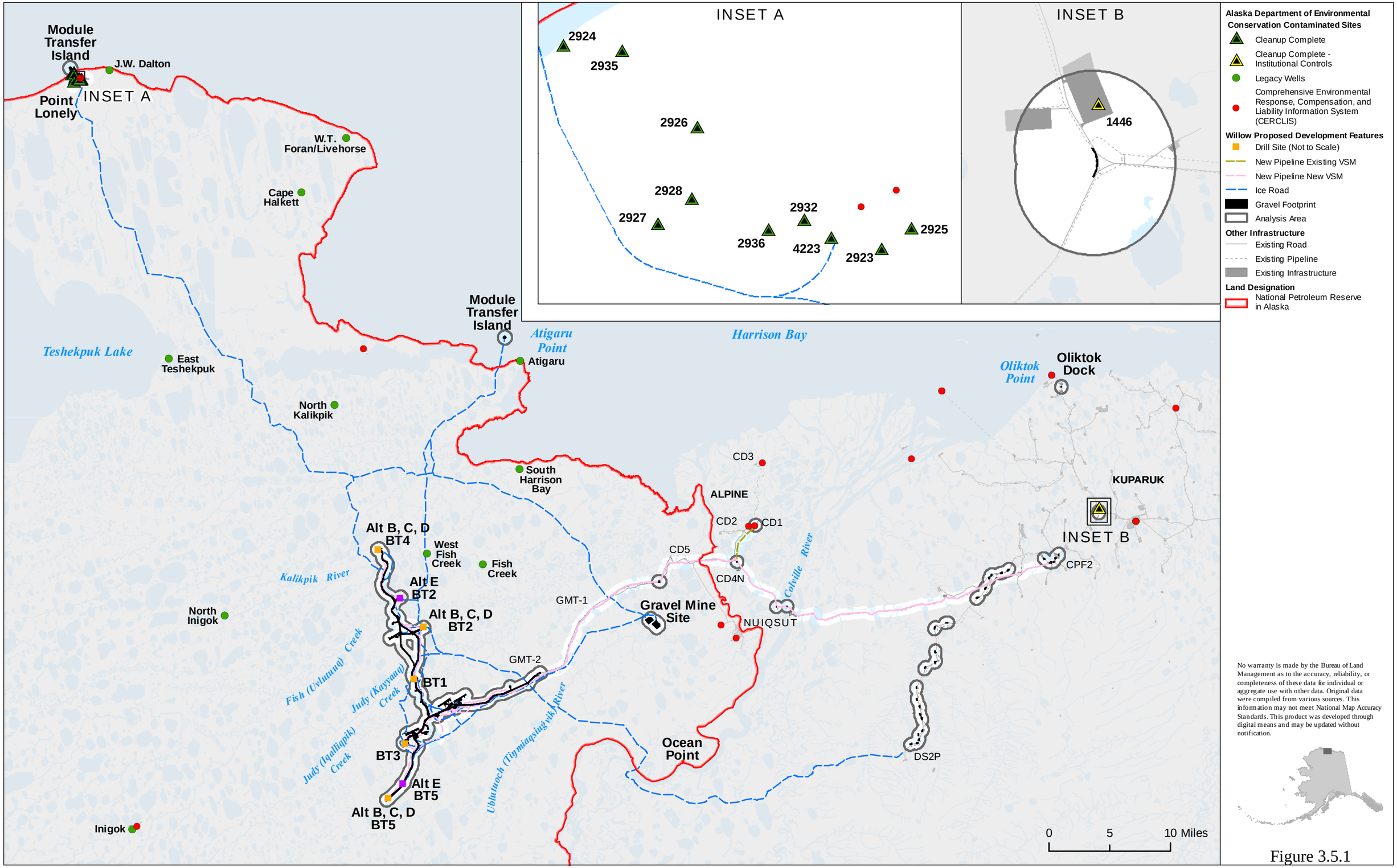





Figure 3.5.1

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Atigaru Point
Teshekpuk Lake
Oliktok Dock
KUPARUK
ALPINE
CD1
CPF2
DEADHORSE
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
BT1
NUIQSUT
Ocean Point
BT3
Alt E BT5
DS2P
Alt B, C, D BT5
To Anchorage or Fairbanks
0 5 10 Miles

**Estimated Flight Path**
- Alternatives
- Option 1
- Option 2

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Option 3 Existing Road
- Gravel Footprint
- Attenuation Zone (Analysis Area)

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska



Figure 3.6.1

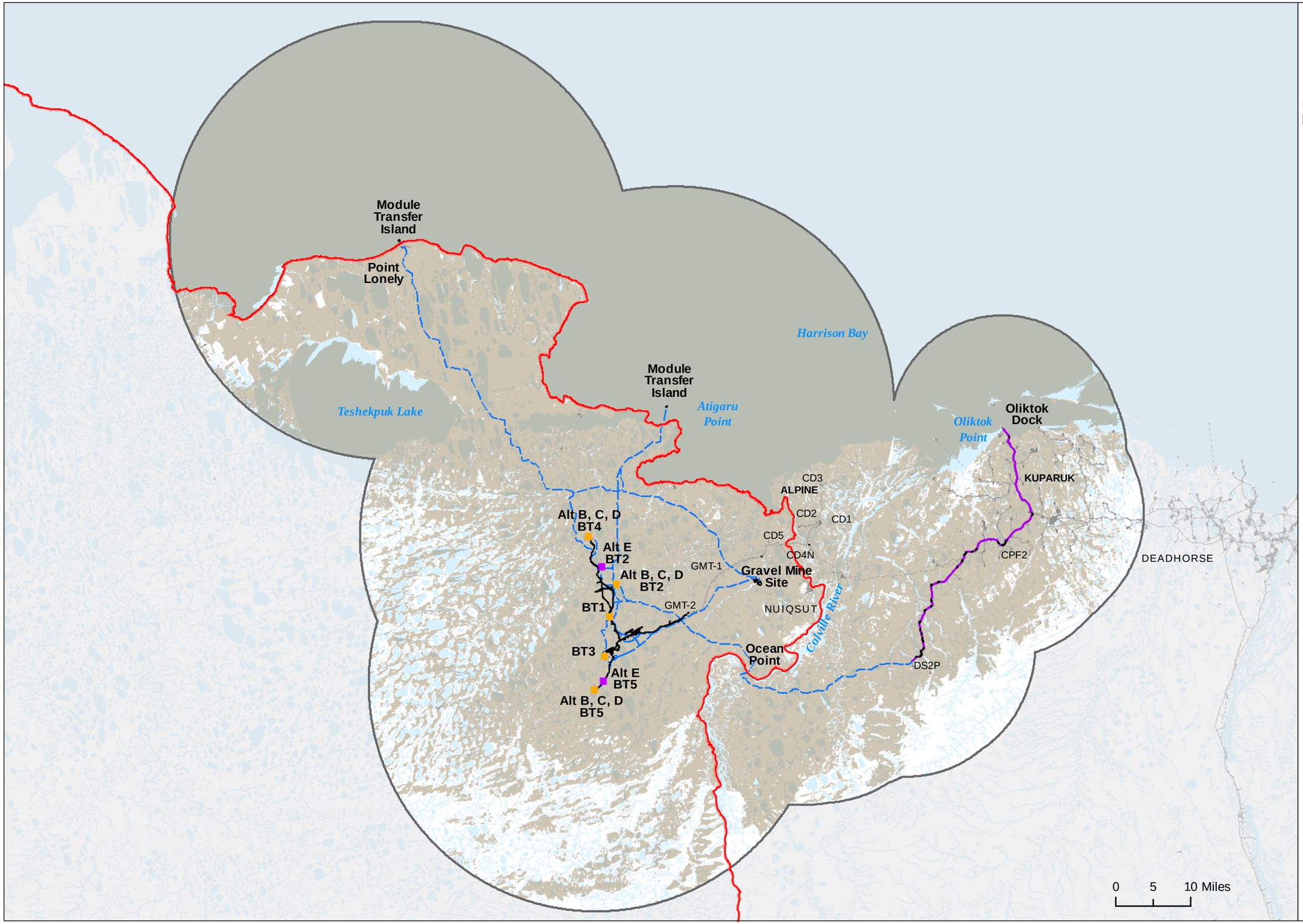





Figure 3.7.1

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Atigaru Point
Teshekpuk Lake
Oliktok Point
Oliktok Dock
KUPARUK
CD3 ALPINE
CD2
CD1
CD5
CD4N
CPF2
DEADHORSE
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
GMT-1
Gravel Mine Site
BT1
GMT-2
NUIQSUT
Colville River
BT3
Ocean Point
DS2P
Alt E BT5
Alt B, C, D BT5
0 5 10 Miles

**Visual Resource Inventory**
**Scenic Quality Classes**
- A
- B
- C
- Analysis Area

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.7.2

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
CPF2
DEADHORSE
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
GMT-1
Gravel Mine Site
BT1
GMT-2
NUIQSUT
Colville River
BT3
Ocean Point
Alt E BT5
Alt B, C, D BT5
DS2P
0 5 10 Miles

**Visual Resources Inventory**
**Sensitivity Levels**
- High
- Moderate
- Analysis Area

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.7.3

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
CPF2
DEADHORSE
Alt B, C, D
BT4
Alt E
BT2
Alt B, C, D
BT2
GMT-1
Gravel Mine Site
BT1
GMT-2
NUIQSUT
Colville River
BT3
Ocean Point
DS2P
Alt E
BT5
Alt B, C, D
BT5
0 5 10 Miles

**Visual Resource Inventory**
**Distance Zones**
- Foreground
- Background
- Seldom Seen
- Analysis Area

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.7.4

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Oliktok Dock
Oliktok Point
CD3
ALPINE
KUPARUK
CD2
CD1
Alt B, C, D BT4
CD5
Alt E BT2
CD4N
CPF2
DEADHORSE
GMT-1
Gravel Mine Site
Alt B, C, D BT2
BT1
GMT-2
NUIQSUT
Colville River
BT3
Ocean Point
DS2P
Alt E BT5
Alt B, C, D BT5
0 5 10 Miles

**Visual Resource Inventory Classes**
- II
- III
- IV
- Analysis Area

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.7.5

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
CPF2
DEADHORSE
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
GMT-1
Gravel Mine Site
BT1
GMT-2
NUIQSUT
Colville River
BT3
Ocean Point
DS2P
Alt E BT5
Alt B, C, D BT5
0 5 10 Miles

**Visual Resource Management Class**
**Alt_A**
- VRM Class 2
- VRM Class 3
- VRM Class 4
- Analysis Area

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.7.6

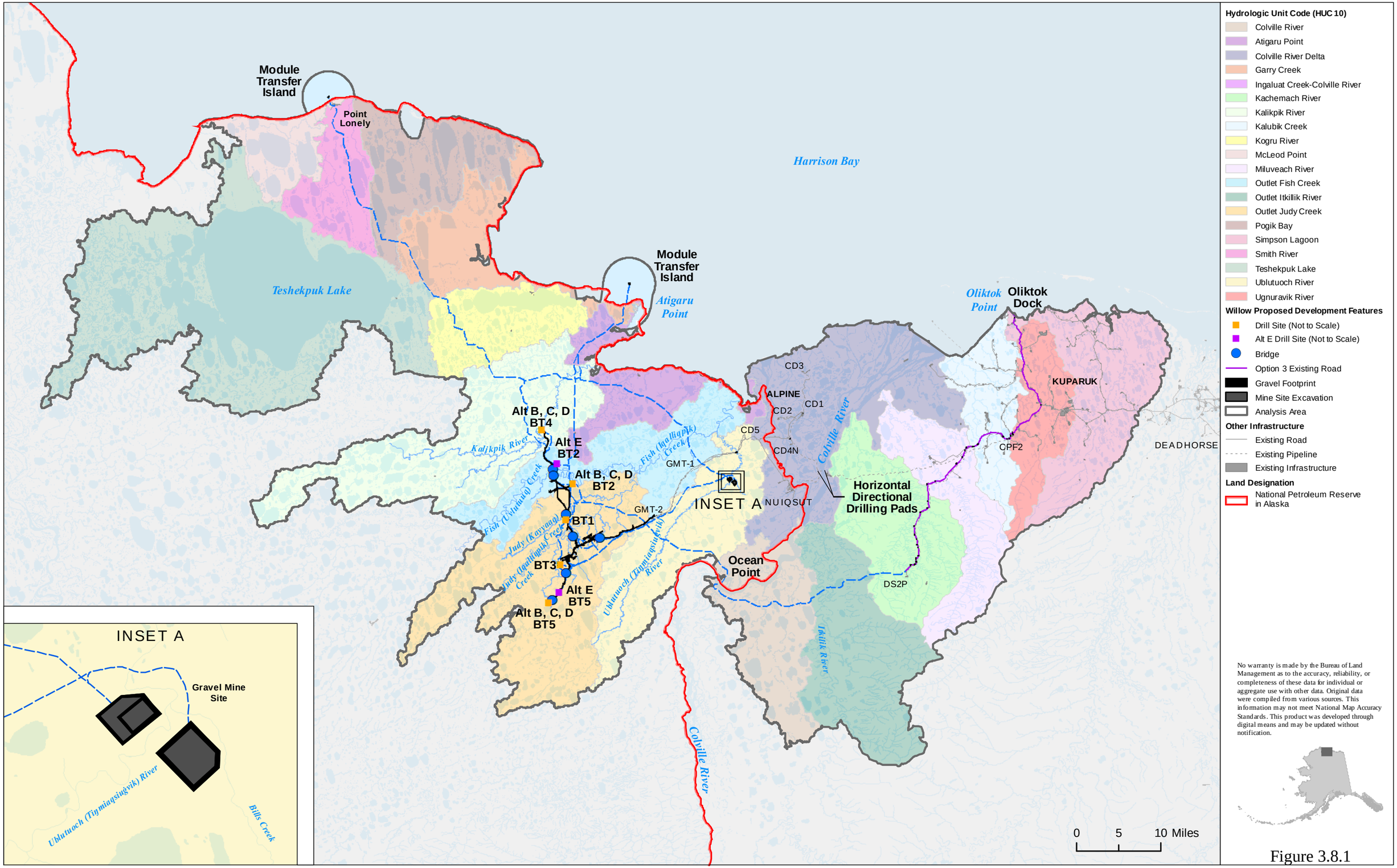



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Figure 3.8.1




Figure 3.8.2

Alt B, C, D BT4
Kalikpik River
Fish Creek Boat Ramp (Alt B and E)
Alt E BT2
Willow Creek #8
Lake M0112
Lake M0235
Alt B, C, D BT2
Fish (Uvlutuuq) Creek
Judy (Iqalliqpik) Creek
Tinmiaqsiuġvik Boat Ramp (Alts B, C, D and E)
CD5
ALPINE
CD2
CD1
CD4N
Horizontal Directional Drilling Pads
GMT-1
Gravel Mine Site
Bills Creek
INSET A
NUIQSUT
Colville River
Willow Creek #1
GMT-2
Lake M1253A
BT1
Lake L9911
Judy Creek Boat Ramp (Alt B and E)
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Willow Creek #2
Lake M0015
Lake R0064
Constructed Freshwater Reservoir (Alt B, C, and D)
BT 3
Willow Creek #4
Willow Creek #3
Ocean Point
Alt E BT5
Willow Creek #4A
Alt B, C, D BT5
Ublutuoch (Tipmiaqsiugvik) River
0 2.5 5 Miles

INSET A
Gravel Mine Site
Ublutuoch (Tipmiaqsiugvik) River
Bills Creek
0 0.5 1 Miles

**Floodplain**
- 50-Year
- 100-Year

**Willow Area Streams**
- Unnamed Stream (Willow Creek #)
- Named Streams

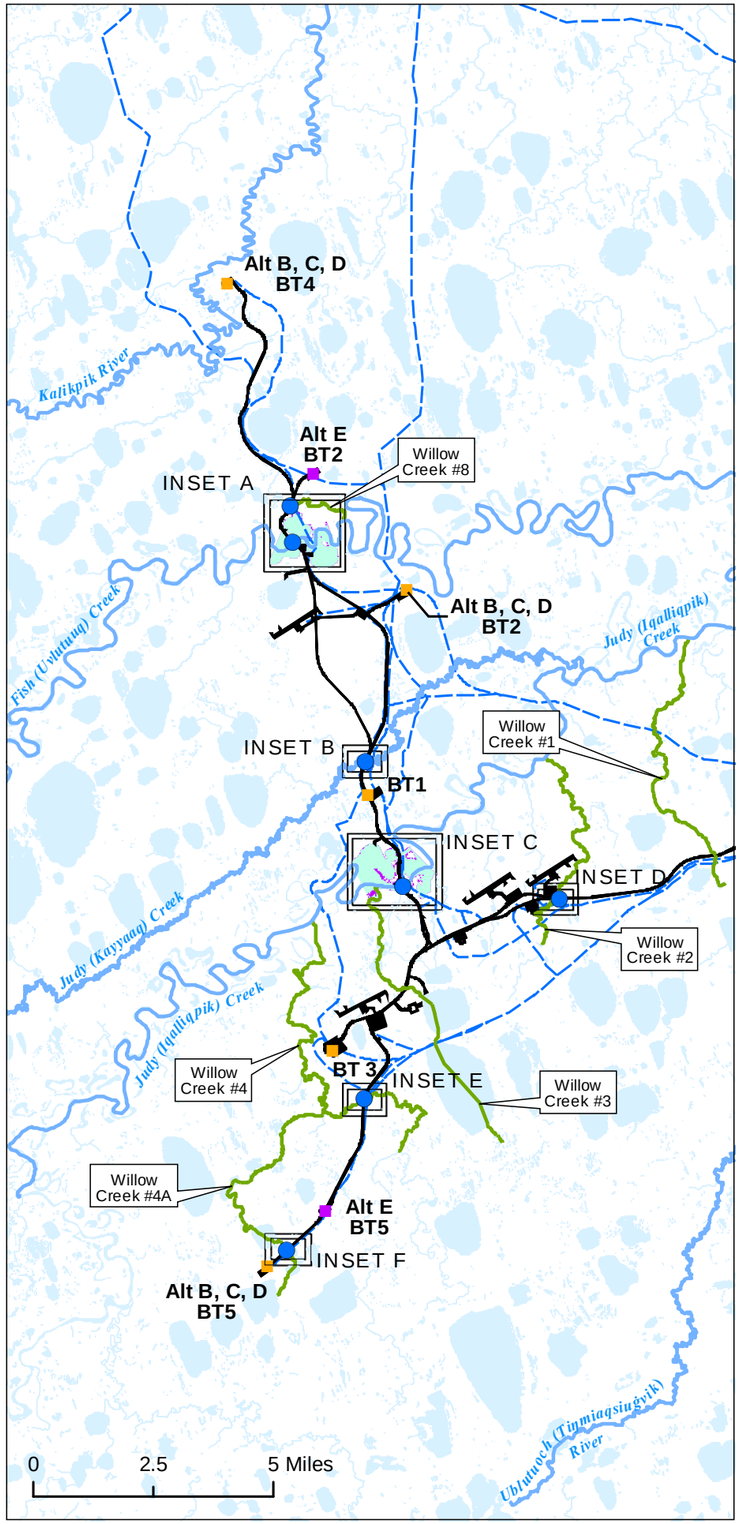
**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Bridge
- Ice Road
- Gravel Footprint
- Mine Site Excavation
- Multi-Season Ice Pad

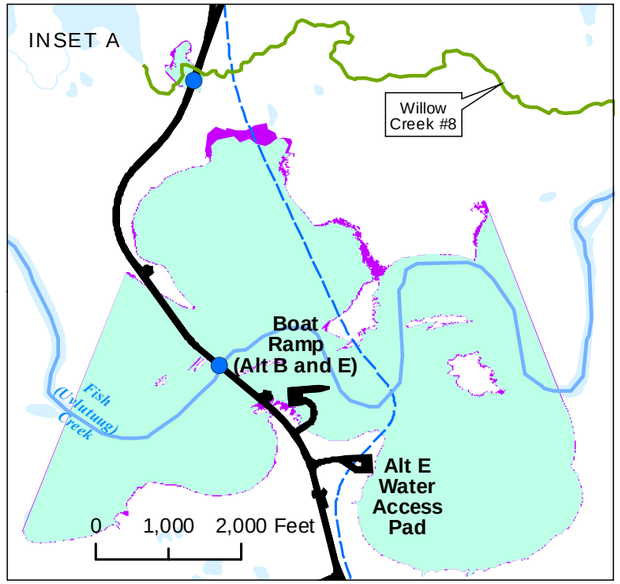
**Land Designation**
- National Petroleum Reserve in Alaska

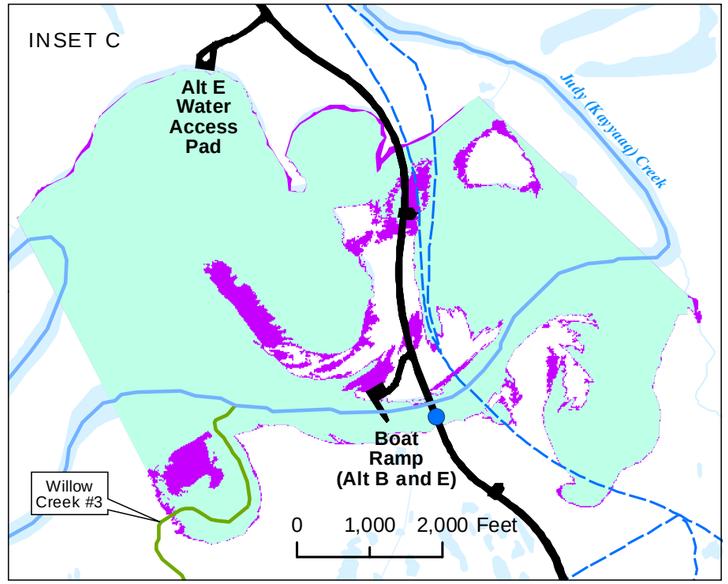
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

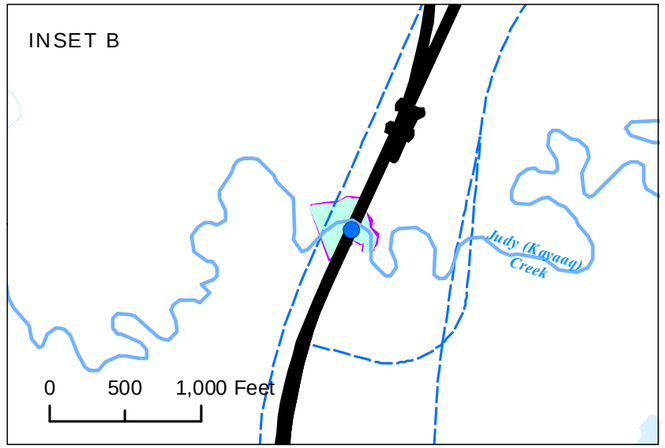


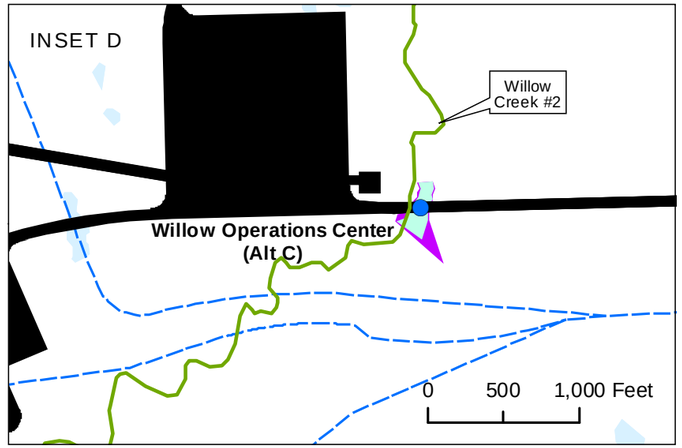
Figure 3.8.3

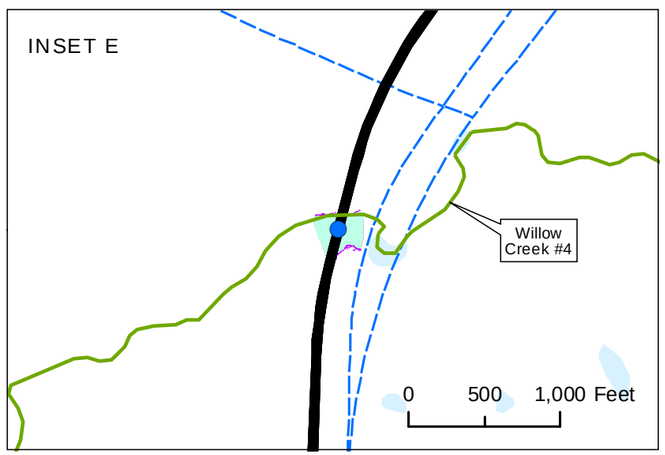


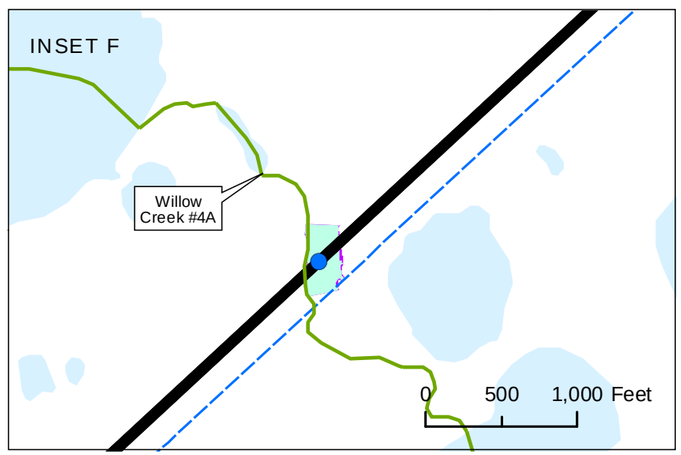




**Floodplain**
- 50-Year
- 100-Year

**Willow Area Streams**
- Unnamed Stream (Willow Creek #)
- Named Streams

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Bridge
- Ice Road
- Gravel Footprint



Figure 3.8.4

Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
KUPARUK
CPF2
DEADHORSE
Colville River
GMT-1
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
BT1
BT3
Alt E BT5
Alt B, C, D BT5
Kalikpik River
Fish (Uyluraiq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Fish (Iqalliqpik) Creek
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
DS2P
Itkillik River
Colville River
0 5 10 Miles

INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek

**Waterbodies**
- Winter Liquid Water Availability

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Bridge
- Option 3 Existing Road
- Gravel Footprint
- Mine Site Excavation
- Analysis Area

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

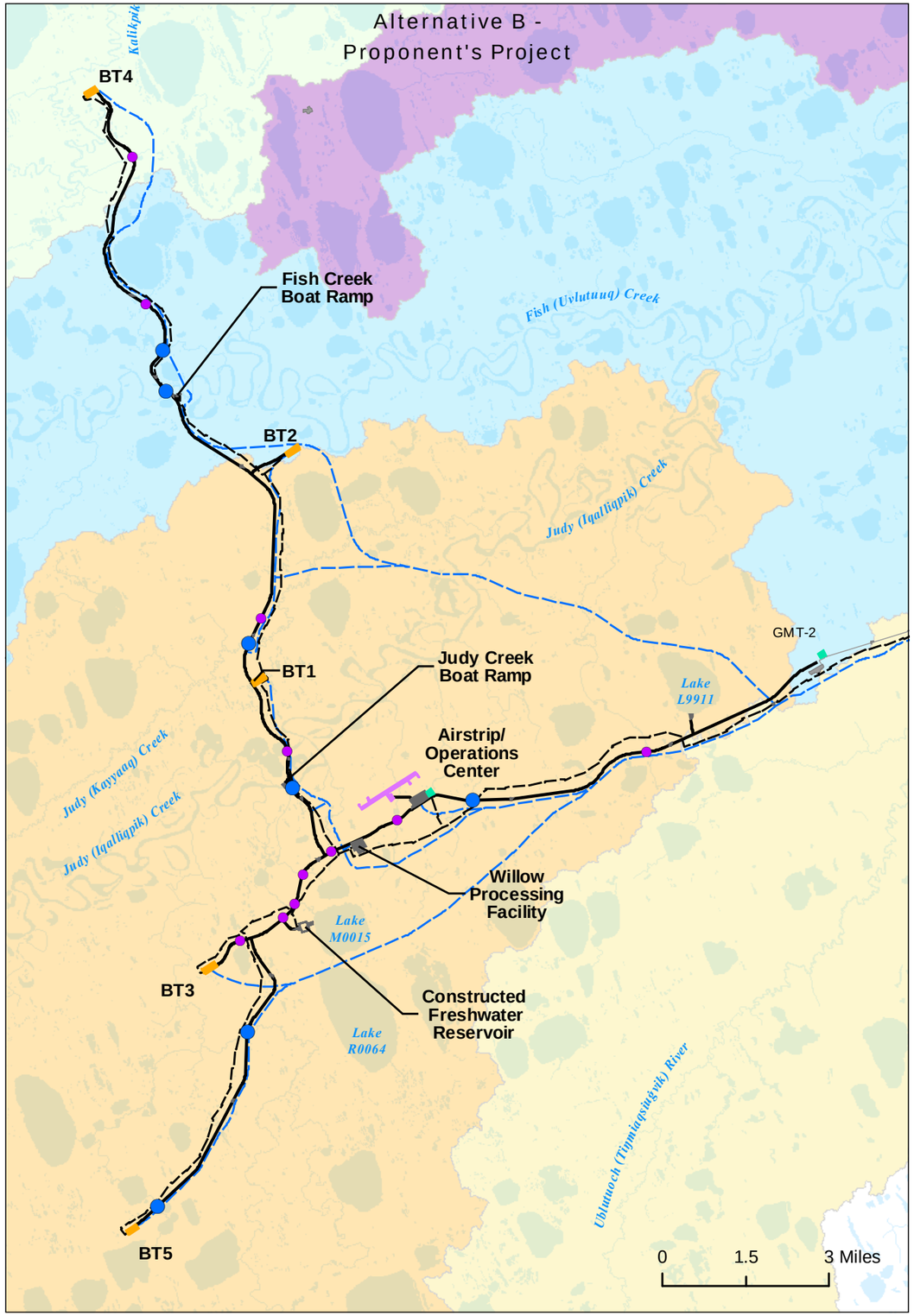
**Land Designation**
- National Petroleum Reserve in Alaska

Data Source:
North Slope Science Initiative (2011)

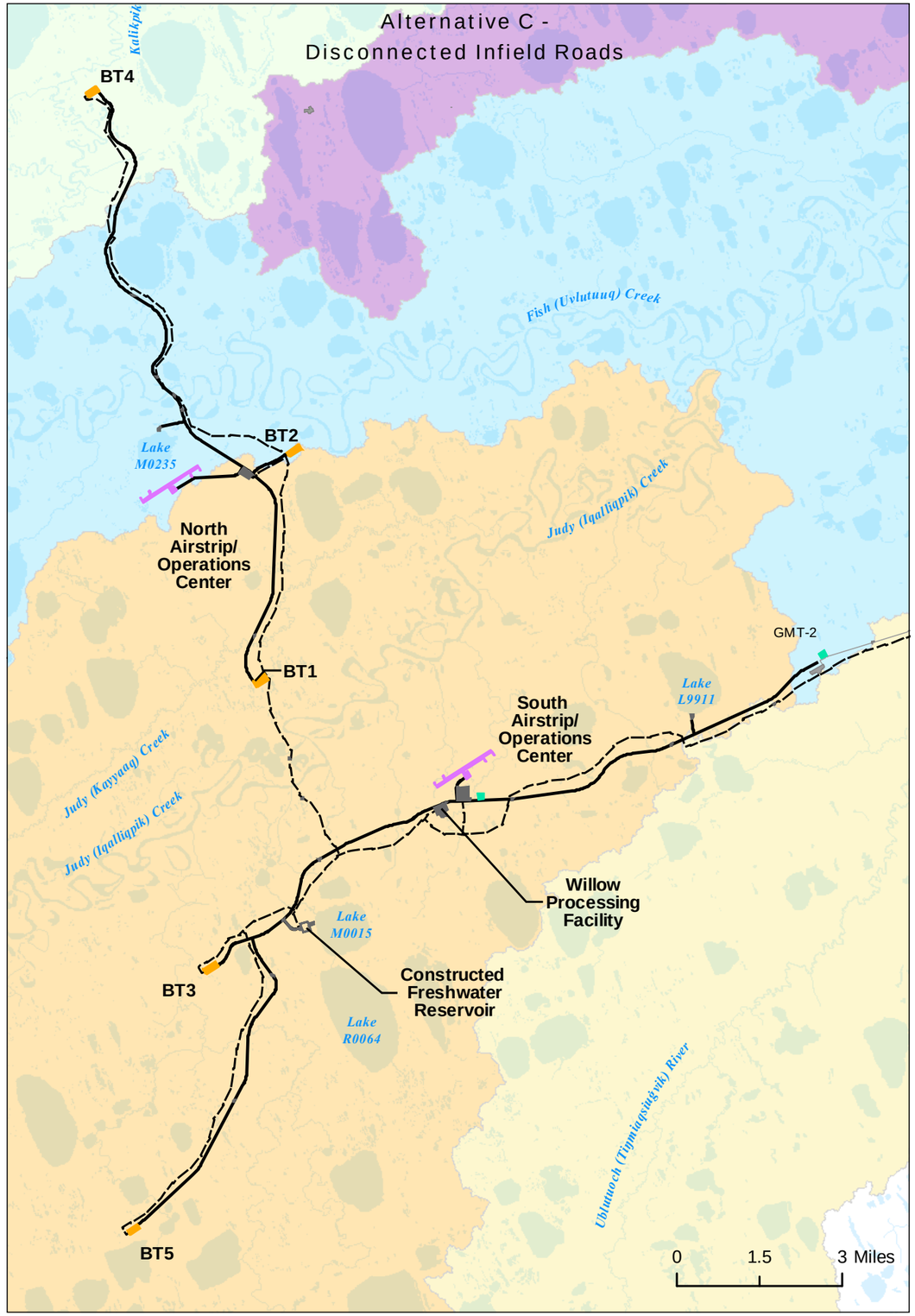


Figure 3.8.5

## Alternative B - Proponent's Project




## Alternative C - Disconnected Infield Roads



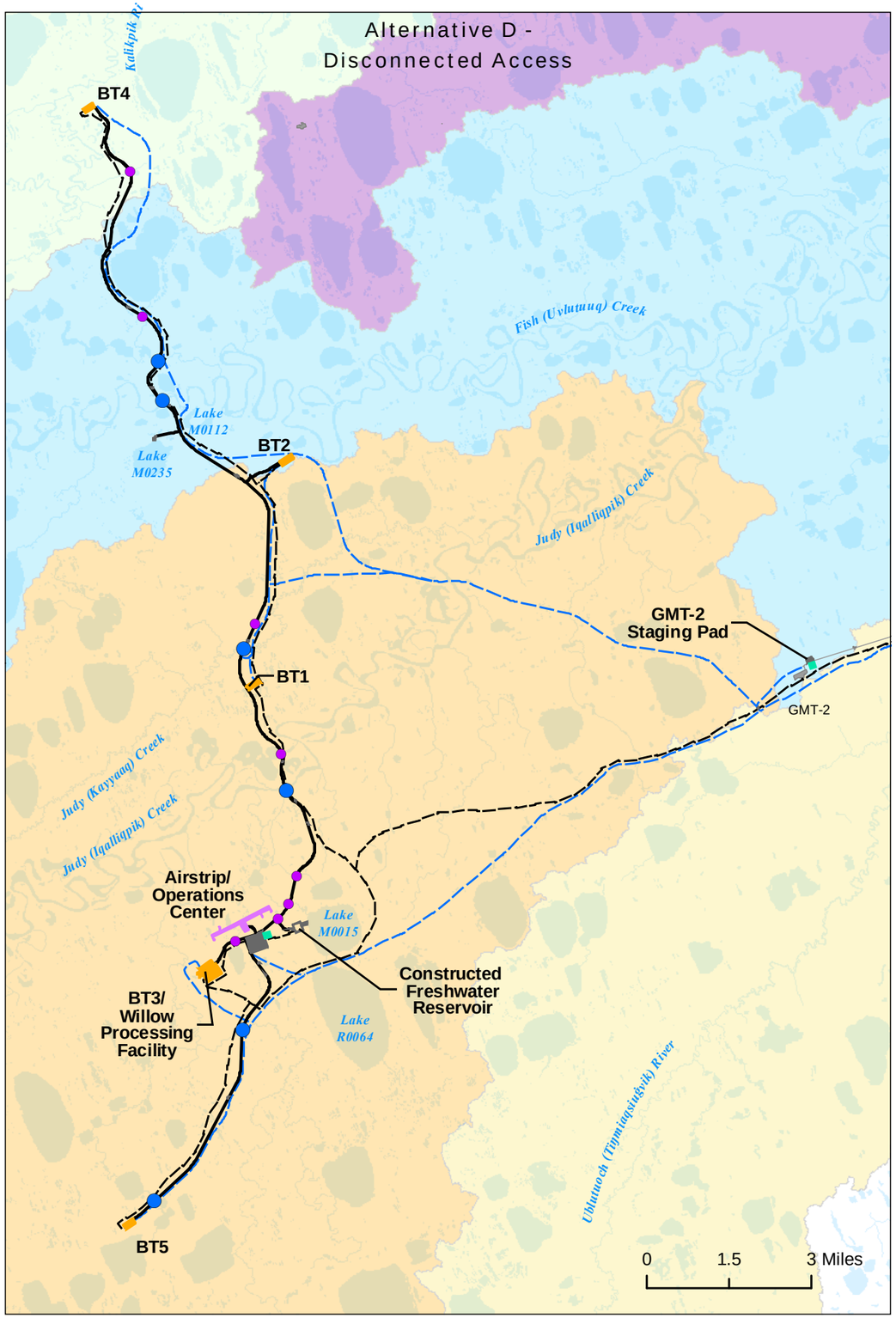

**United States Geological Survey**
**Hydrologic Unit Code (HUC 10)**
- Atigaru Point
- Kalikpik River
- Outlet Fish Creek
- Outlet Judy Creek
- Ublutuoch River

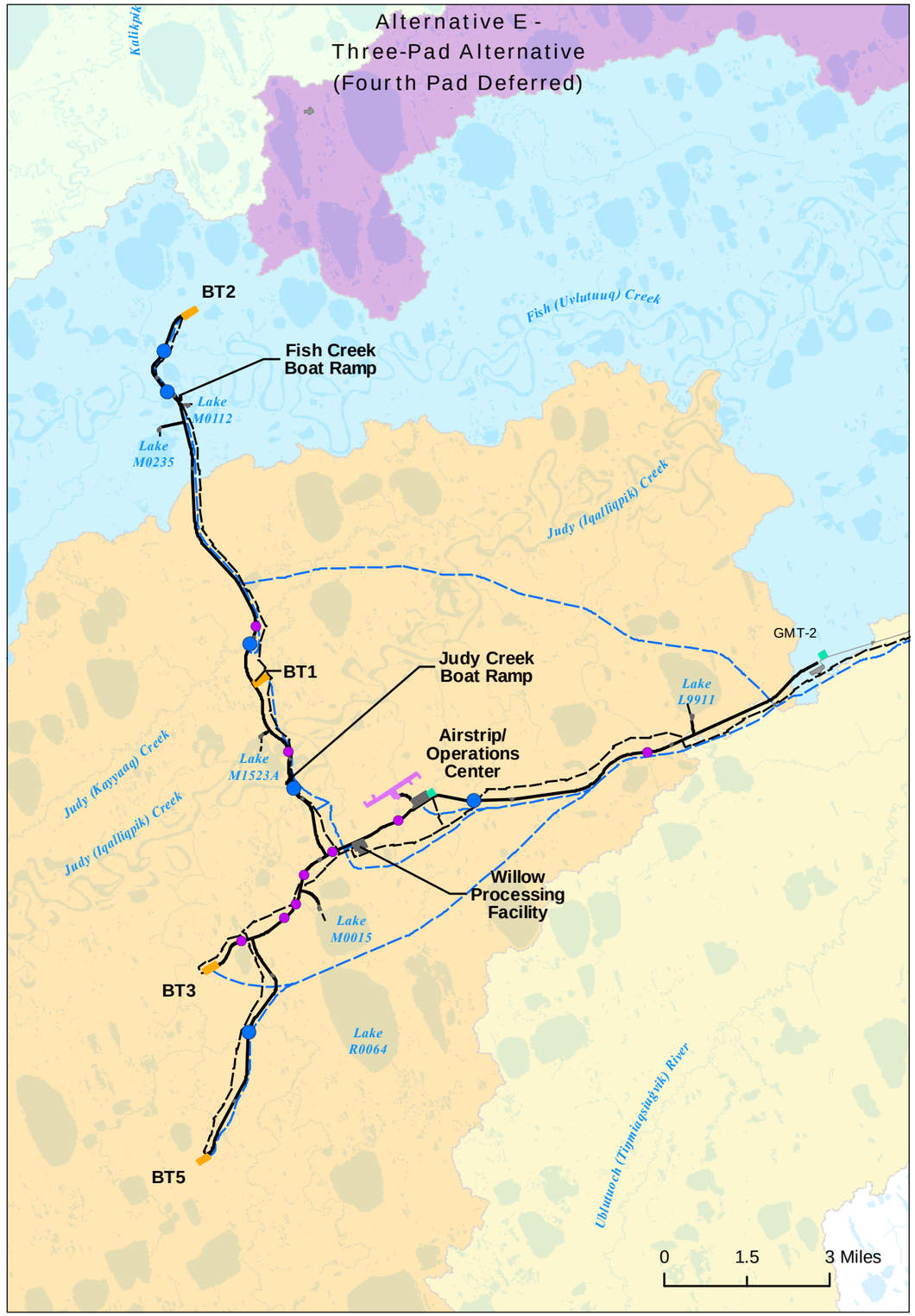
**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.8.6A



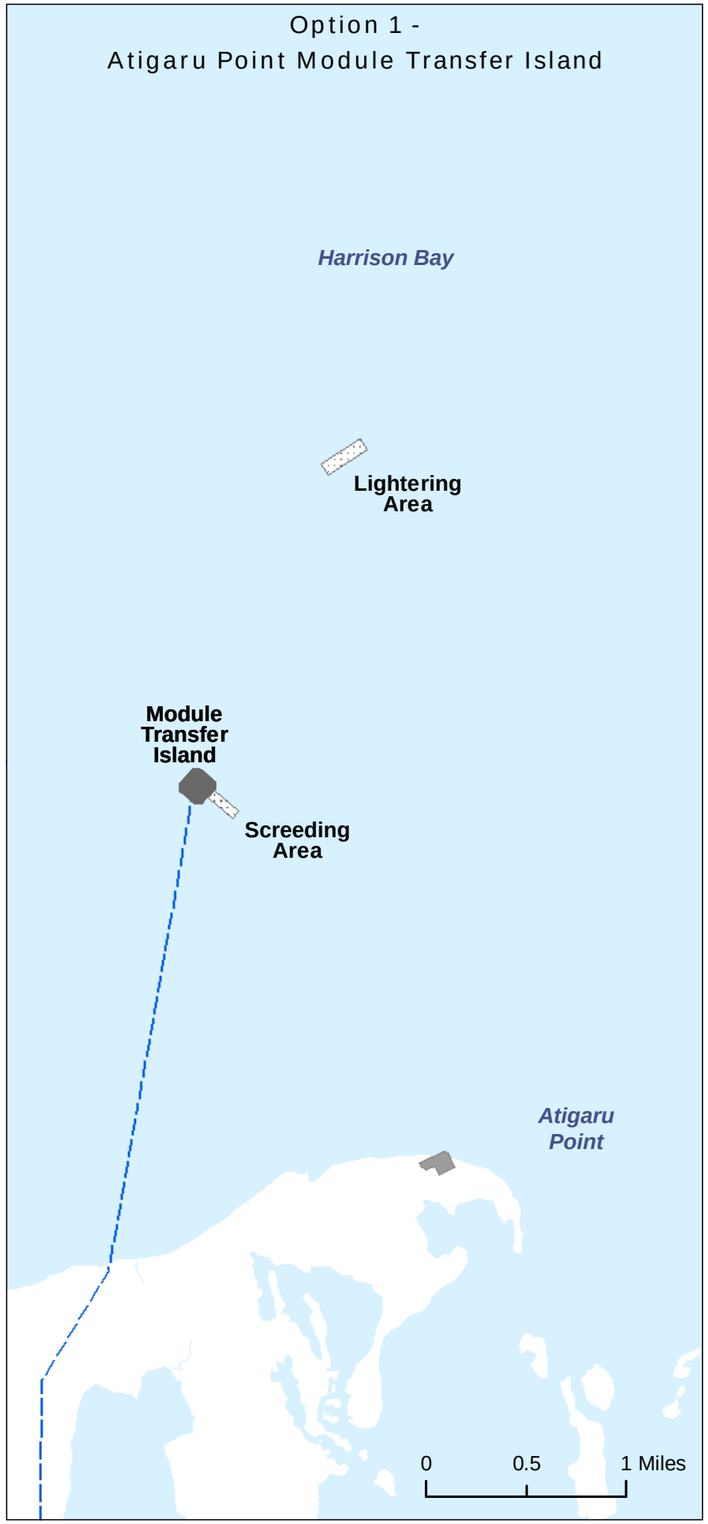

United States Geological Survey
Hydrologic Unit Code (HUC 10)
- Atigaru Point
- Kalikpik River
- Outlet Fish Creek
- Outlet Judy Creek
- Ublutuoch River

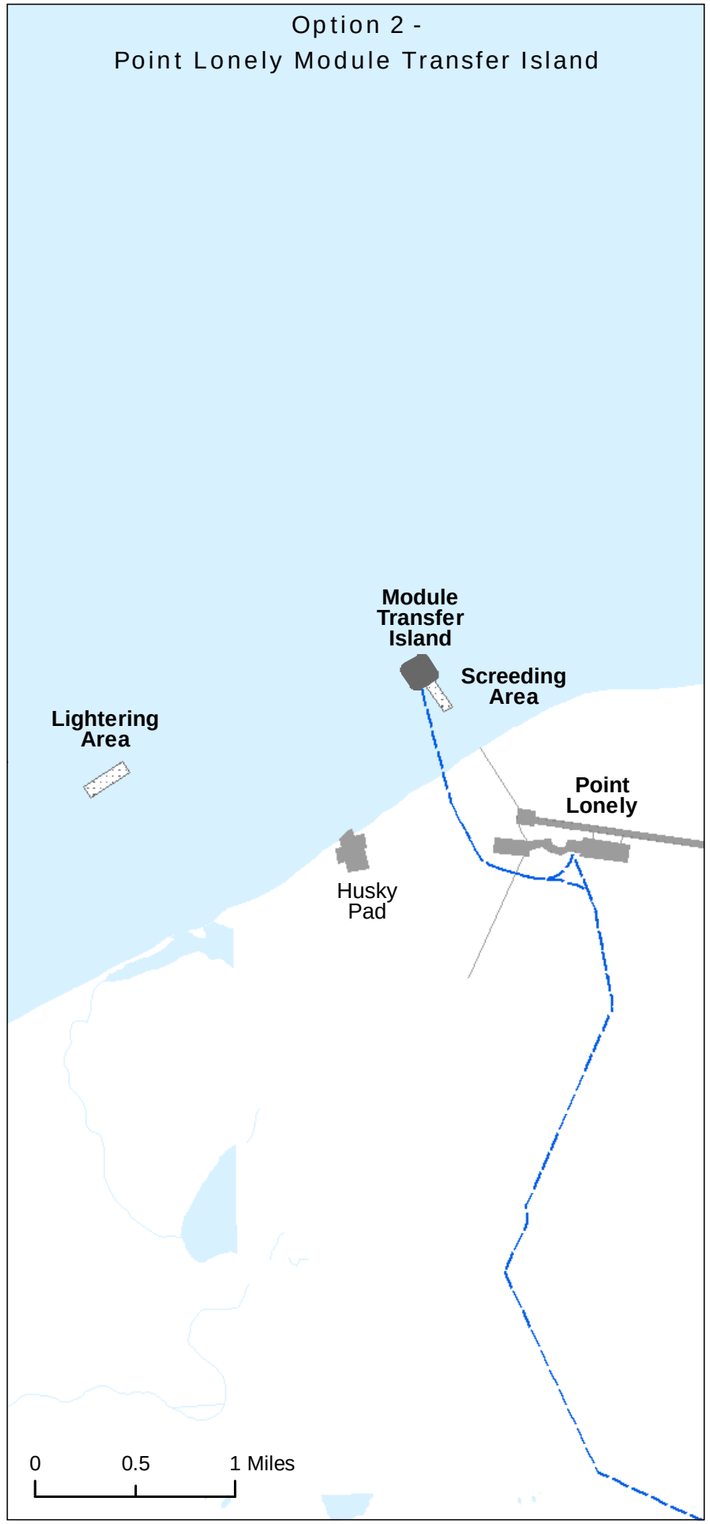
Willow Proposed Development Features
- Culverty Battery
- Bridge
- Gravel Road
- Pipeline
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.8.6B





**Willow Proposed Development Features**

- Ice Road
- Module Transfer Island
- Screeding

**Other Infrastructure**

- Existing Road
- Existing Pipeline
- Existing Infrastructure

Note:
1. Oliktok Dock activity would occur under all action alternatives and Option 3: Colville River Crossing.



Figure 3.8.7

Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
CD3
ALPINE
CD2
CD1
CD5
CD4N
KUPARUK
CPF2
DEADHORSE
Colville River
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
Kalikpik River
Fish (Isatlilqpik) Creek
GMT-1
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
Fish (Usviuuuq) Creek
GMT-2
BT1
Judy (Kayyaaq) Creek
Judy (Isatlilqpik) Creek
BT3
Alt E BT5
Alt B, C, D BT5
Ublutuoch (Tiŋmiaqsiugvik) River
Ocean Point
DS2P
Itkillik River
0 5 10 Miles

INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiugvik) River
Bills Creek

**Hydrologic Unit Code (HUC 10)**
- Colville River
- Atigaru Point
- Colville River Delta
- Garry Creek
- Ingaluat Creek-Colville River
- Kachemach River
- Kalikpik River
- Kalubik Creek
- Kogru River
- McLeod Point
- Miluveach River
- Outlet Fish Creek
- Outlet Itkillik River
- Outlet Judy Creek
- Pogik Bay
- Simpson Lagoon
- Smith River
- Teshekpuk Lake
- Ublutuoch River
- Ugnuravik River

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Bridge
- Ice Road
- Option 3 Existing Road
- Gravel Footprint
- Mine Site Excavation
- Analysis Area

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska



Figure 3.9.1

Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
CPF2
DEADHORSE
Colville River
Alt B, C, D BT4
Alt E BT2
Alt B, C, D BT2
BT1
BT3
Alt E BT5
Alt B, C, D BT5
Kalikpik River
Fish (Uqalliqpik) Creek
Judy Creek
GMT-1
GMT-2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
Ocean Point
DS2P
Itkillik River
0 5 10 Miles

INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiugvik) River
Bills Creek

**National Wetlands Inventory**
**Cowardin Class System and Subsystem**
- E1, M1
- E2, M2
- L1, L2
- PEM1, PEM2 - C, F, H Modifiers
- PEM1 - A, B, E Modifiers
- PSS1
- PUB
- PUS
- R2, R3, R5

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Bridge
- Ice Road
- Option 3 Existing Road
- Gravel Footprint
- Mine Site Excavation
- Analysis Area

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska



Figure 3.9.2

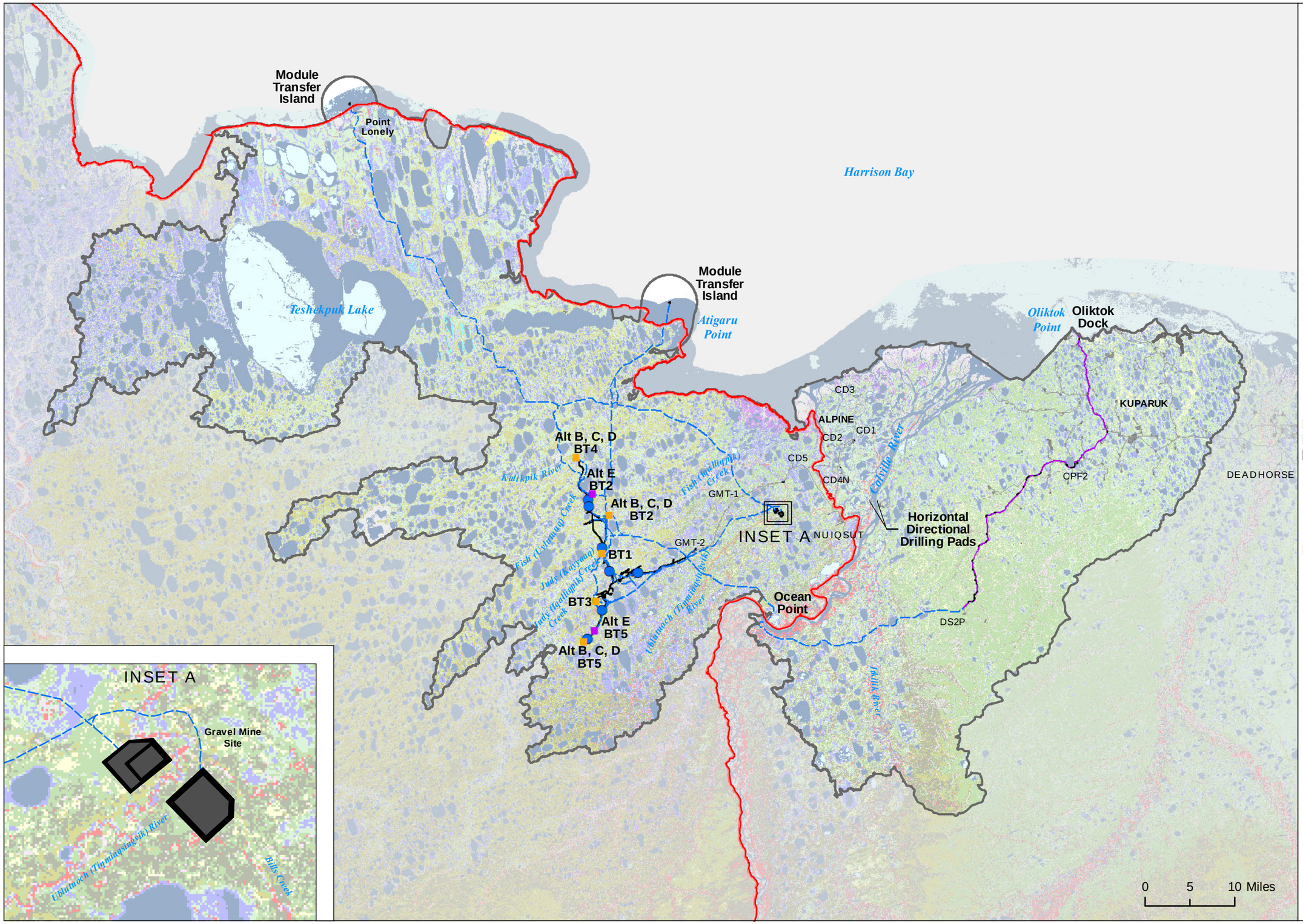





Figure 3.9.3

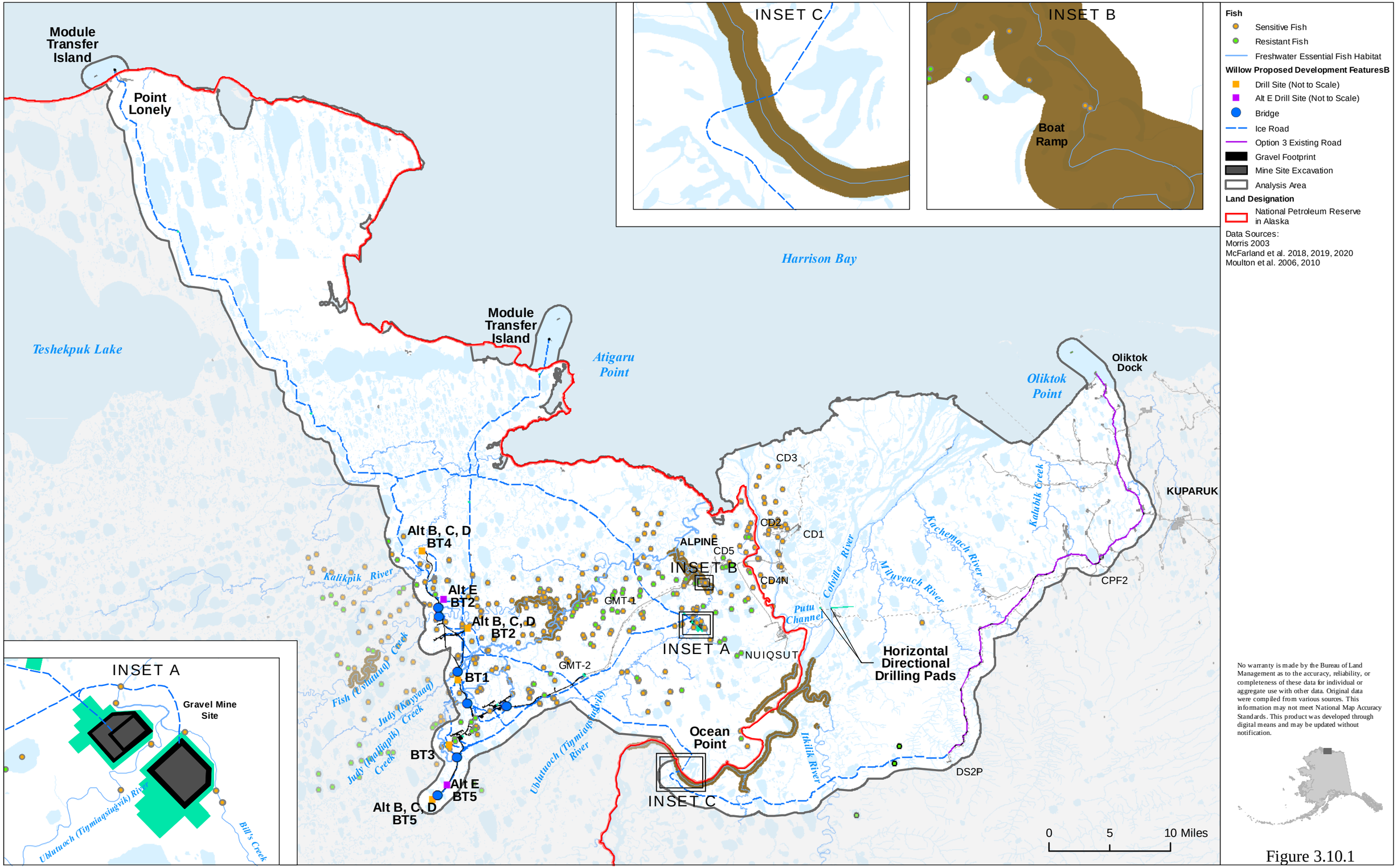
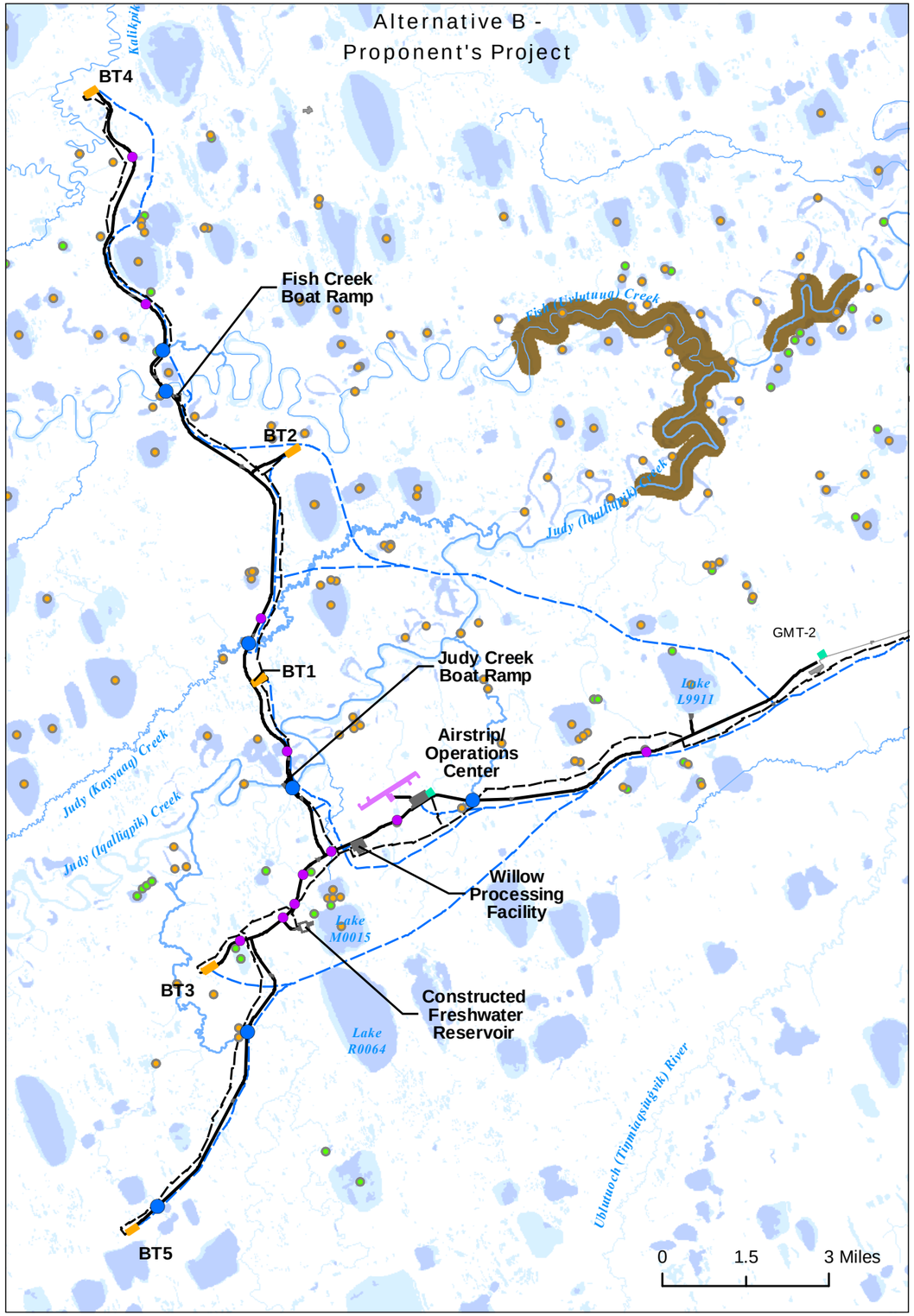
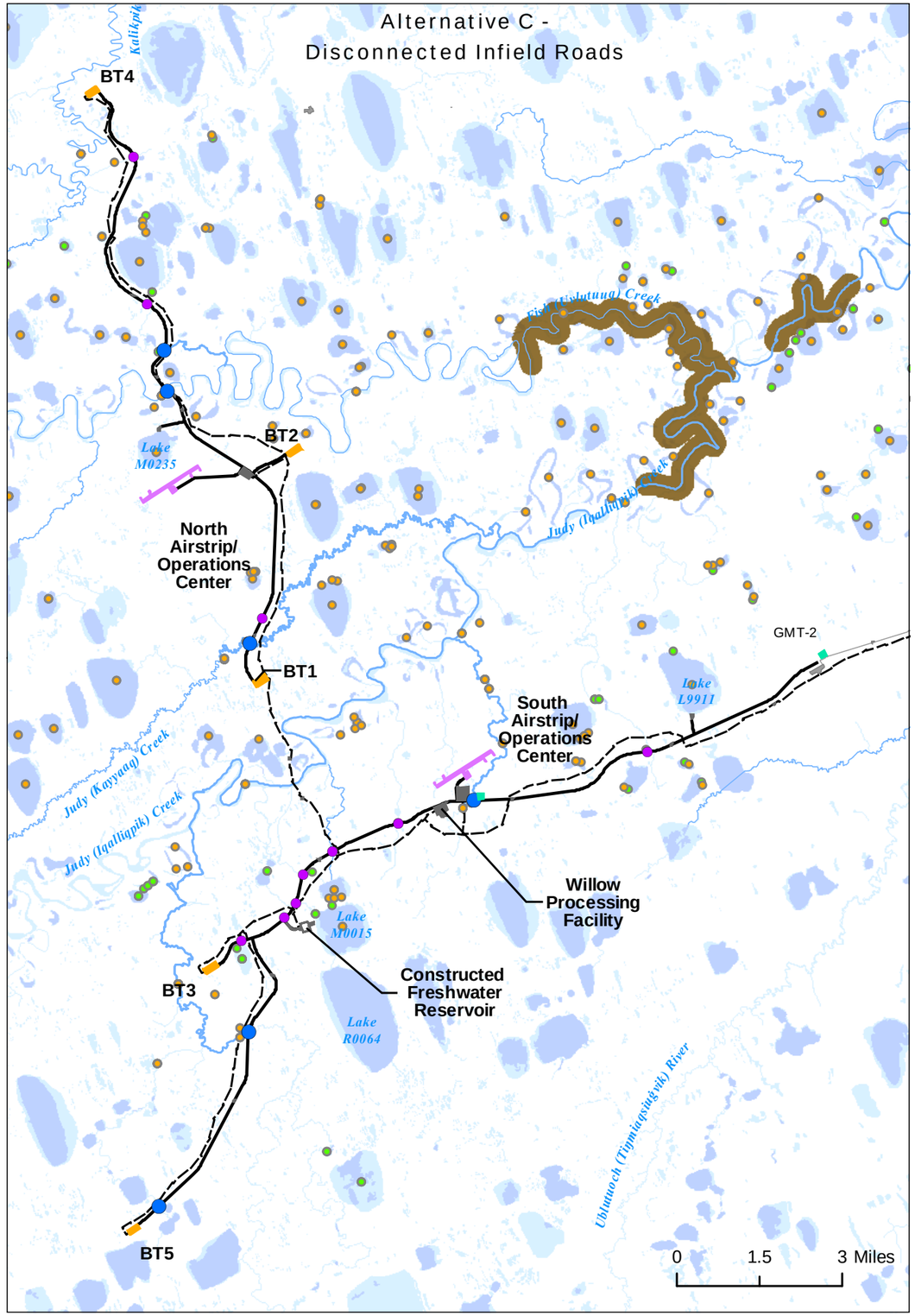





Figure 3.10.1



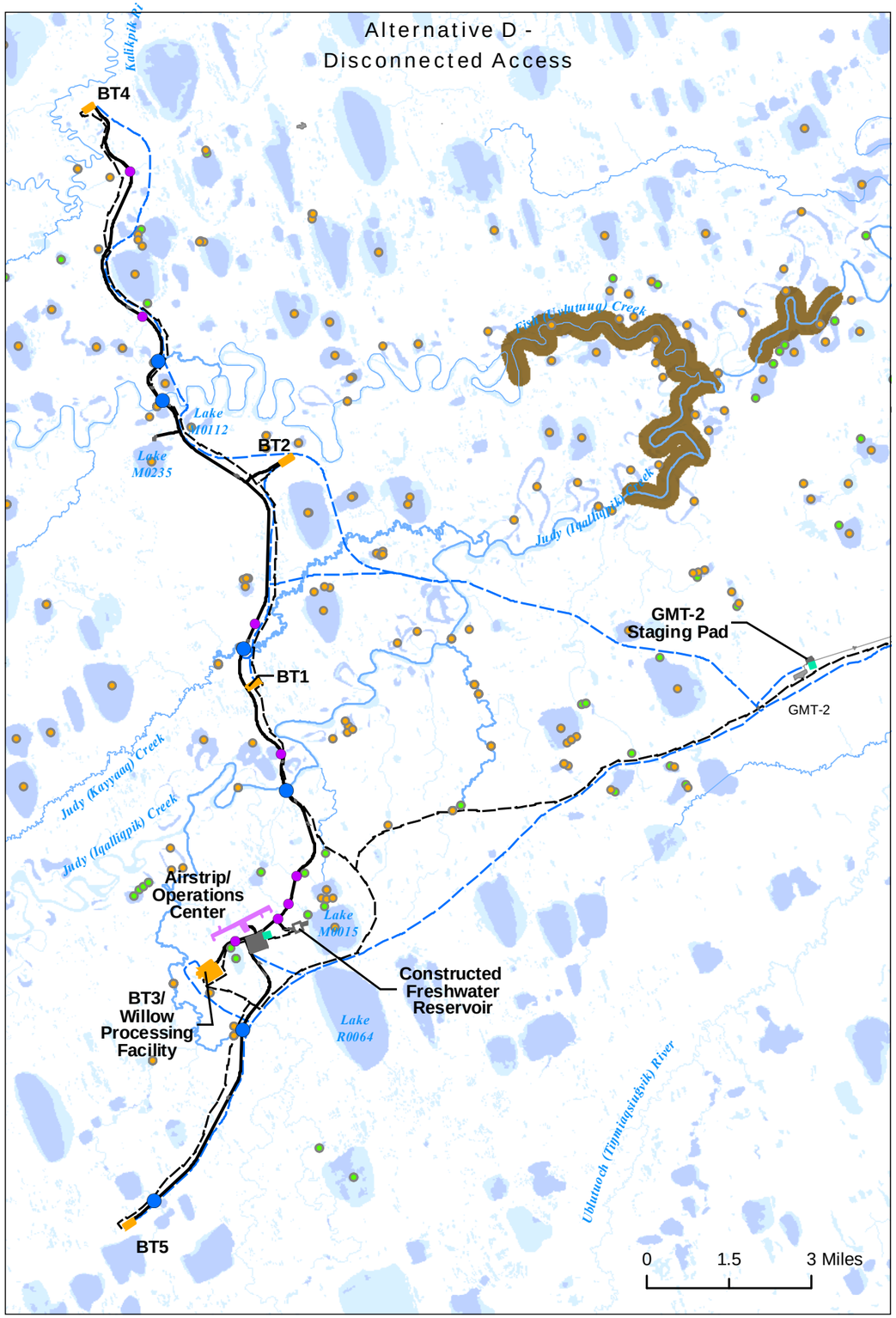

**Fish**
- Sensitive Fish
- Resistant Fish
- Freshwater Essential Fish Habitat
- Overwintering Fish Habitat
- Winter Liquid Water Availability

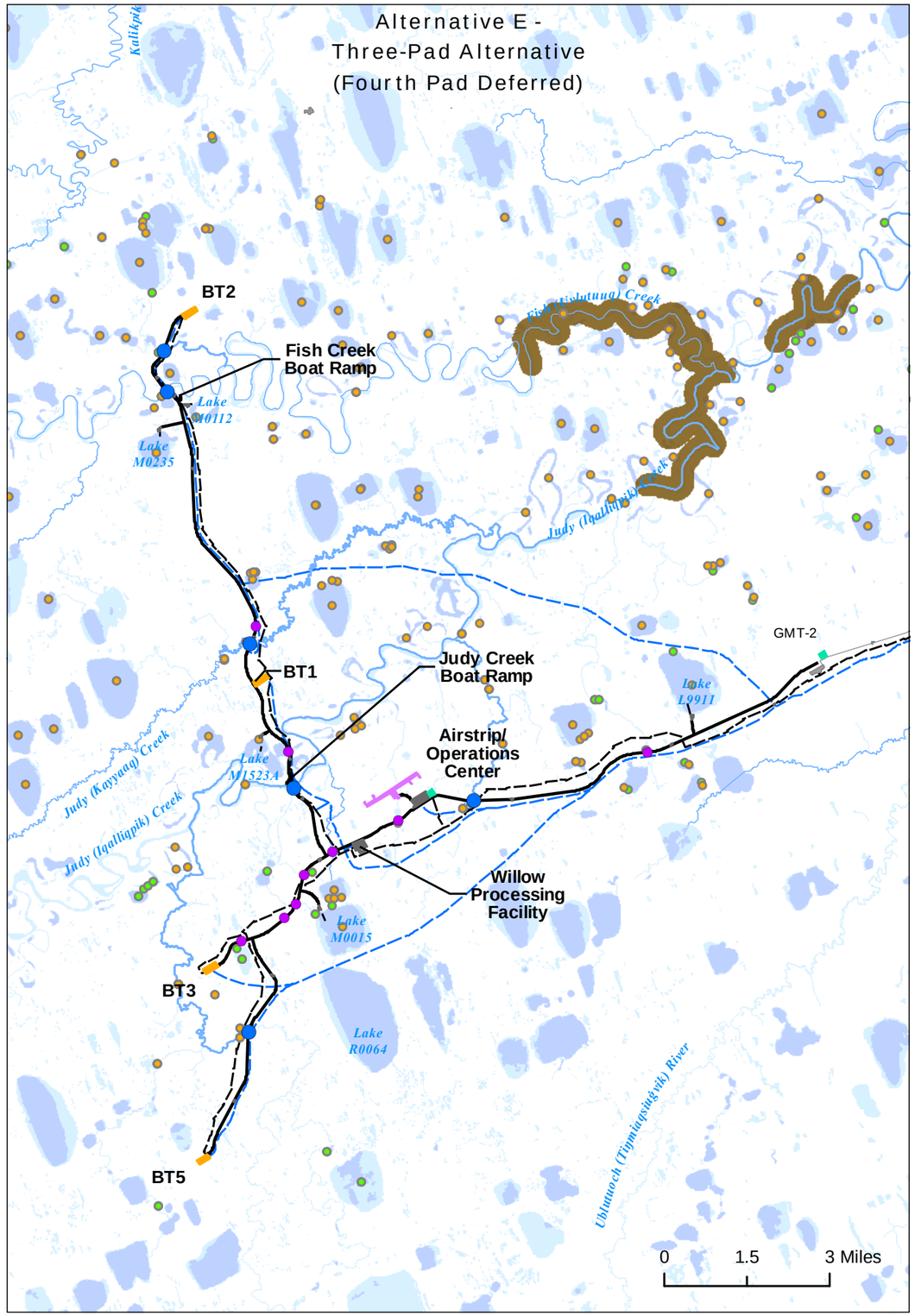
**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.10.2A



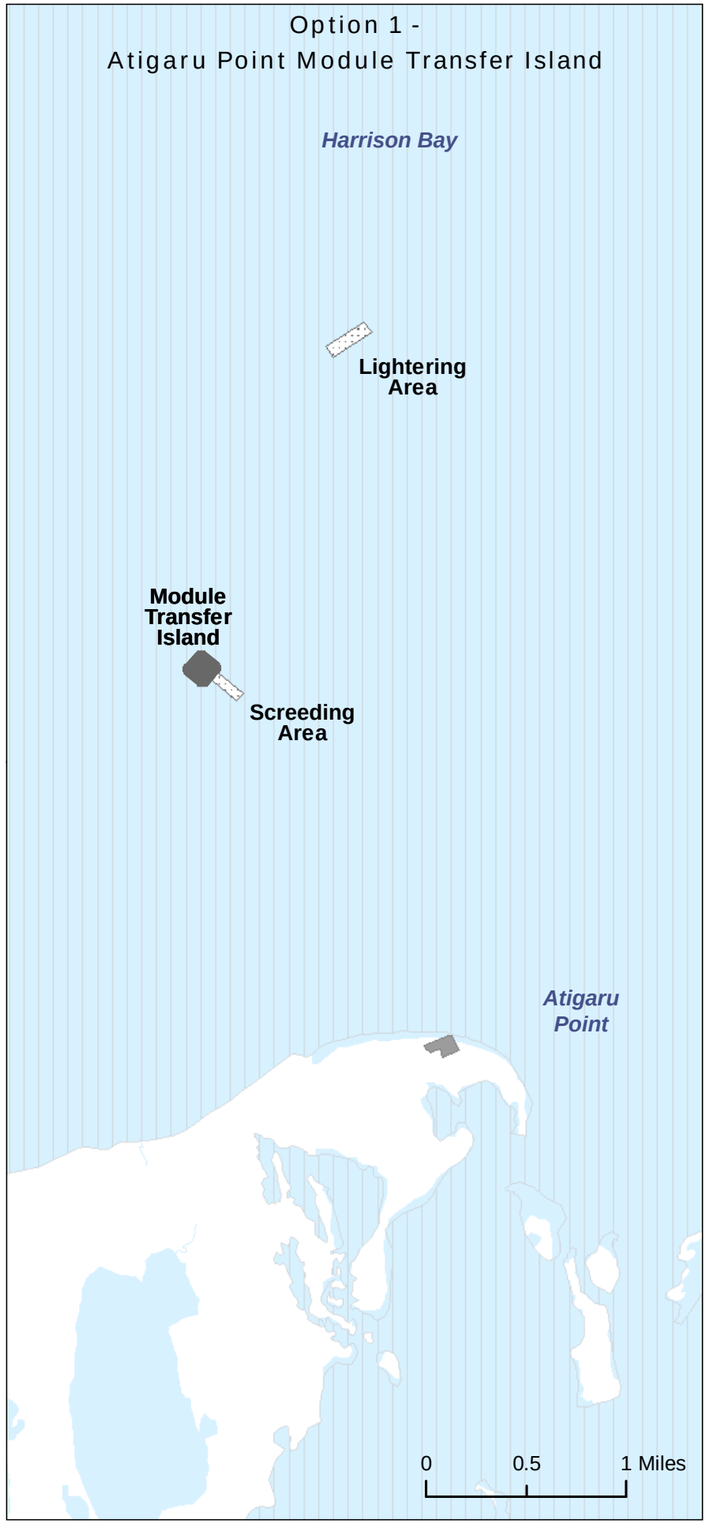

**Fish**
- Sensitive Fish
- Resistant Fish
- Freshwater Essential Fish Habitat
- Overwintering Fish Habitat
- Winter Liquid Water Availability

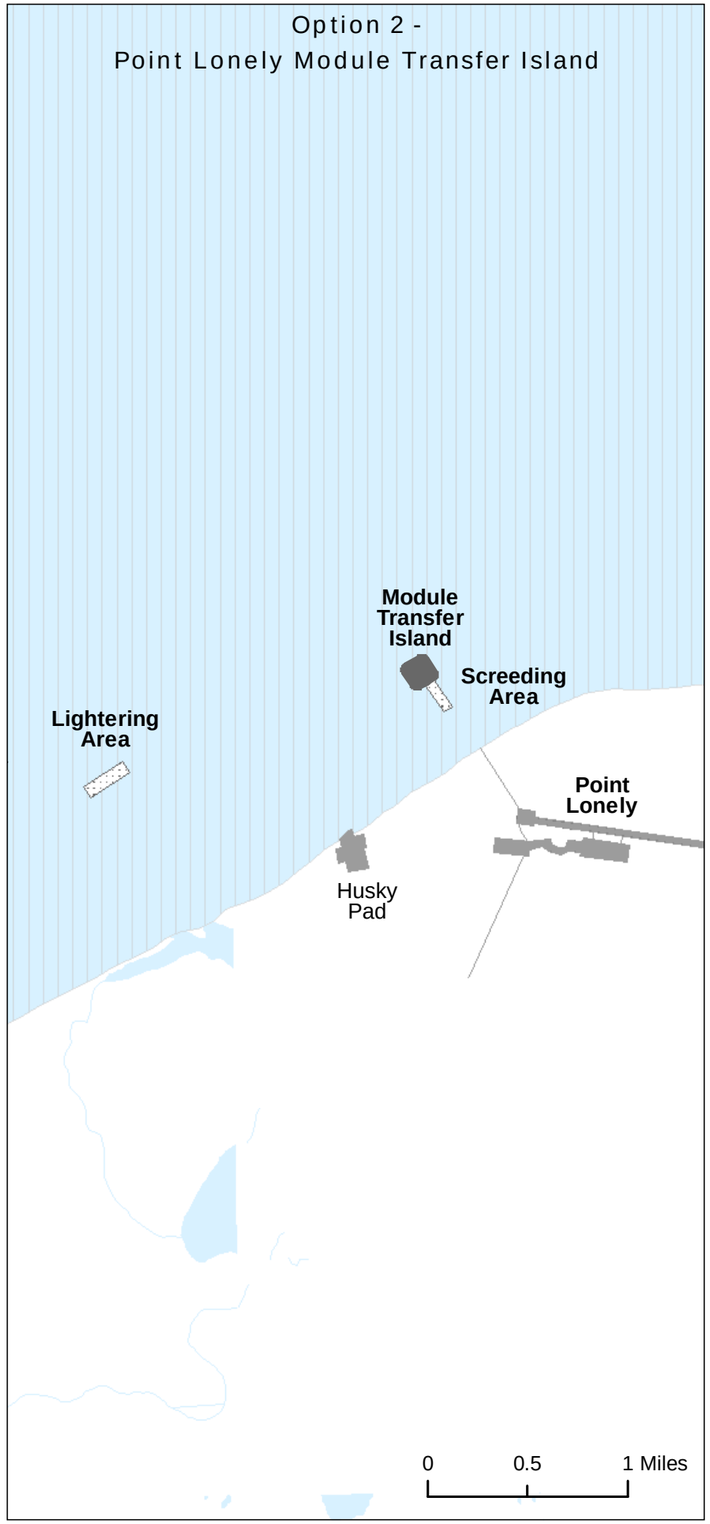
**Willow Proposed Development Features**
- Culverty Battery
- Bridge
- Gravel Road
- Pipeline
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.10.2B





**Fish**

Marine Essential Fish Habitat

**Willow Proposed Development Features**

Screeding

**Other Infrastructure**

Existing Road

Existing Pipeline

Existing Infrastructure

Note:
1. Oliktok Dock activity would occur under all action alternatives and Option 3: Colville River Crossing.



Figure 3.10.3

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Alt B, C, D BT4
Tinmiaqsiugvik Boat Ramp (Alt B, C, D, E)
CD5
Colville River
Mine Site F
CPF2
Mine Site C
Kalikpik River
Alt E BT2
CD4N
GMT-1
INSET A
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
Options 1 and 2 Multi-Season Ice Pad
GMT-2
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
BT1
Judy Creek Boat Ramp (Alt B, E)
Judy (Iqalliqpik) Creek
BT3
Ocean Point
Ublutuoch (Tinmiaqsiugvik) River
DS2P
Alt E BT5
Alt B, C, D BT5
0 5 10 Miles

Multi-Season Ice Pad
INSET A
Gravel Mine Site
Ublutuoch (Tinmiaqsiugvik) River
Bills Creek

**Bird Habitat**

**Number of Species Using**
- 1-10
- 11 - 20
- 21 - 30
- >30

**Best Management Practice Areas**
- K-4a Goose Molting Area

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

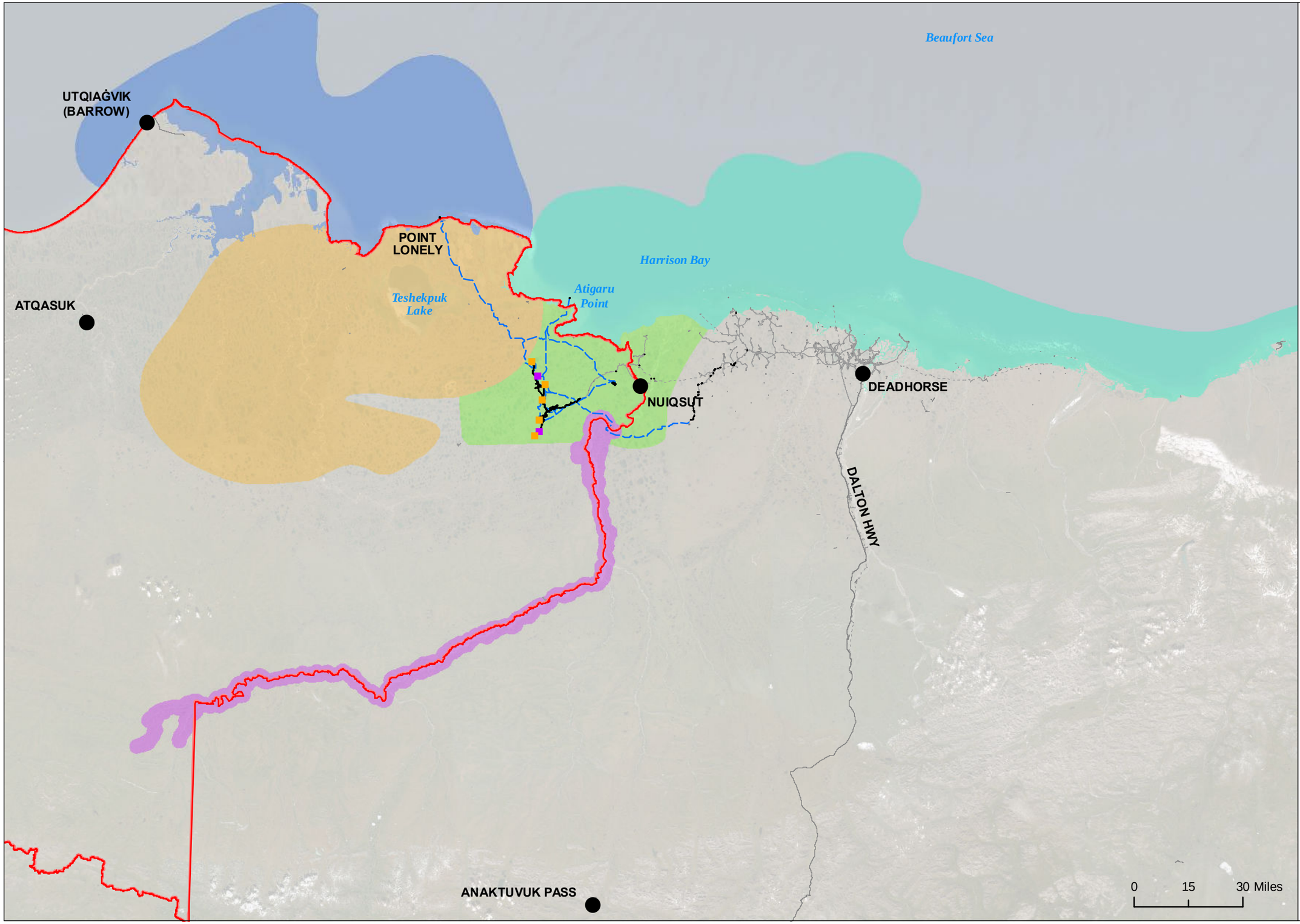
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

Data Source:
Habitat mapping was done by ABR, Inc. for ARCO Alaska, Inc., PhillipsAlaska, Inc. and ConocoPhillips, Alaska, Inc. as part of their baseline environmental studies and NEPA documentation for the Alpine, Tarn, Meltwater, Palm, West Sak Development Area, Kuparuk, GMT1, GMT2, and Willow oil development projects.



Figure 3.11.1




**Important Bird Areas of Alaska**
- Barrow Canyon & Smith Bay
- Beaufort Sea Nearshore
- Colville River Delta
- Lower Colville River
- Teshekpuk Lake Area

**Willow Proposed Development Features**
- Drill Site (Not to Scale)
- Alt E Drill Site (Not to Scale)
- Ice Road
- Gravel Footprint

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Data Source:
Audubon Alaska (2020)



Figure 3.11.2

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Alt B, C, D BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D, E)
CD5
Colville River
Mine Site F
CPF2
Mine Site C
Kalikpik River
Alt E BT2
CD4N
GMT-1
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy Creek Boat Ramp (Alt B, E)
Judy (Iqalliqpik) Creek
BT3
Ocean Point
Alt E BT5
Alt B, C, D BT5
Ublutuoch (Tiŋmiaqsiuġvik) River
DS2P
0 5 10 Miles

INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek

**Spectacled Eider Legend**
- ABR Pre-Breeding Observations 1992-2019
- USFWS Pre-Breeding Observations 1992-2019
- Unsurveyed by USFWS
- Willow Study Area 2017-2019
- Kuparuk Study Area 1993-2015 and 2019
- Colville Study Area 1993-2019

**Estimated June Density, 2012 - 2015 (Birds per square mile)**
- 0 to 0.08
- >0.08 to 0.26
- >0.26 to 0.51
- >0.51 to 0.87
- >0.87 to 2.22
- >2.22

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2016, BLM Unpublished Data
Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned, Stehn et al. 2012 for survey methodology. Remaining portions of NPR-A portrayed in the figure were surveyed in miscellaneous years 1999-2014.



Figure 3.11.3

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Option 1 Multi-Season Ice Pad
Alt B, C, D BT4
Kalikpik River
Alt E BT2
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Options 1 and 2 Multi-Season Ice Pad
BT1
Judy Creek Boat Ramp (Alt B, E)
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
BT3
Alt E BT5
Alt B, C, D BT5
Ublutuoch (Tiŋmiaqsiuġvik) River
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D, E)
GMT-1
GMT-2
Gravel Mine Site
NUIQSUT
CD5
CD4N
CD3
ALPINE
CD2
CD1
Colville River
Horizontal Directional Drilling Pads
Ocean Point
DS2P
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
Mine Site F
CPF2
Mine Site C
0 5 10 Miles

INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek

**Steller's Eider**
- ABR Pre-breeding Observations 1992-2019
- USFWS Pre-Breeding Observations 1992-2019
- Willow Study Area 2017-2019
- Kuparuk Study Area 1993-2015 and 2019
- Colville Study Area 1993-2019

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2019, Unpublished Data.
Refer to Larned, Stehn et al. 2012 for survey methodology. Remaining portions of NE NPR-A portrayed in the figure north and east of the Willow study area were surveyed by ABR in miscellaneous years 1999-2014.



Figure 3.11.4

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Option 1 Multi-Season Ice Pad
Alt B, C, D BT4
Kalikpik River
Alt E BT2
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Options 1 and 2 Multi-Season Ice Pad
BT1
Judy Creek Boat Ramp (Alt B, E)
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
BT3
Alt E BT5
Alt B, C, D BT5
Ublutuoch (Tiŋmiaqsiuġvik) River
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D, E)
GMT-1
GMT-2
INSET A
Gravel Mine Site
NUIQSUT
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Horizontal Directional Drilling Pads
Ocean Point
DS2P
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
Mine Site F
CPF2
Mine Site C
0 5 10 Miles

INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek

**Yellow-Billed Loon**
- Nests
- ROP E-9 Lake/Nest Buffers
- ABR Survey Area 1992 - 2019
- Unsurveyed by USFWS

**Estimated June Density, 2012 - 2015 (Birds per square mile)**
- 0 to 0.05
- >0.05 to 0.16
- >0.16 to 0.31
- >0.31 to 0.50
- >0.50 to 1.30

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

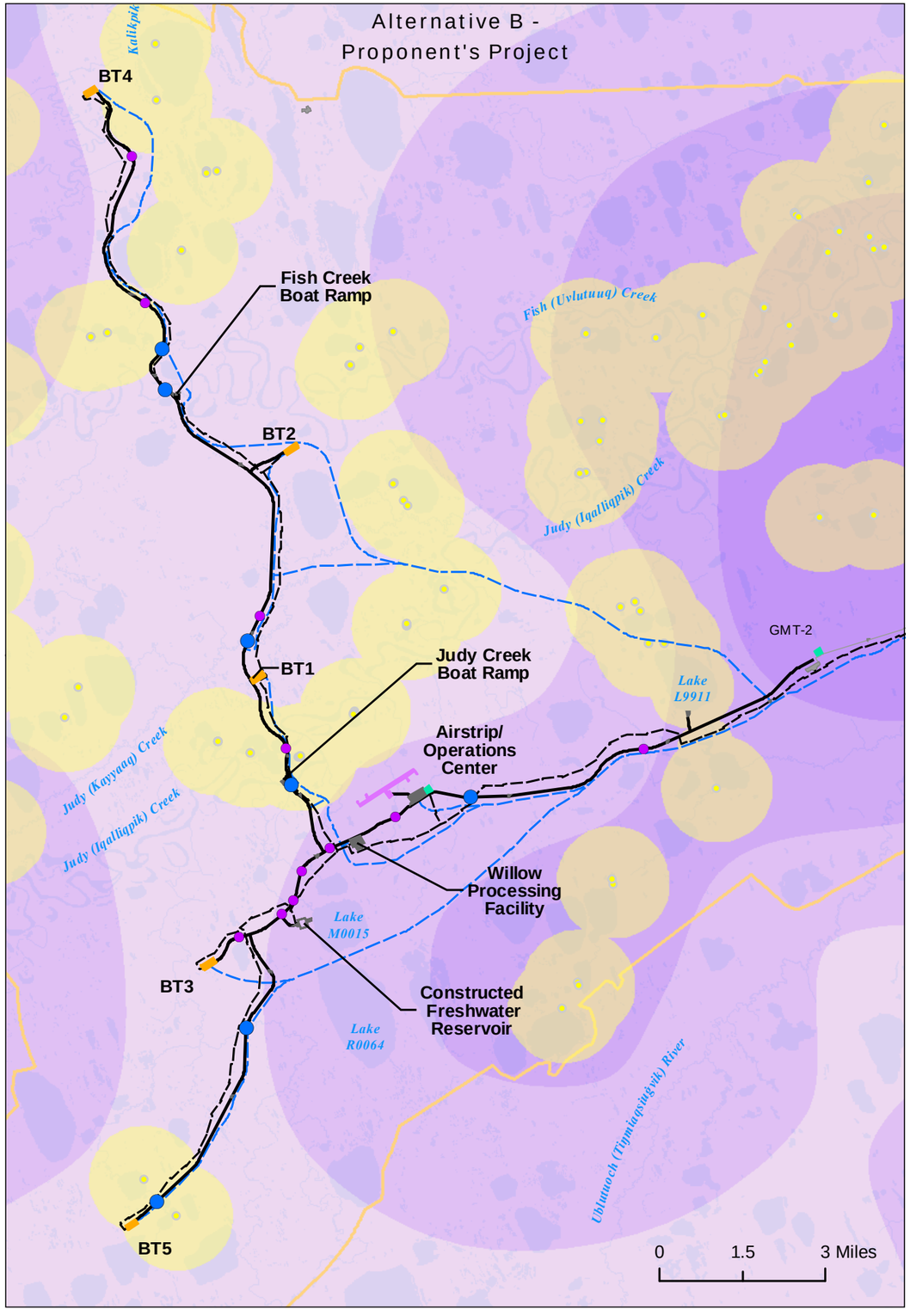
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

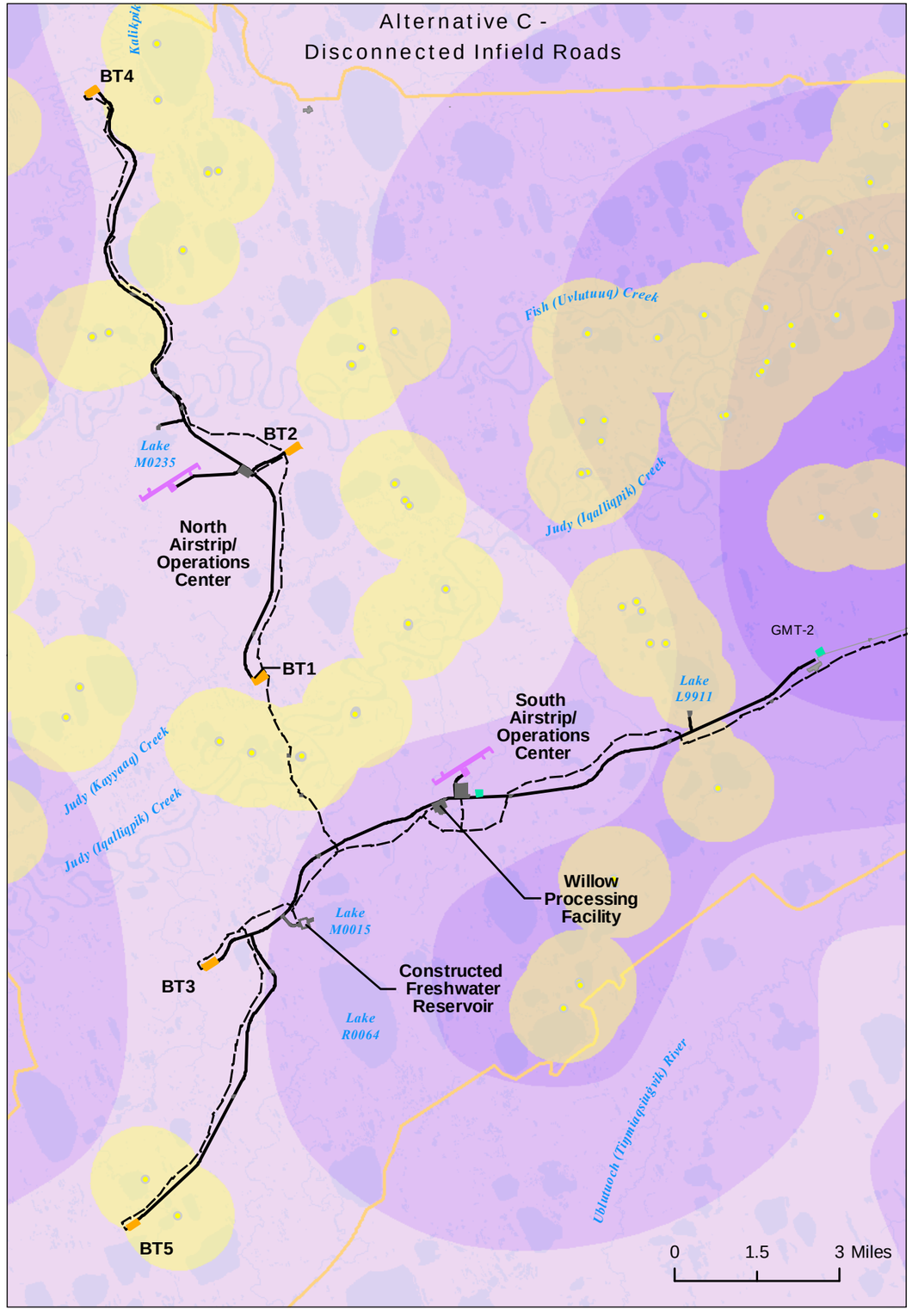
**Land Designation**
- National Petroleum Reserve in Alaska

Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. ABR surveys were not conducted the same number of years across the area displayed; surveys were conducted 16 years in NPR-A and 25 years on the Colville River Delta. USFWS 2013, BLM Unpublished Data Estimated density from USFWS 2016, unpublished data, produced by interpolation using a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned, Stehn et al. 2012 for survey methodology.



Figure 3.11.5




**Yellow-Billed Loon**
- Nests
- ROP E-9 Lake/Nest Buffers
- ABR Survey Area 1992 - 2019

**Estimated June Density, 2012 - 2015**
**(Birds per square mile)**
- 0 to 0.05
- >0.05 to 0.16
- >0.16 to 0.31
- >0.31 to 0.50
- >0.50 to 1.30

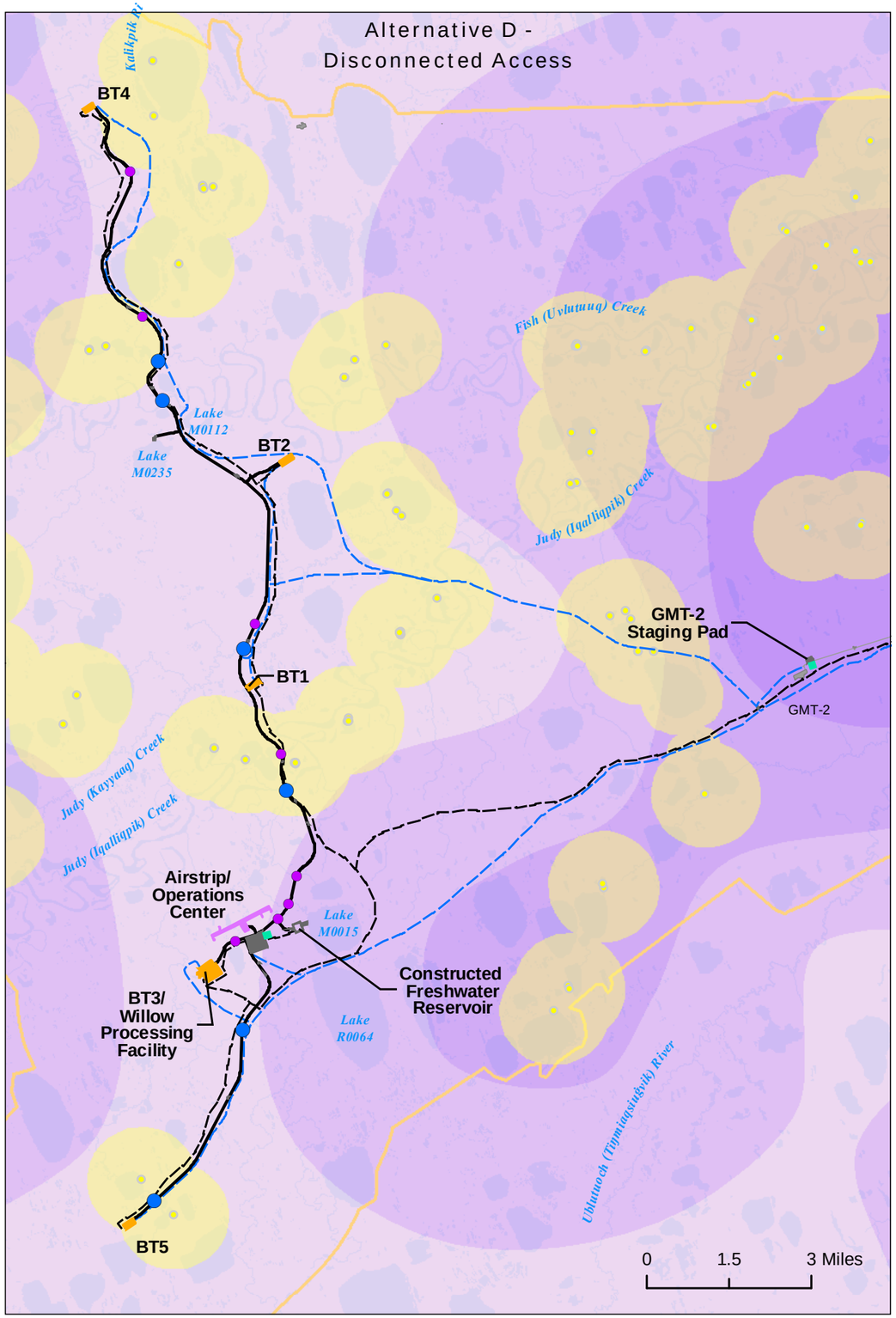
**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

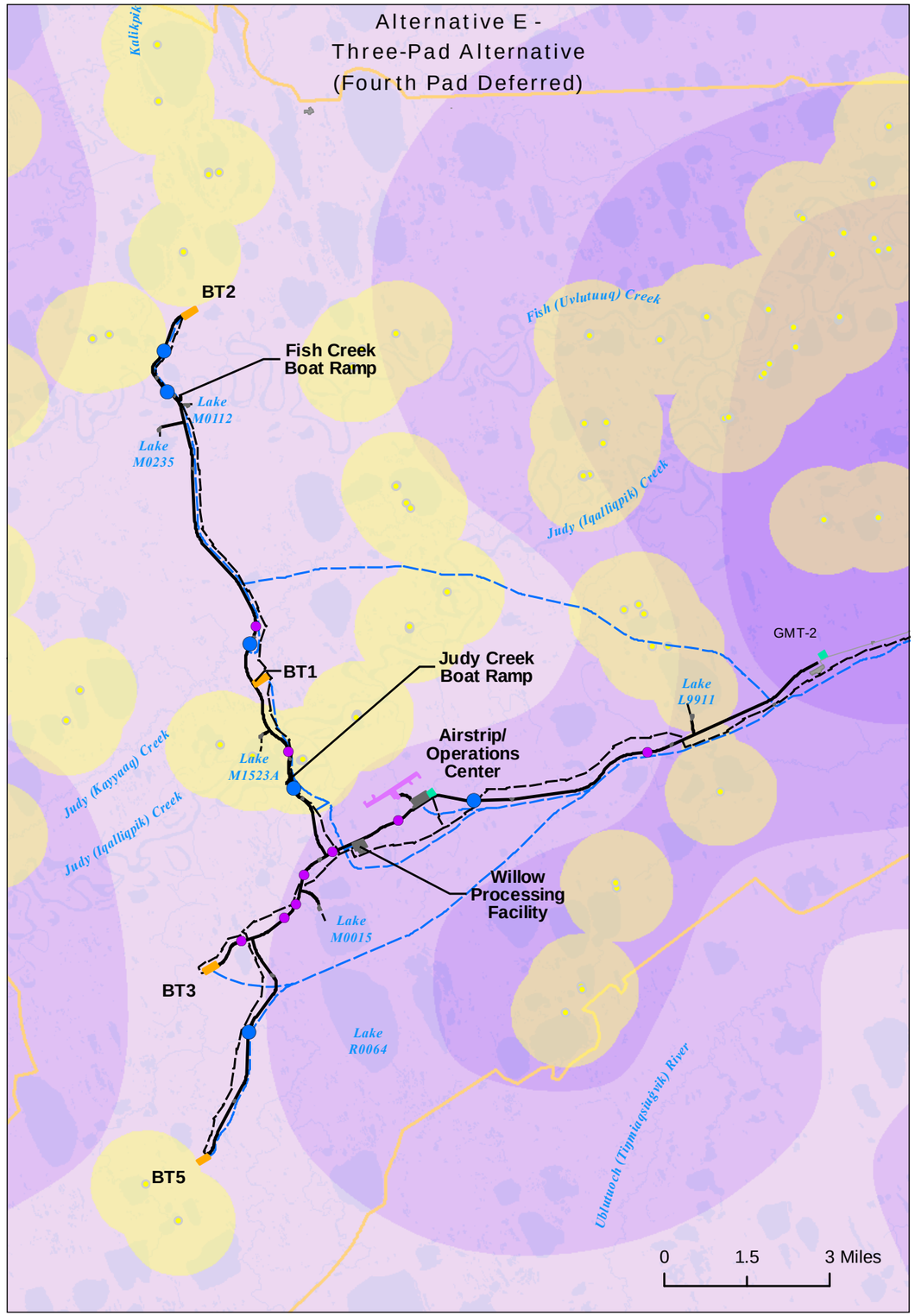


Figure 3.11.6A

## Alternative D - Disconnected Access




## Alternative E - Three-Pad Alternative (Fourth Pad Deferred)




**Yellow-Billed Loon**
- Nests
- ROP E-9 Lake/Nest Buffers
- ABR Survey Area 1992 - 2019

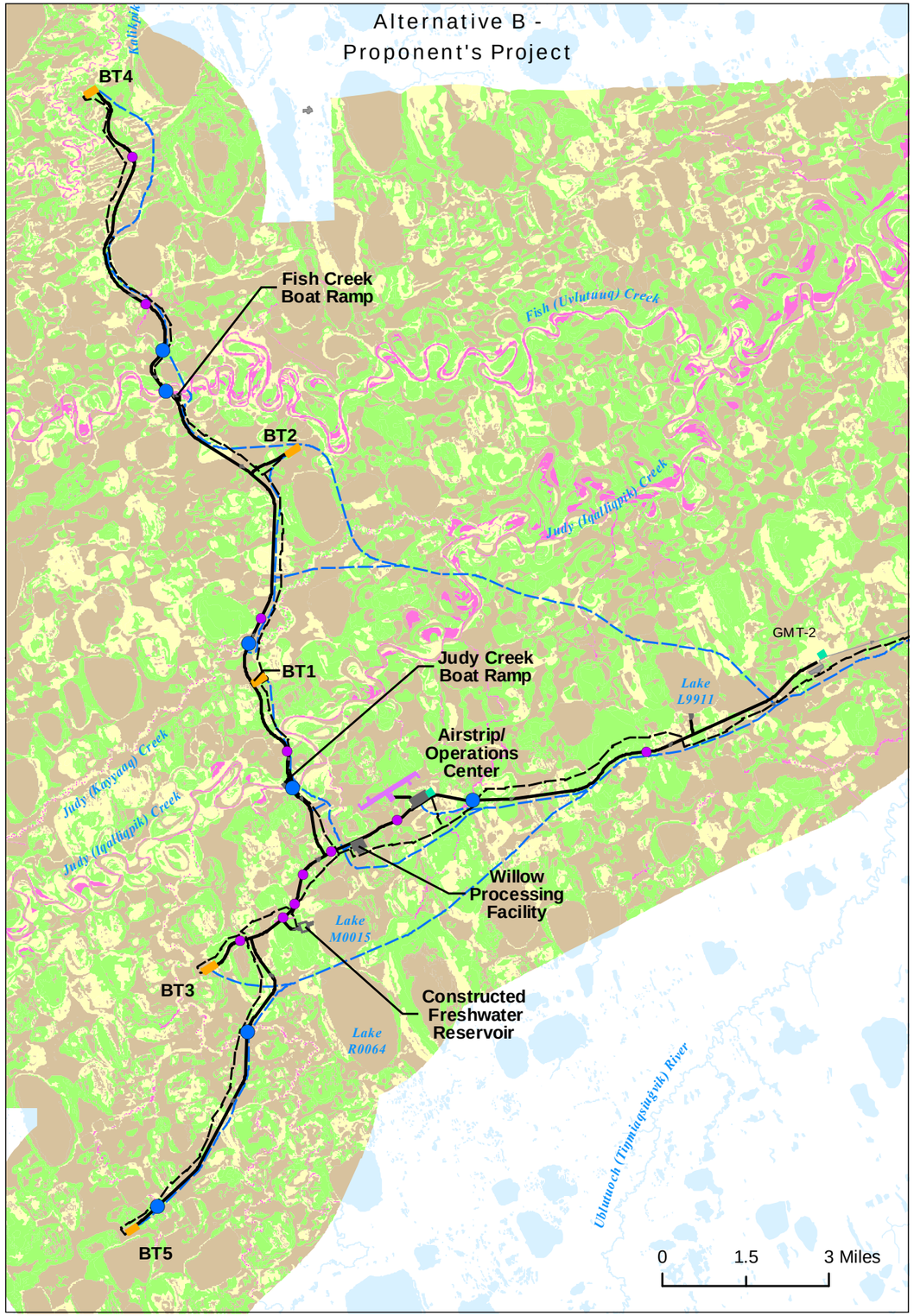
**Estimated June Density, 2012 - 2015**
**(Birds per square mile)**
- 0 to 0.05
- >0.05 to 0.16
- >0.16 to 0.31
- >0.31 to 0.50
- >0.50 to 1.30

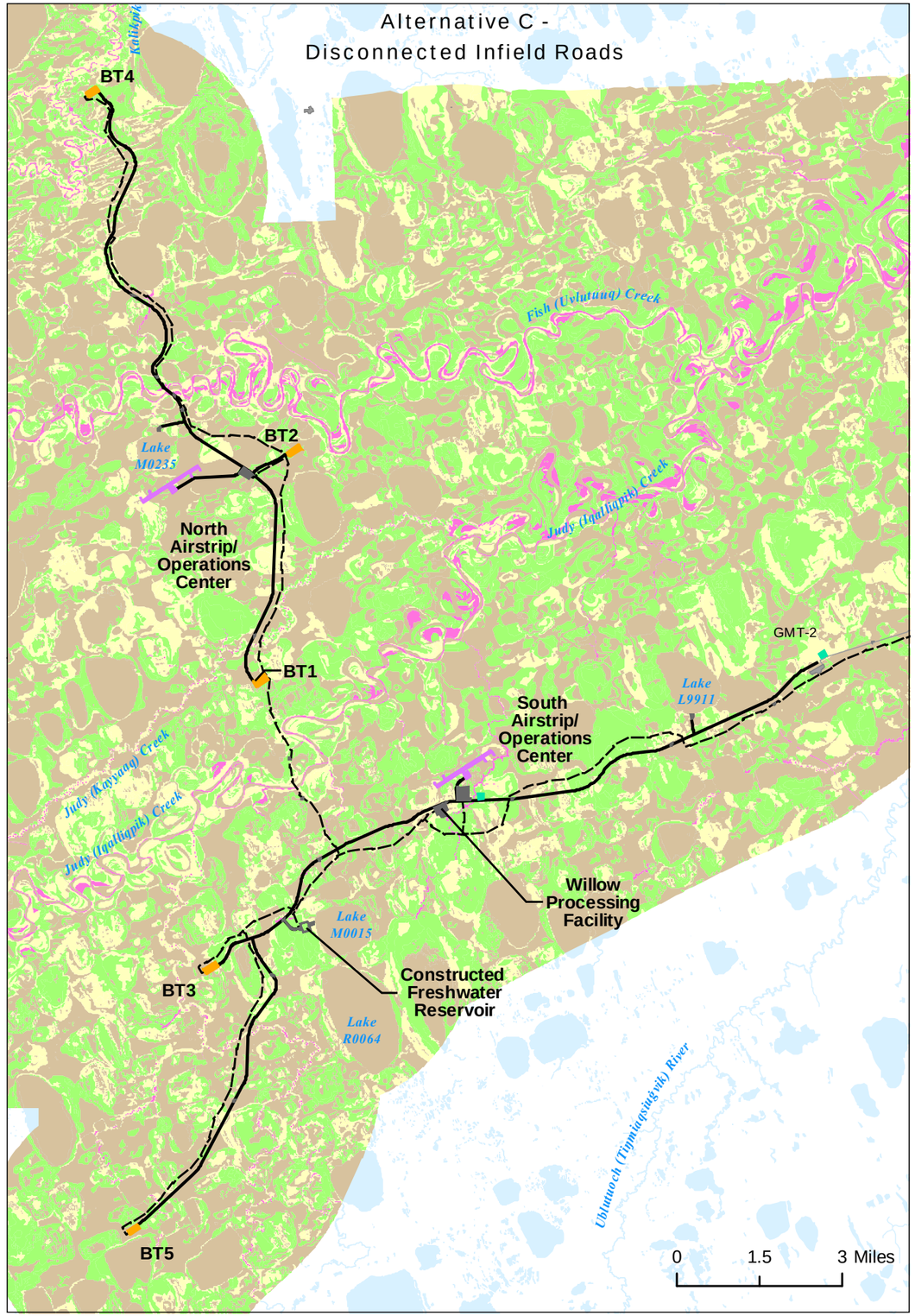
**Willow Proposed Development Features**
- Culverty Battery
- Bridge
- Gravel Road
- Pipeline
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure



Figure 3.11.6B




**Bird Habitat**

**Number of Species Using**
- 1-10
- 11 - 20
- 21 - 30
- >30

**Willow Proposed Development Features**
- Culvert Battery
- Bridge
- Gravel Road
- Pipeline
- Ice Road
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

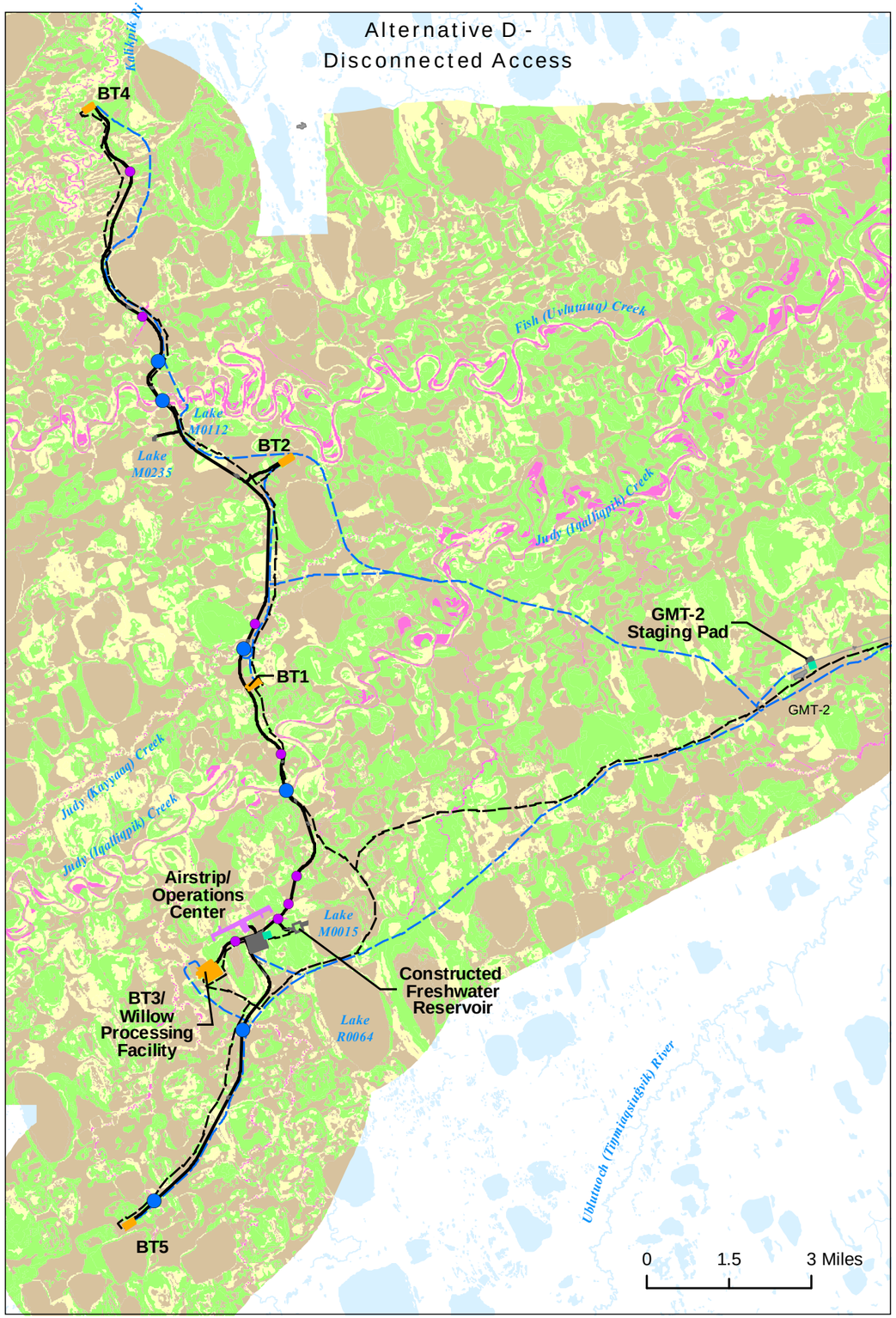
**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Note:
Preferred habitat has a significantly greater use than availability during pre-breeding or used during nesting; avoided habitat has a significantly less use than availability during pre-breeding, proportion to availability is not significantly preferred or avoided.
Data Source:
Habitat mapping was done by ABR, Inc. for ARCO Alaska, Inc., Phillips Alaska, Inc. and ConocoPhillips, Alaska, Inc. as part of their baseline environmental studies and NEPA documentation for the Alpine, Tarn, Meltwater, Palm, West Sak Development Area, Kuparuk, GMT1, GMT2, and Willow oil development projects.

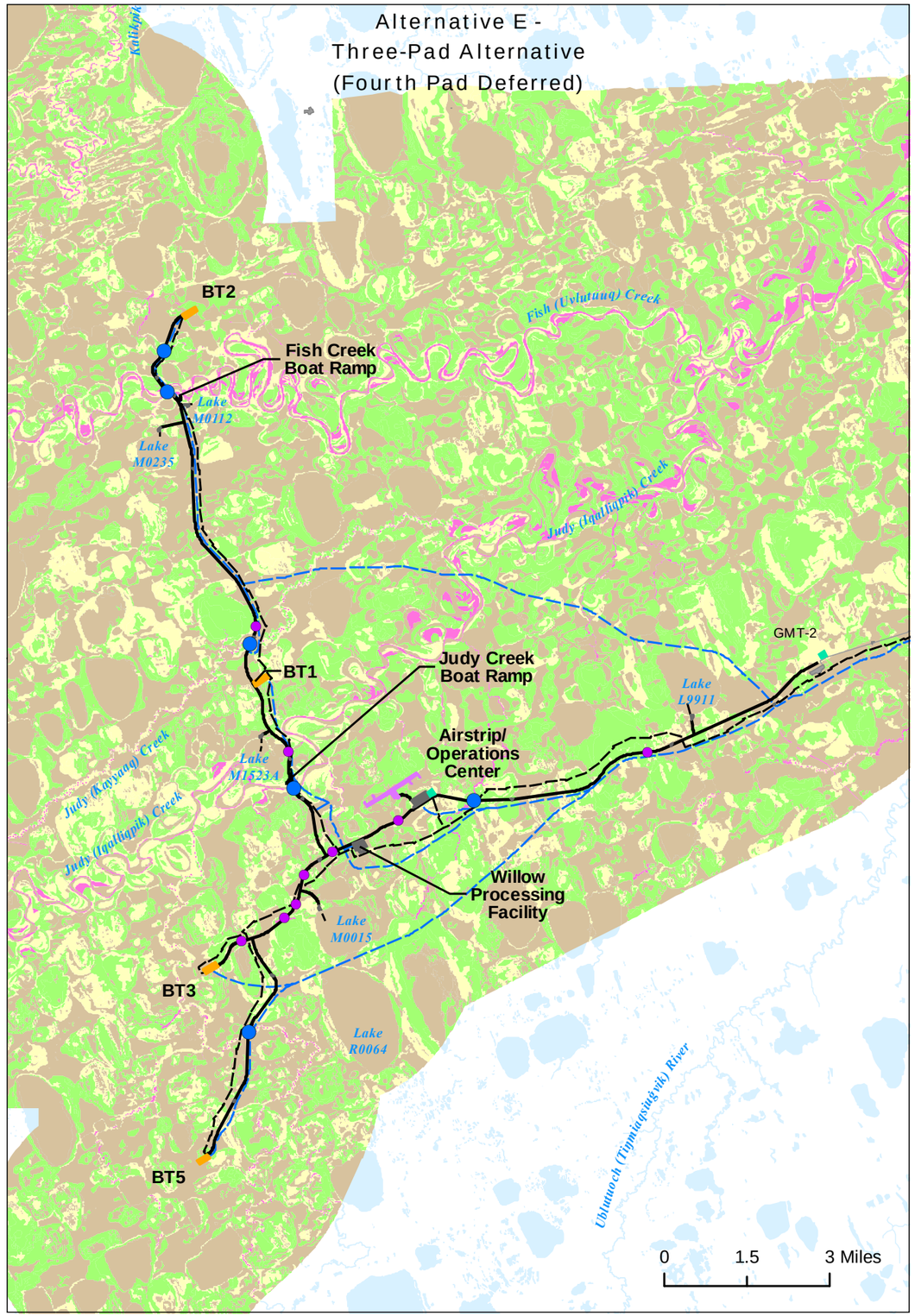


Figure 3.11.7A

## Alternative D - Disconnected Access




## Alternative E - Three-Pad Alternative (Fourth Pad Deferred)




**Bird Habitat**

**Number of Species Using**
- 1-10
- 11 - 20
- 21 - 30
- >30

**Willow Proposed Development Features**
- Culverty Battery
- Bridge
- Gravel Road
- Pipeline
- Airstrip
- Drill Site Pad
- Gravel Pad
- Ice Pad

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Note:
Preferred habitat has a significantly greater use than availability during pre-breeding or used during nesting; avoided habitat has a significantly less use than availability during pre-breeding, proportion to availability is not significantly preferred or avoided.

Data Source:
Habitat mapping was done by ABR, Inc. for ARCO Alaska, Inc., Phillips Alaska, Inc. and ConocoPhillips, Alaska, Inc. as part of their baseline environmental studies and NEPA documentation for the Alpine, Tarn, Meltwater, Palm, West Sak Development Area, Kuparuk, GMT1, GMT2, and Willow oil development projects.



Figure 3.11.7B

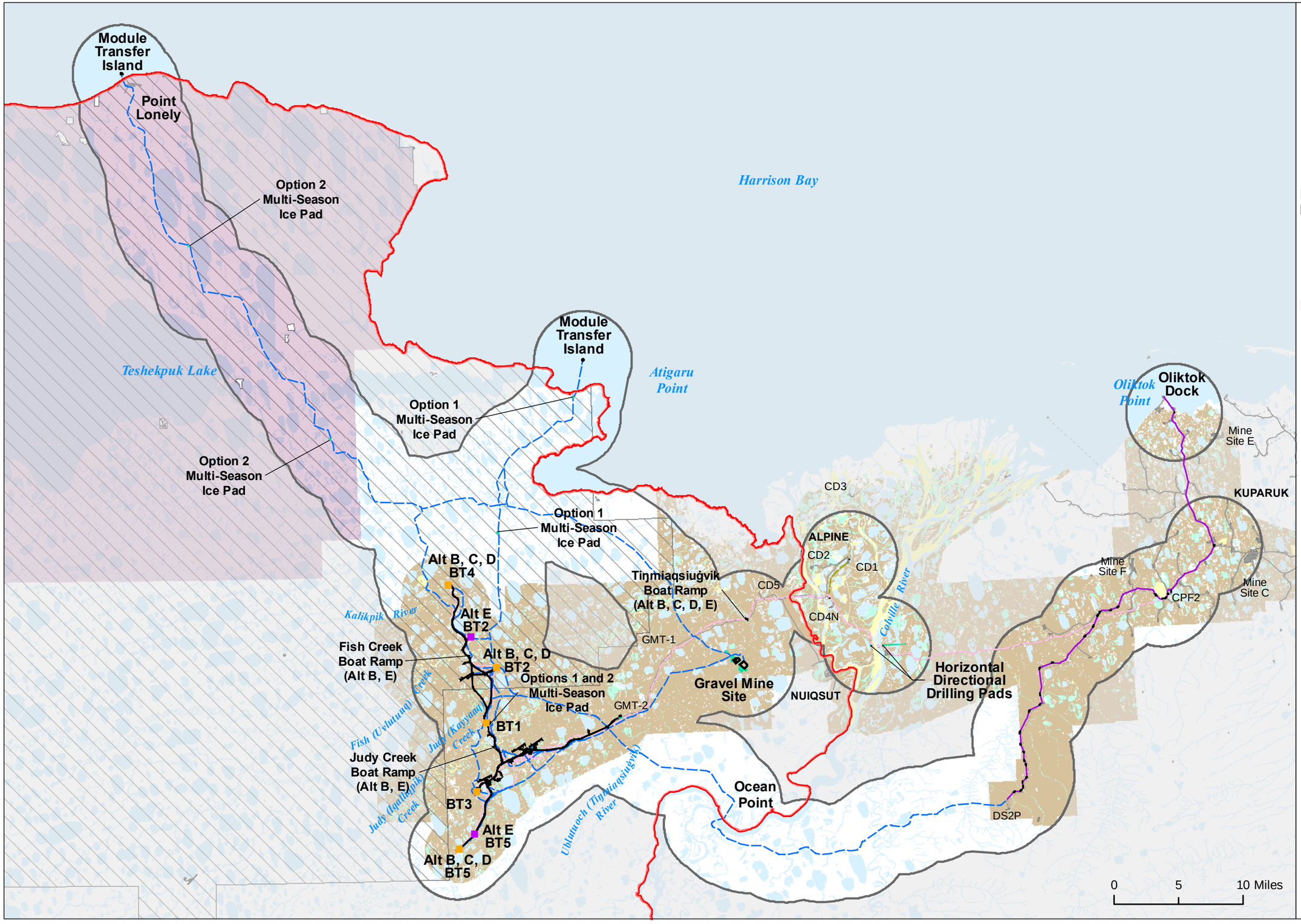
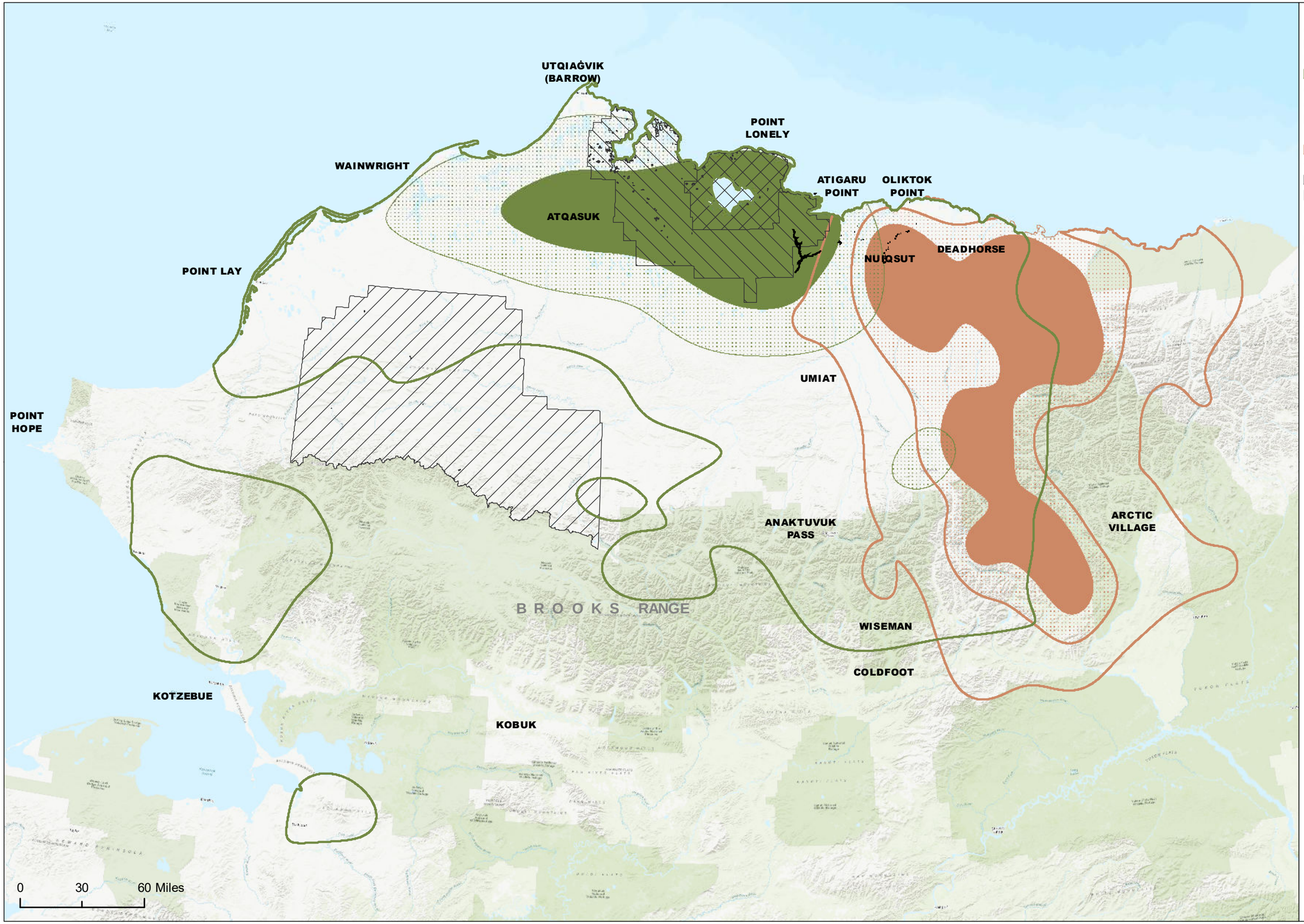

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Alt B, C, D BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D, E)
CD5
Colville River
Mine Site F
Mine Site C
CPF2
Kalikpik River
Alt E BT2
CD4N
GMT-1
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uvlutuut) Creek
Judy (Kayyaaq) Creek
Judy Creek Boat Ramp (Alt B, E)
Judy (Iqalliqpik) Creek
BT3
Ocean Point
Alt E BT5
Ulluruch (Tiŋmiaqsiuġvik) River
Alt B, C, D BT5
DS2P
0
5
10 Miles
Terrestrial Mammal Habitat
No. of Species Using
1
6-8
>8
Willow Proposed Development Features
Drill Site (Not to Scale)
Alt E Drill Site (Not to Scale)
New Pipeline Existing VSM
New Pipeline New VSM
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Required Operating Procedure
K-9: No New Infrastructure
Teshekpuk Lake Special Area
Data Source:
Habitat mapping was done by ABR, Inc. for ARCO Alaska, Inc., PhillipsAlaska, Inc. and ConocoPhillips, Alaska, Inc. as part of their baseline environmental studies and NEPA documentation for the Alpine, Tarn, Meltwater, Palm, West Sak Development Area, Kuparuk, GMT1, GMT2, and Willow oil development projects.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.12.1




**Teshekpuk Caribou Herd**
**(Herd Density)**
- High
- Medium
- Low

**Central Arctic Caribou Herd**
**(Herd Density)**
- High
- Medium
- Low

**Willow Proposed Development Features**
- Analysis Area
- Gravel Footprint

**Required Operating Procedure**
- K-9: No New Infrastructure
- Teshekpuk Lake Special Area

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
Prichard, Macander et al. 2019

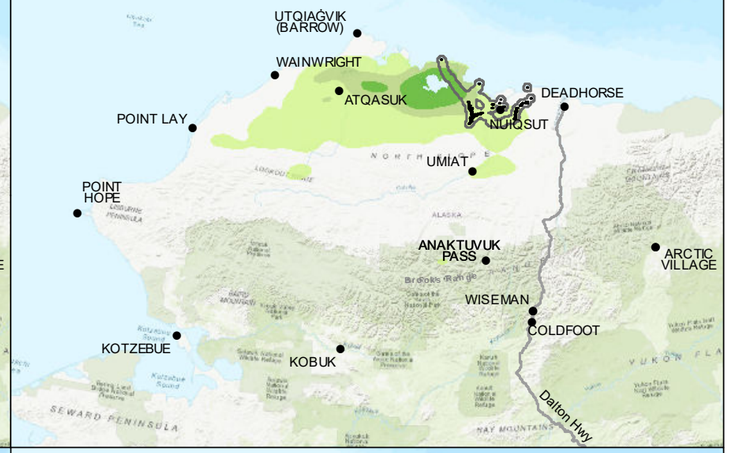


Figure 3.12.2

## Winter (December 1 - April 30)


## Spring Migration (May 1 - May 29)

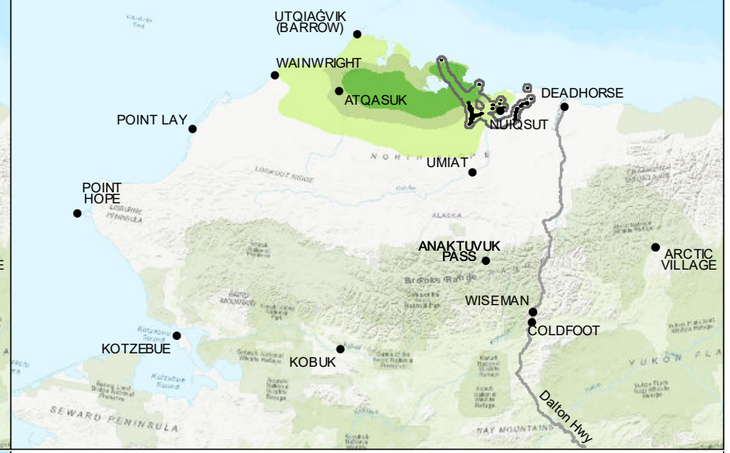

## Calving (May 30 - June 15)



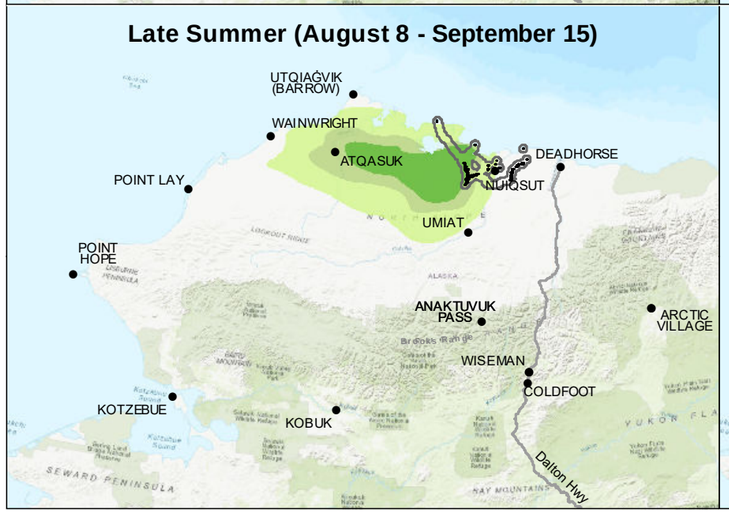

## Postcalving (June 16 - June 24)


## Mosquito (June 25 - July 15)

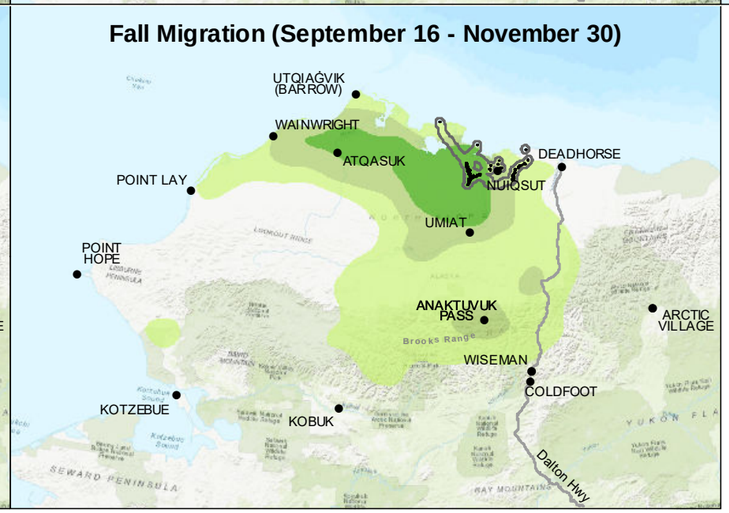

## Oestrid Fly (July 16 - August 7)




## Late Summer (August 8 - September 15)




## Fall Migration (September 16 - November 30)




**Teshekpuk Caribou Herd**

**(Female Density)**

- High
- Medium
- Low

**Willow Proposed Development Features**

- Analysis Area
- Gravel Footprint

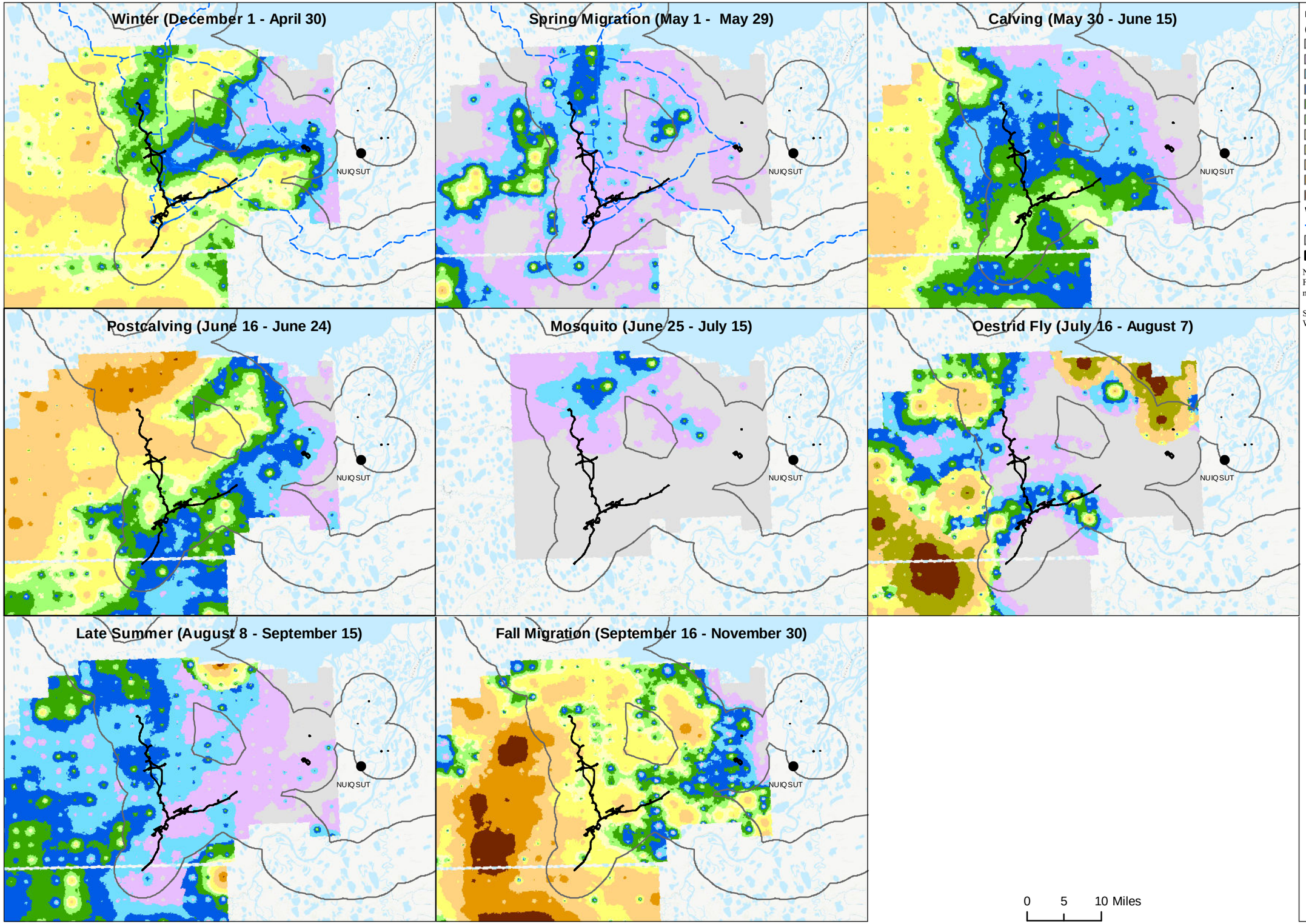
Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
Welch, Prichard et al. 2022



0 100 200 Miles

Figure 3.12.3

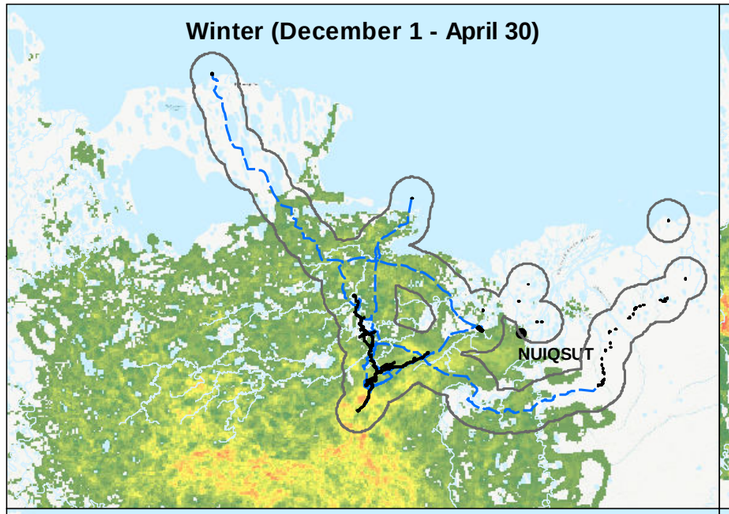


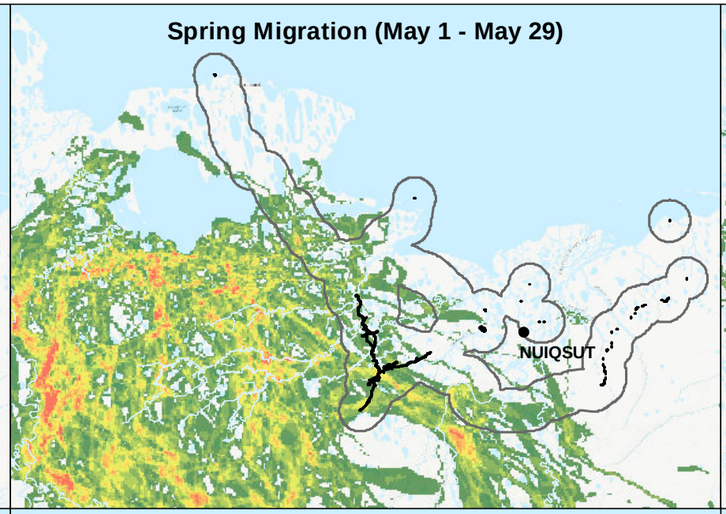

Note:
Figure shows all females (calving and non-calving) during the calving period.

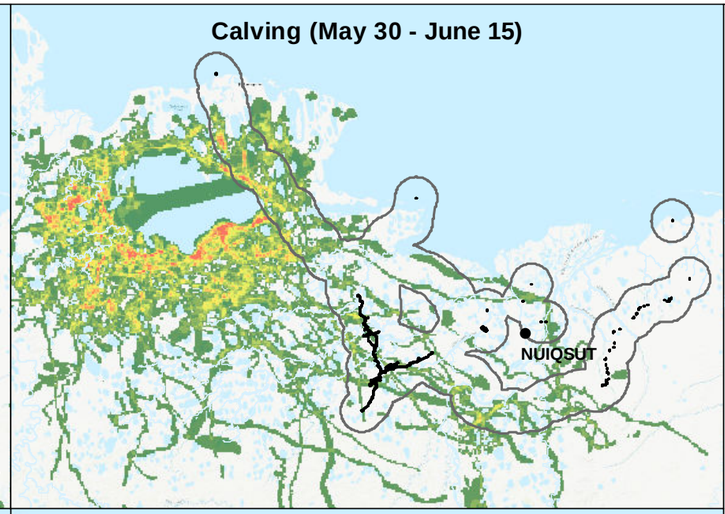
Source:
Welch, Prichard et al. 2022

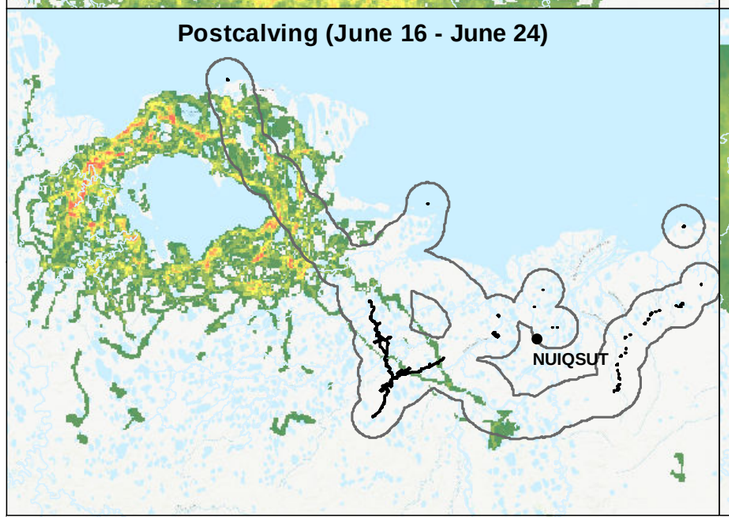


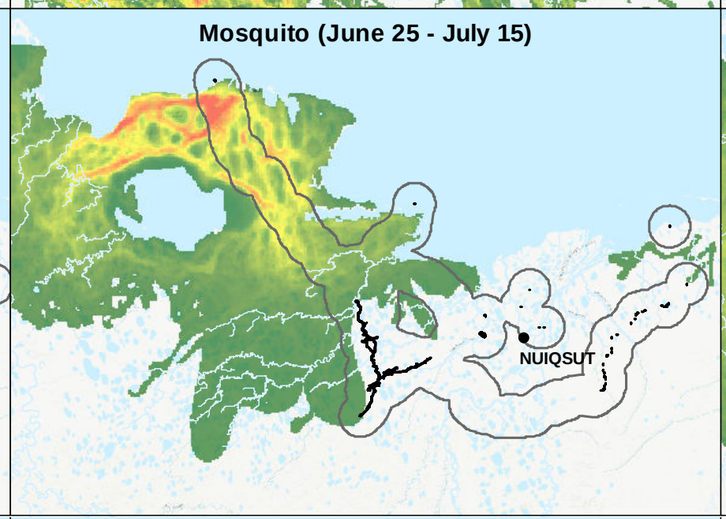
Figure 3.12.4

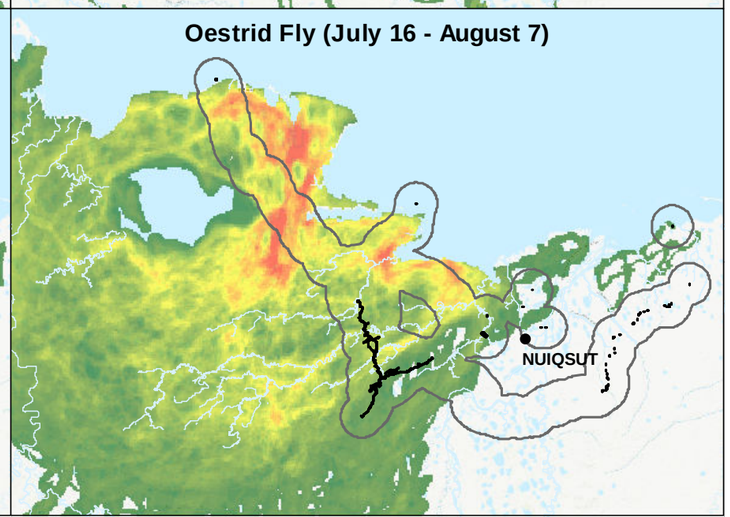


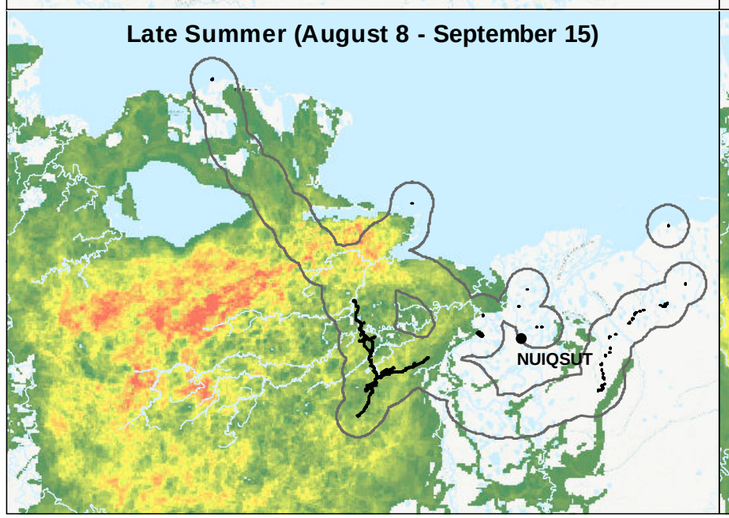



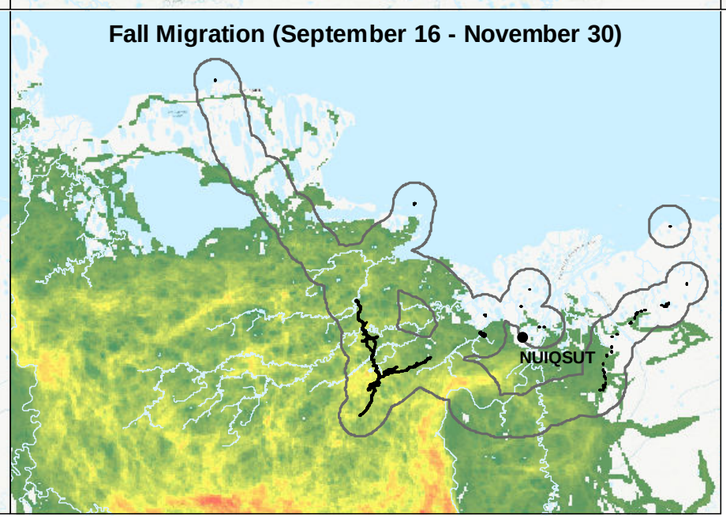




**Teshekpuk Caribou Herd GPS Collars**

**Value**

High : 38.0117

Low : 0

**Willow Proposed Development Features**

- Ice Road
- Analysis Area
- Gravel Footprint

Note:
Locations of GPS-collared individual female caribou were used to calculate dynamic Brownian Bridge Movement Models (Kranstauber et al. 2012) using the move packagin R (Kranstauber et al. 2017, R Core Team 2019). Based on the output of these models, the 95% isopleth of movements for each individual collared caribou in the area in each season were calculated and these were used to calculate the proportion of collared caribou in the area that were using each 100-m pixel.

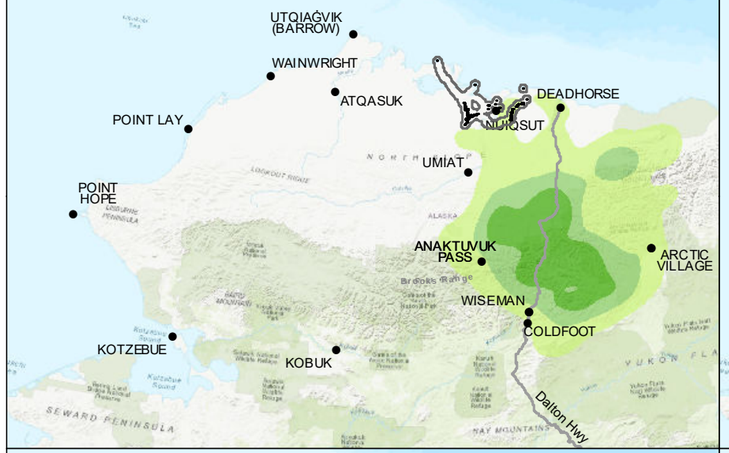
Source:
Welch, Prichard et al. 2022

0 15 30 Miles

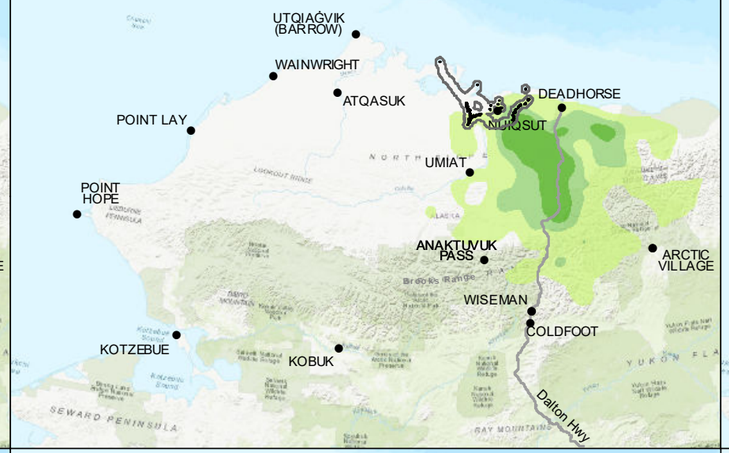


Figure 3.12.5

## Winter (December 1 - April 30)




## Spring Migration (May 1 - May 29)

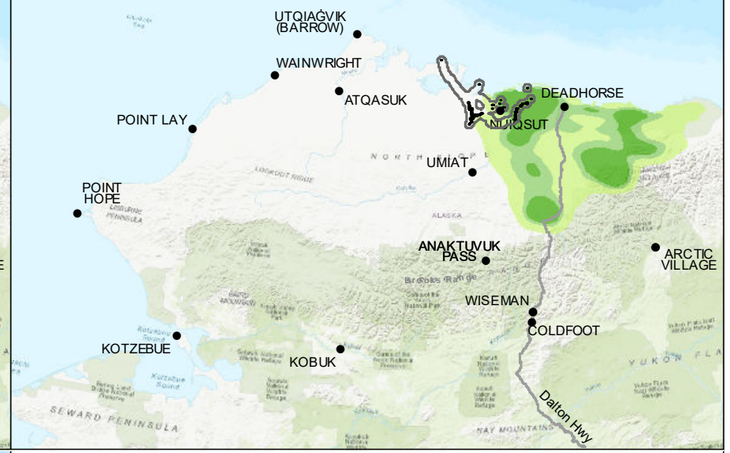



## Calving (May 30 - June 15)

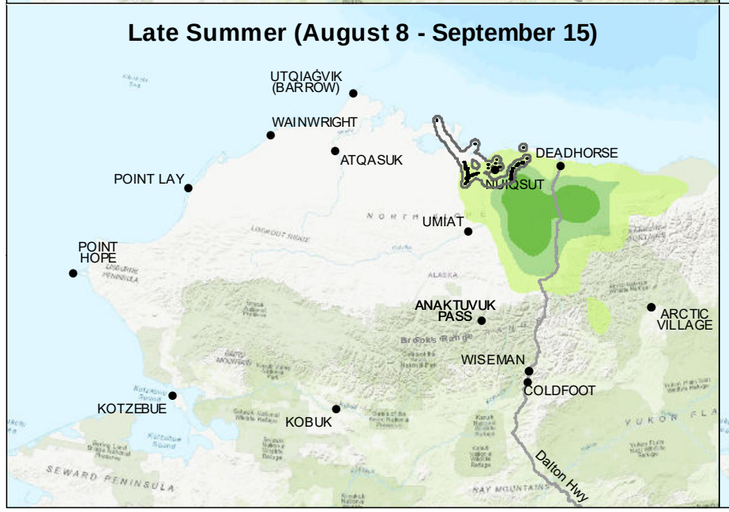

## Postcalving (June 16 - June 24)


## Mosquito (June 25 - July 15)

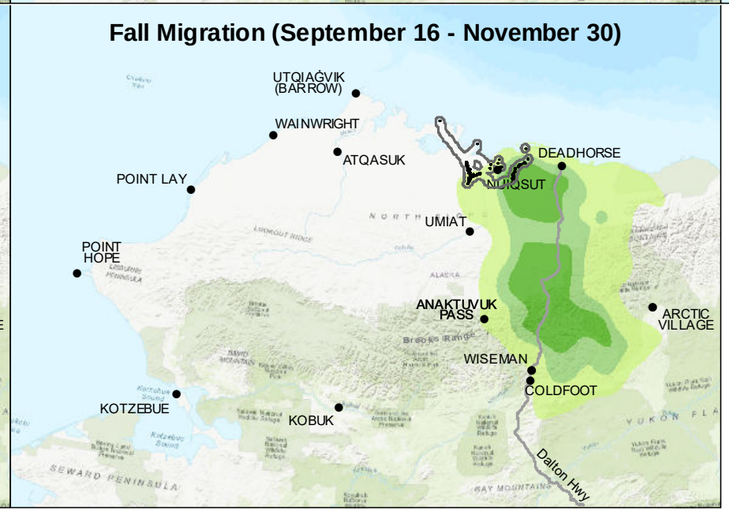

## Oestrid Fly (July 16 - August 7)




## Late Summer (August 8 - September 15)




## Fall Migration (September 16 - November 30)




0 100 200 Miles

**Central Arctic Herd**

**(Female Density)**

- High
- Medium
- Low

**Willow Proposed Development Features**

- Analysis Area
- Gravel Footprint

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.
Figure shows distribution of females known to have calved.

Source:
Welch, Prichard et al. 2022



Figure 3.12.6

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Alt B, C, D BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D, E)
CD5
Colville River
Mine Site F
Mine Site C
CPF2
Kalikpik River
Alt E BT2
CD4N
GMT-1
Fish Creek Boat Ramp (Alt B, E)
Alt B, C, D BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
Fish (Ulutuuq) Creek
Judy (Kayyaaq) Creek
GMT-2
BT1
Judy Creek Boat Ramp (Alt B, E)
Judy (Aqalliqpik) Creek
BT3
Ocean Point
Ublutuoch (Tiŋmiaqsiuġvik) River
Alt E BT5
DS2P
Alt B, C, D BT5
0 5 10 Miles

**Teshekpuk Caribou Herd**
**(Calving Density[a])**
- High
- Medium
- Low

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

**Other Infrastructure**
- Existing Road
- Existing Pipeline
- Existing Infrastructure

**Land Designation**
- National Petroleum Reserve in Alaska

**Required Operating Procedure**
- K-9: No New Infrastructure
- Teshekpuk Lake Special Area

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
a. Welch, Prichard et al. 2022
b. BLM 2013a



Figure 3.12.7