



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

Willow Master Development Plan

Environmental Impact Statement

DRAFT

Volume 2: Appendix A

August 2019

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
U.S. Coast Guard
U.S. Department of Transportation
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 EIS:
\$5,281,000



Mission

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

Cover Photo Illustration: Caribou in the Alpine Development on Alaska's North Slope.
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BLM/AK/PL-19/012+1610+F010

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Draft Environmental Impact Statement

Volume 2: Appendix A

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Anchorage, Alaska

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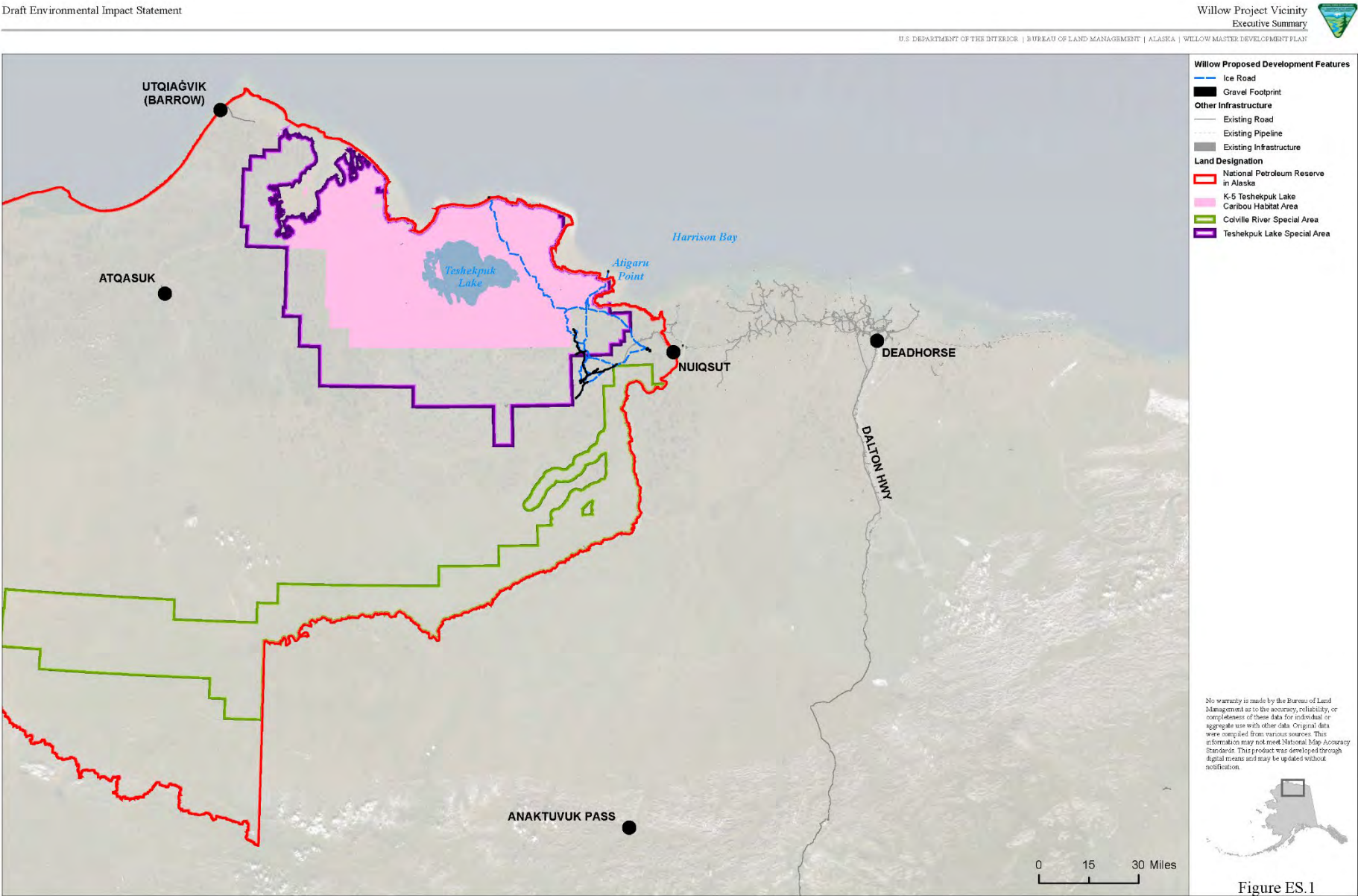


Figure ES.1. Willow Project Vicinity, North Slope, Alaska

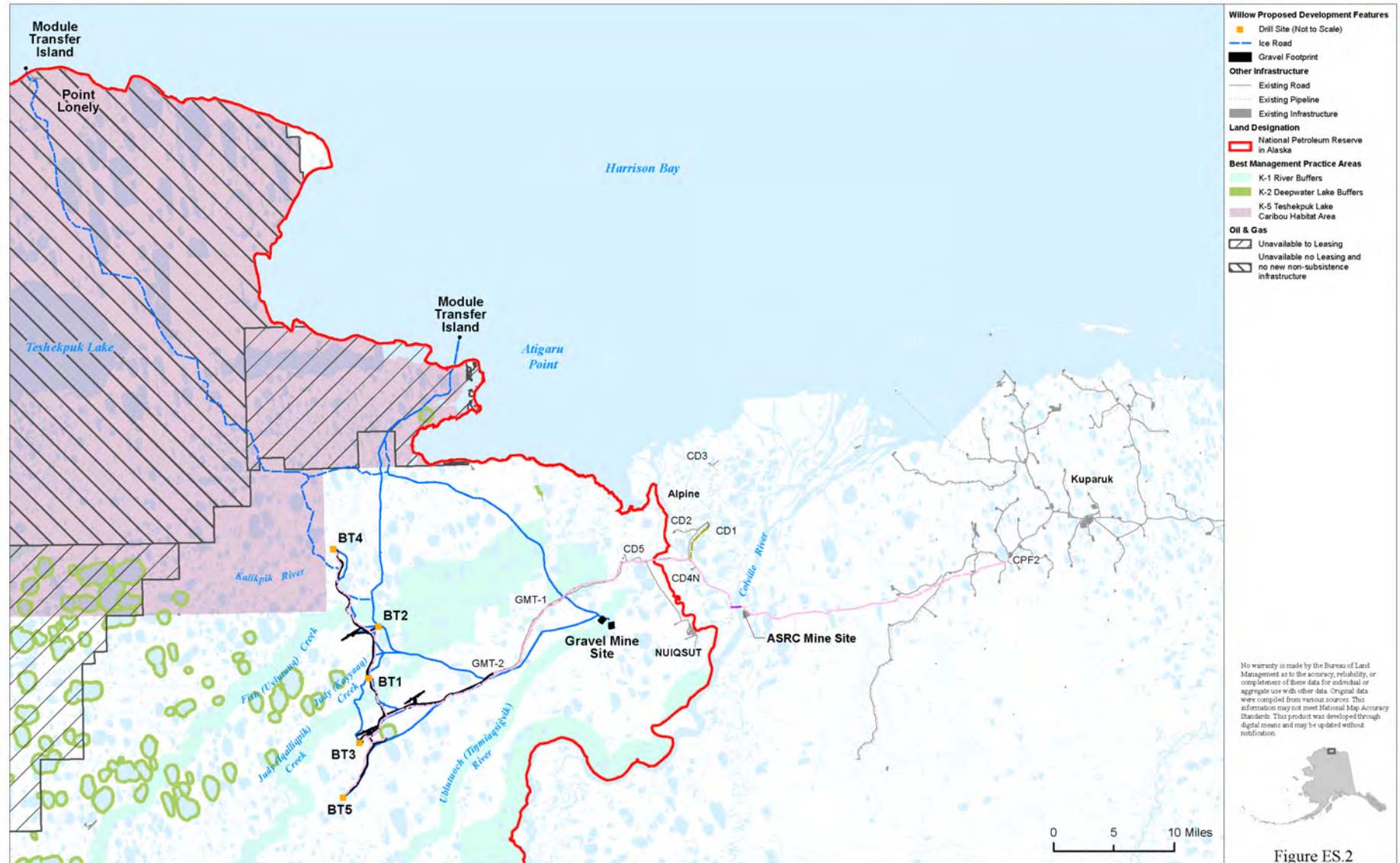


Figure ES.2. Willow Project Area and Alternatives

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Comparison of Action Alternatives
Executive Summary

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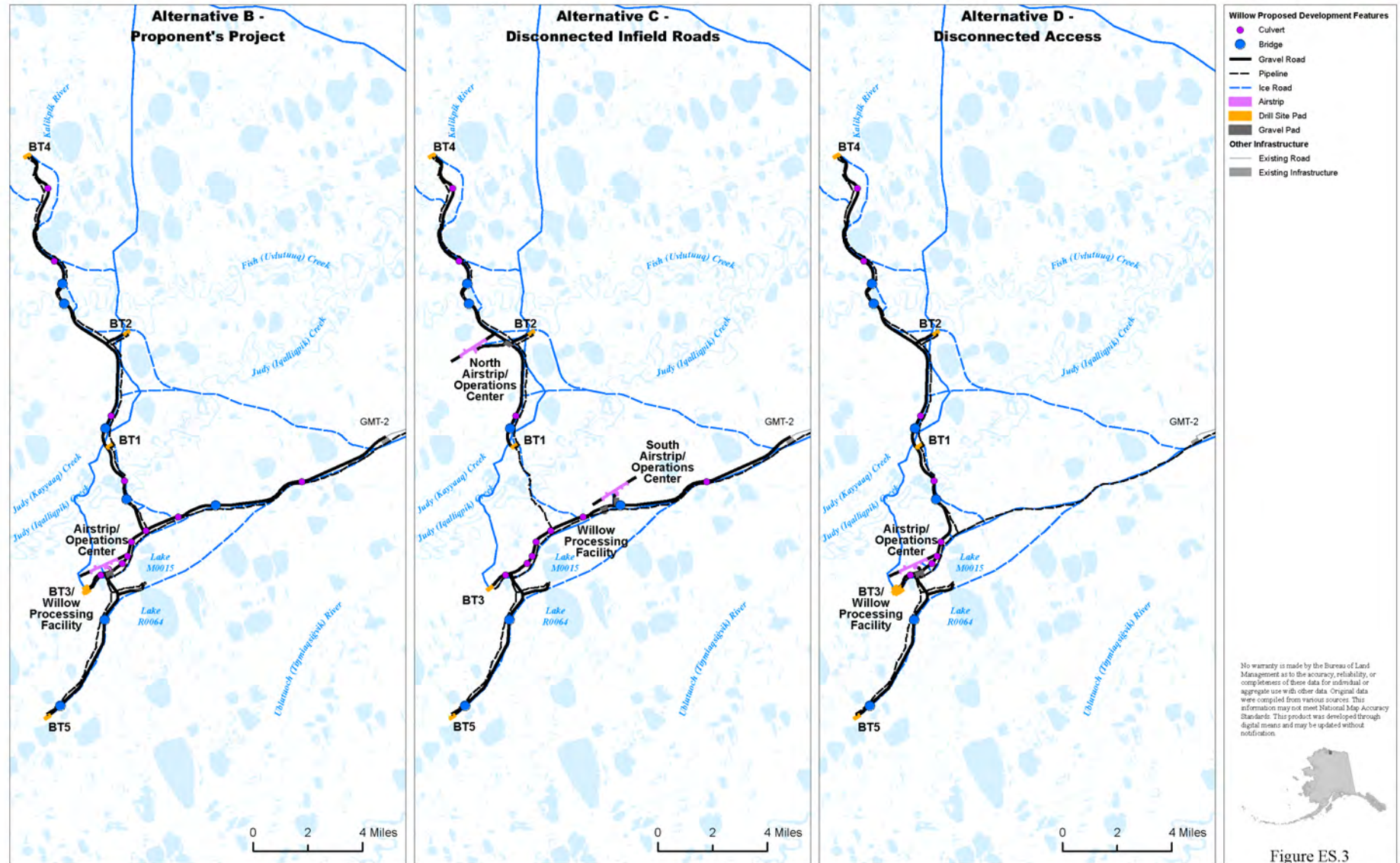


Figure ES.3. Comparison of Action Alternatives

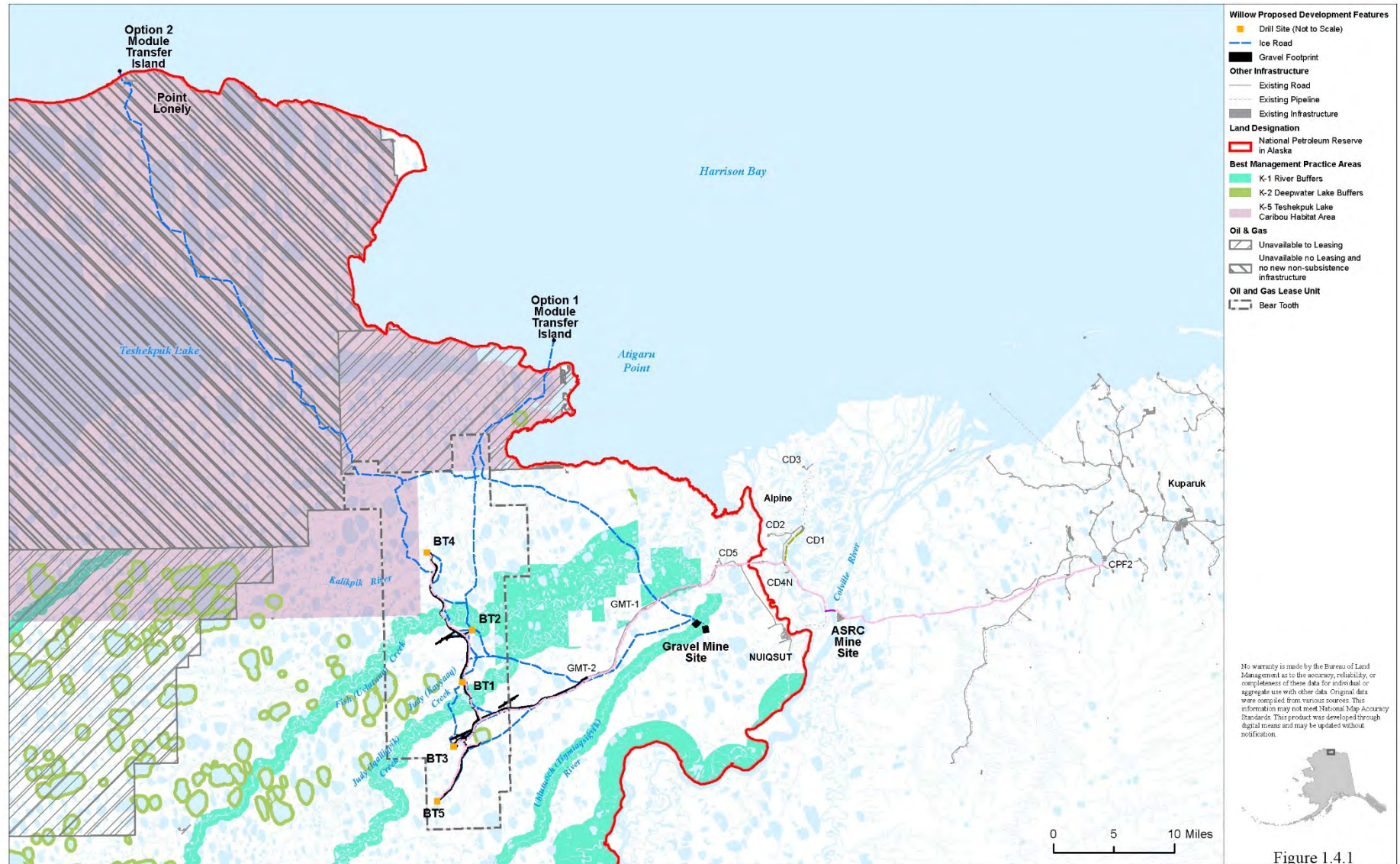


Figure 1.4.1

Figure 1.4.1. Willow Development Location

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Alternative B: Proponent's Project
2.0 - Alternatives

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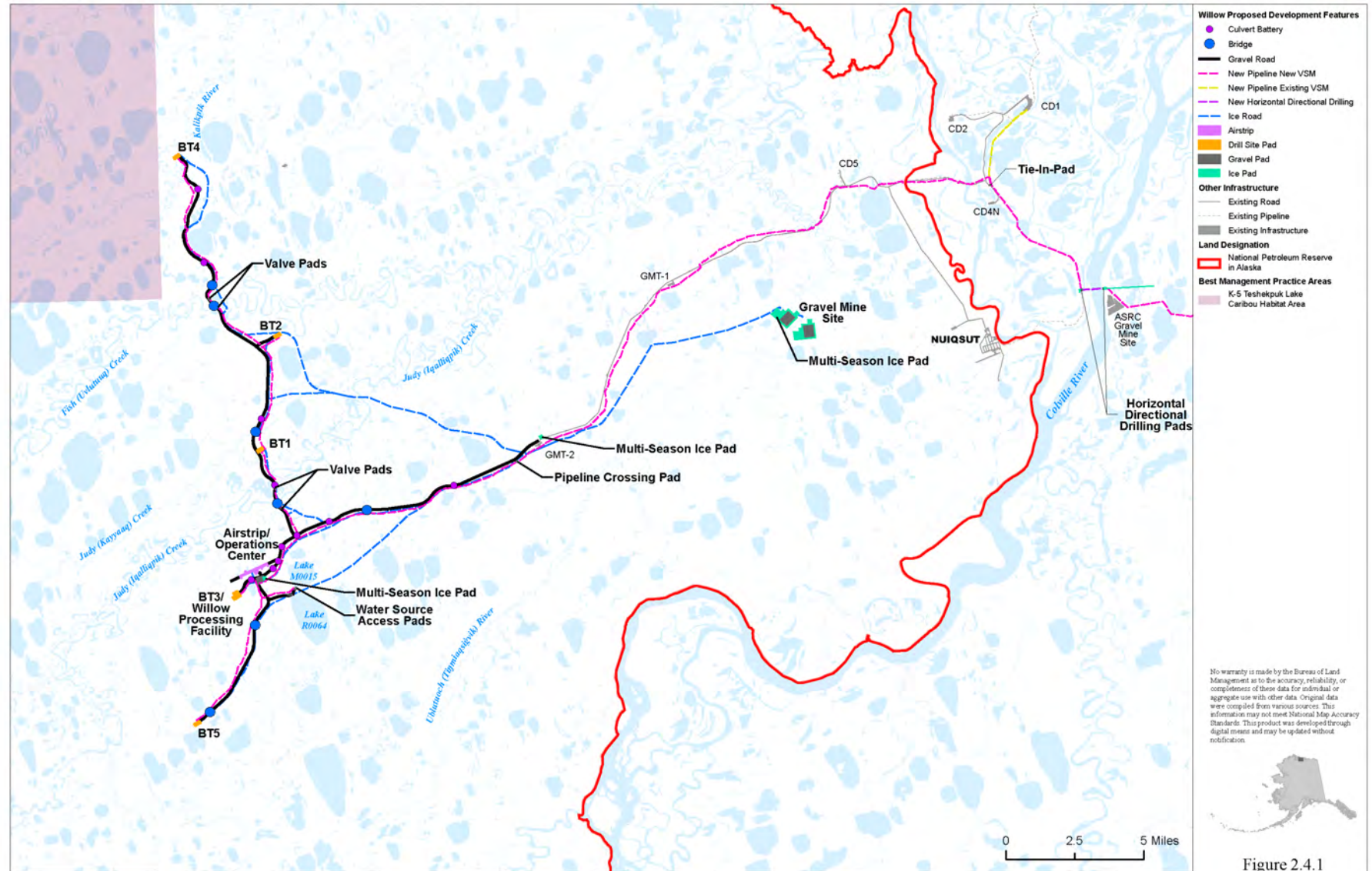


Figure 2.4.1. Alternative B: Proponent's Project

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Alternative C: Disconnected Infield Roads
2.0 - Alternatives

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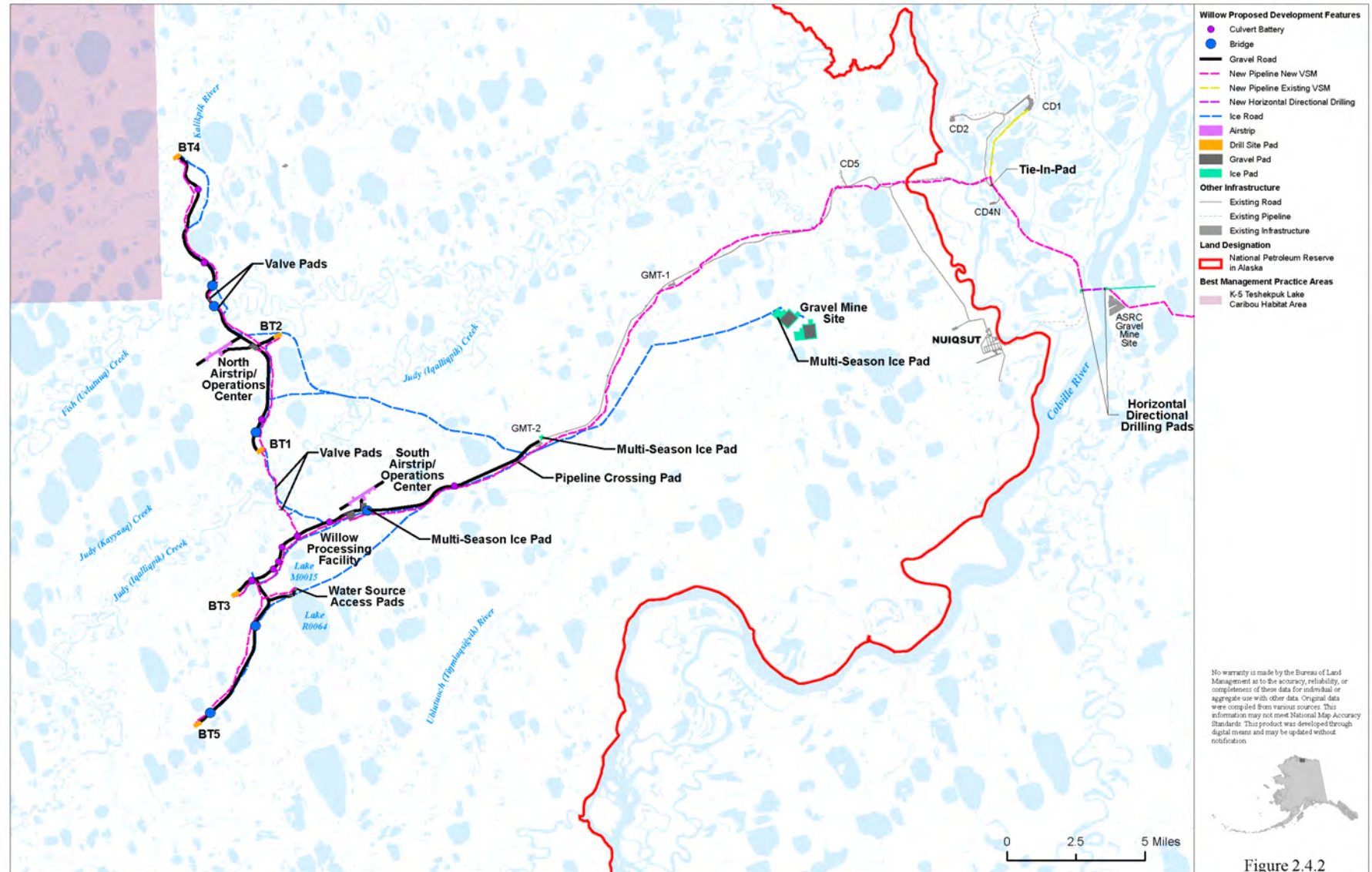


Figure 2.4.2. Alternative C: Disconnected Infield Roads

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Alternative D: Disconnected Access
2.0 - Alternatives

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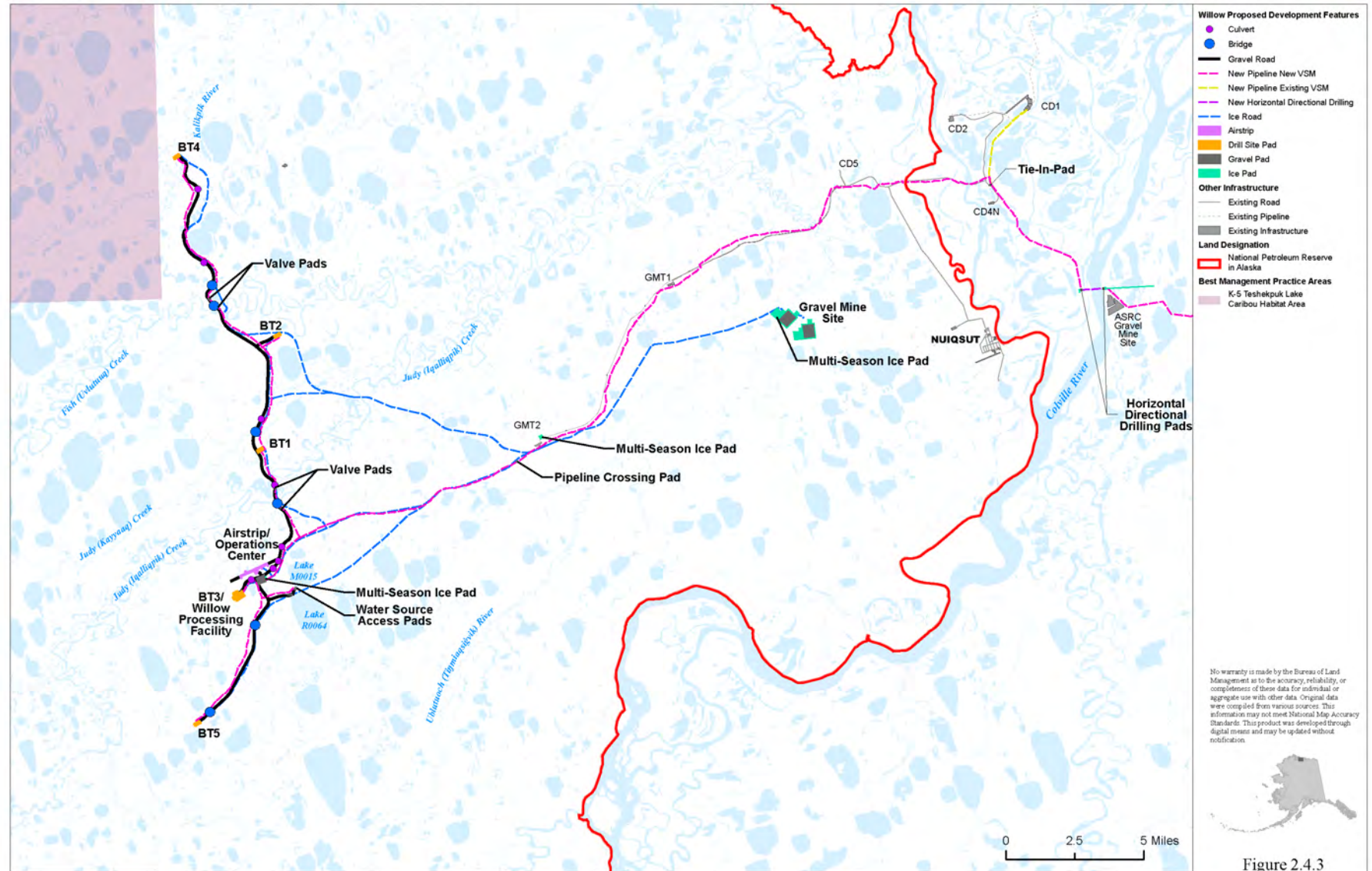


Figure 2.4.3. Alternative D: Disconnected Access

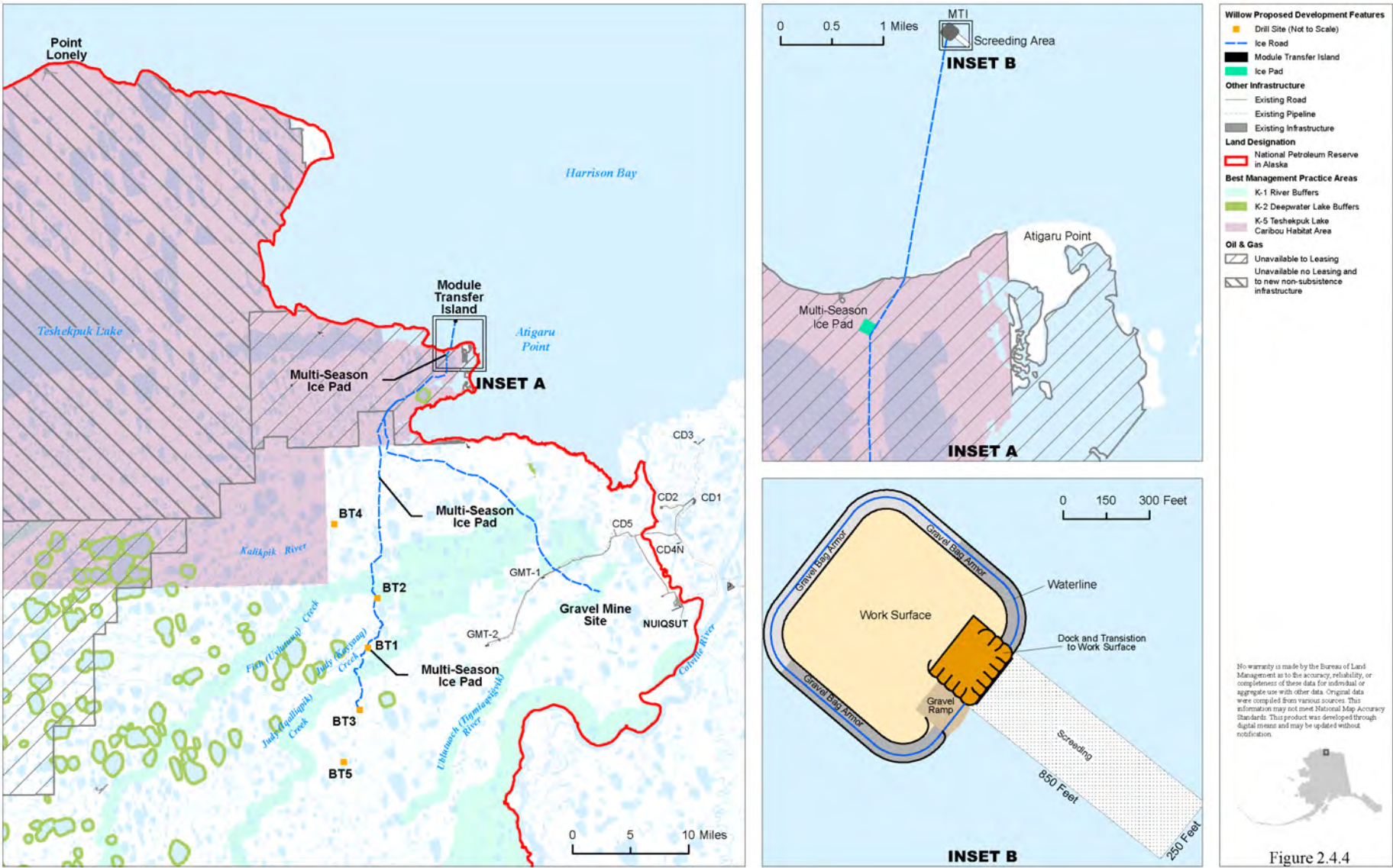


Figure 2.4.4. Option 1: Proponent's Module Transfer Island

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Option 2: Point Lonely Module Transfer Island
2.0 - Alternatives

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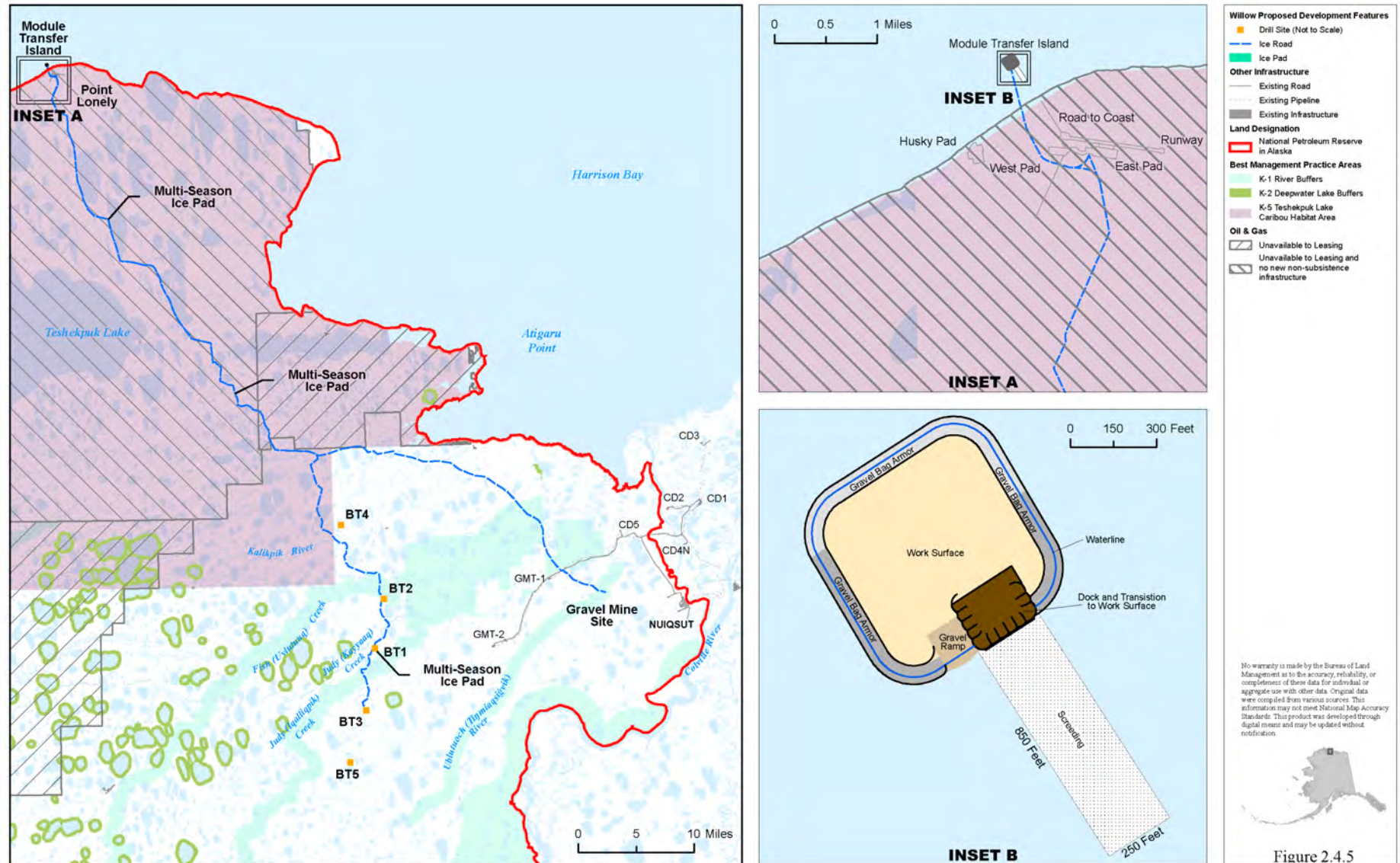


Figure 2.4.5. Option 2: Point Lonely Module Transfer Island

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Alternative B Pipeline Schematic
2.0 - Alternatives

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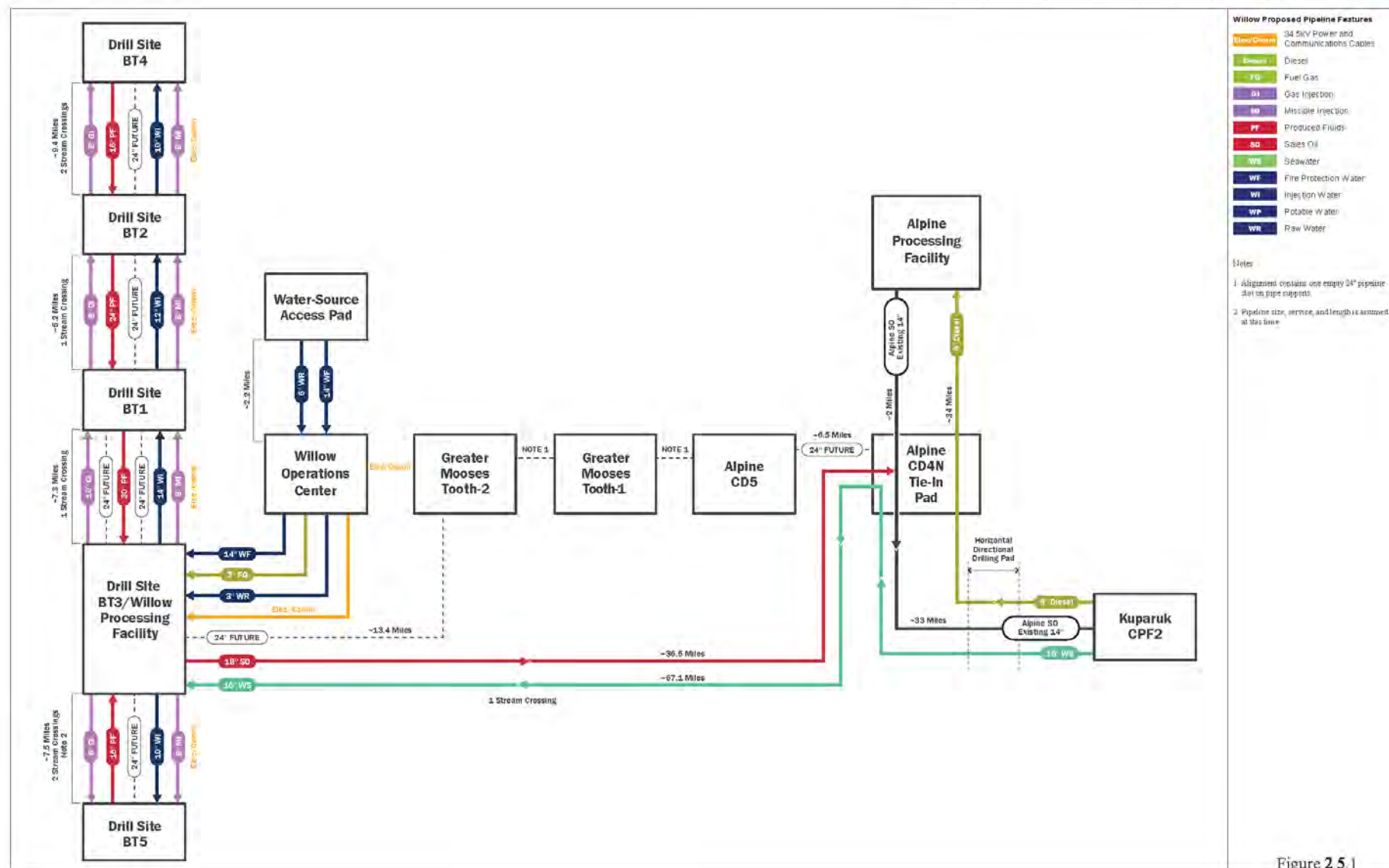


Figure 2.5.1. Alternative B Pipeline Schematic

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Alternative C Pipeline Schematic
2.0 - Alternatives

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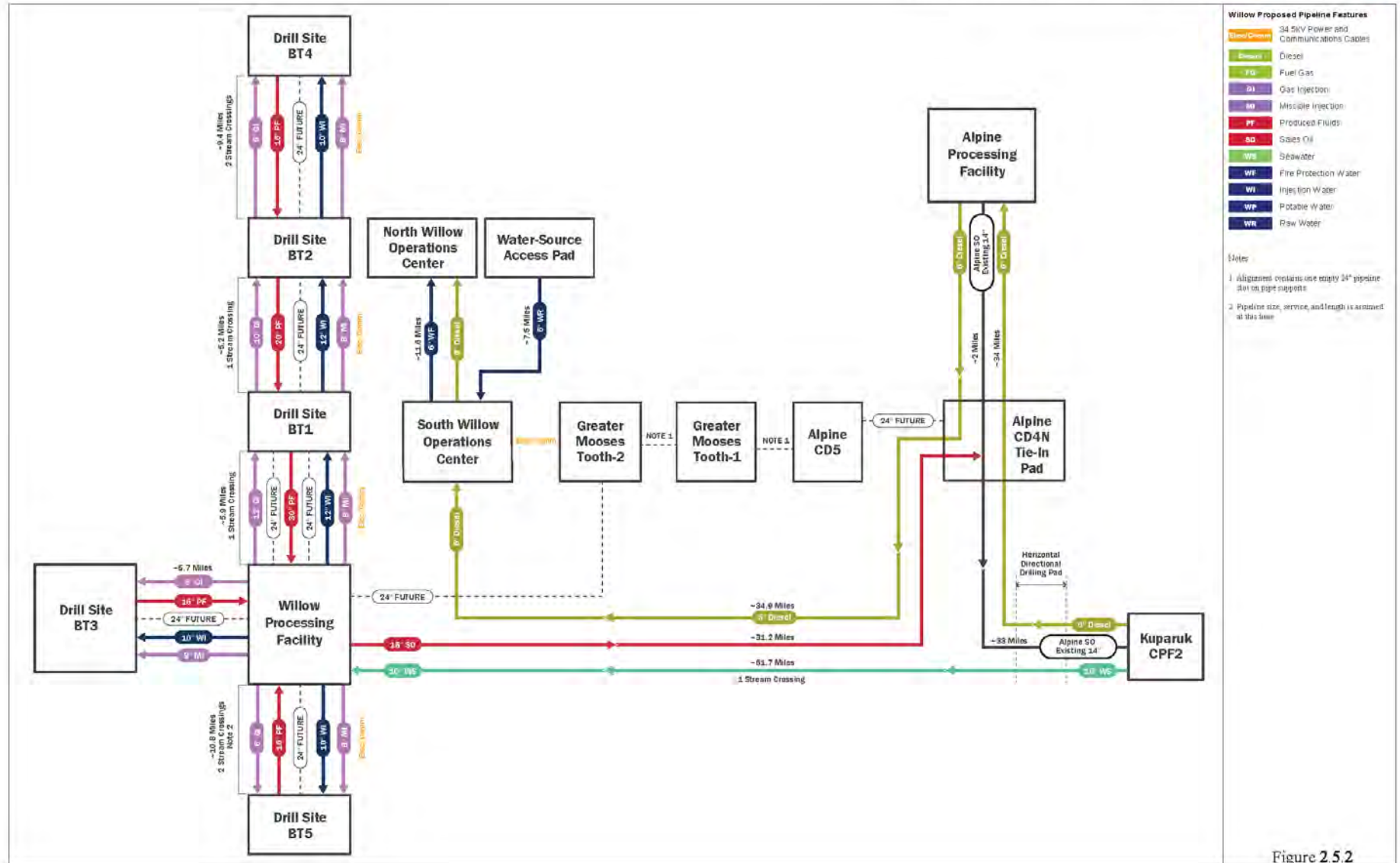


Figure 2.5.2. Alternative C Pipeline Schematic

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Alternative D Pipeline Schematic

2.0 - Alternatives



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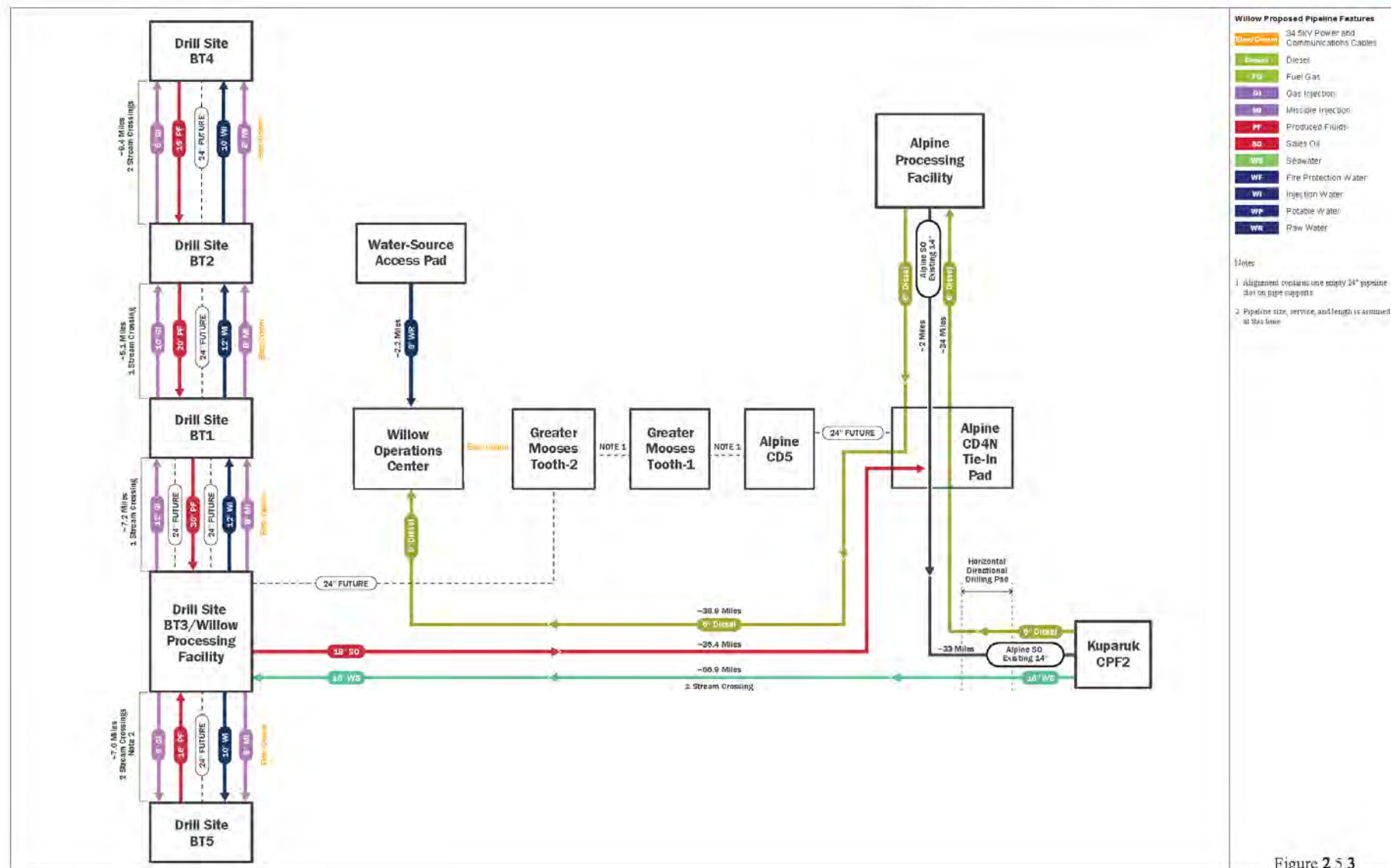


Figure 2.5.3. Alternative D Pipeline Schematic

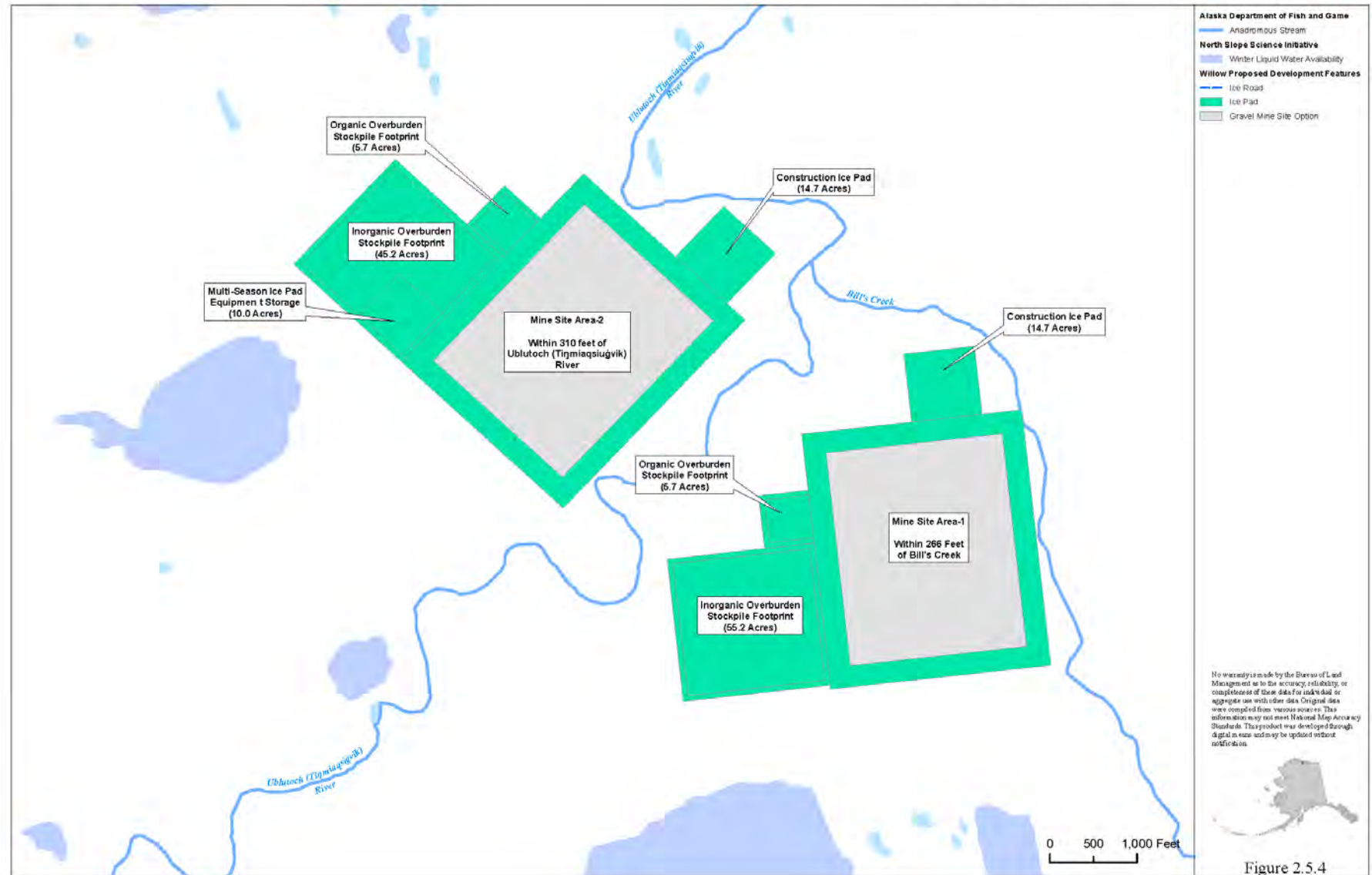


Figure 2.5.4. Tigmiagsiugvik Gravel Mine Site

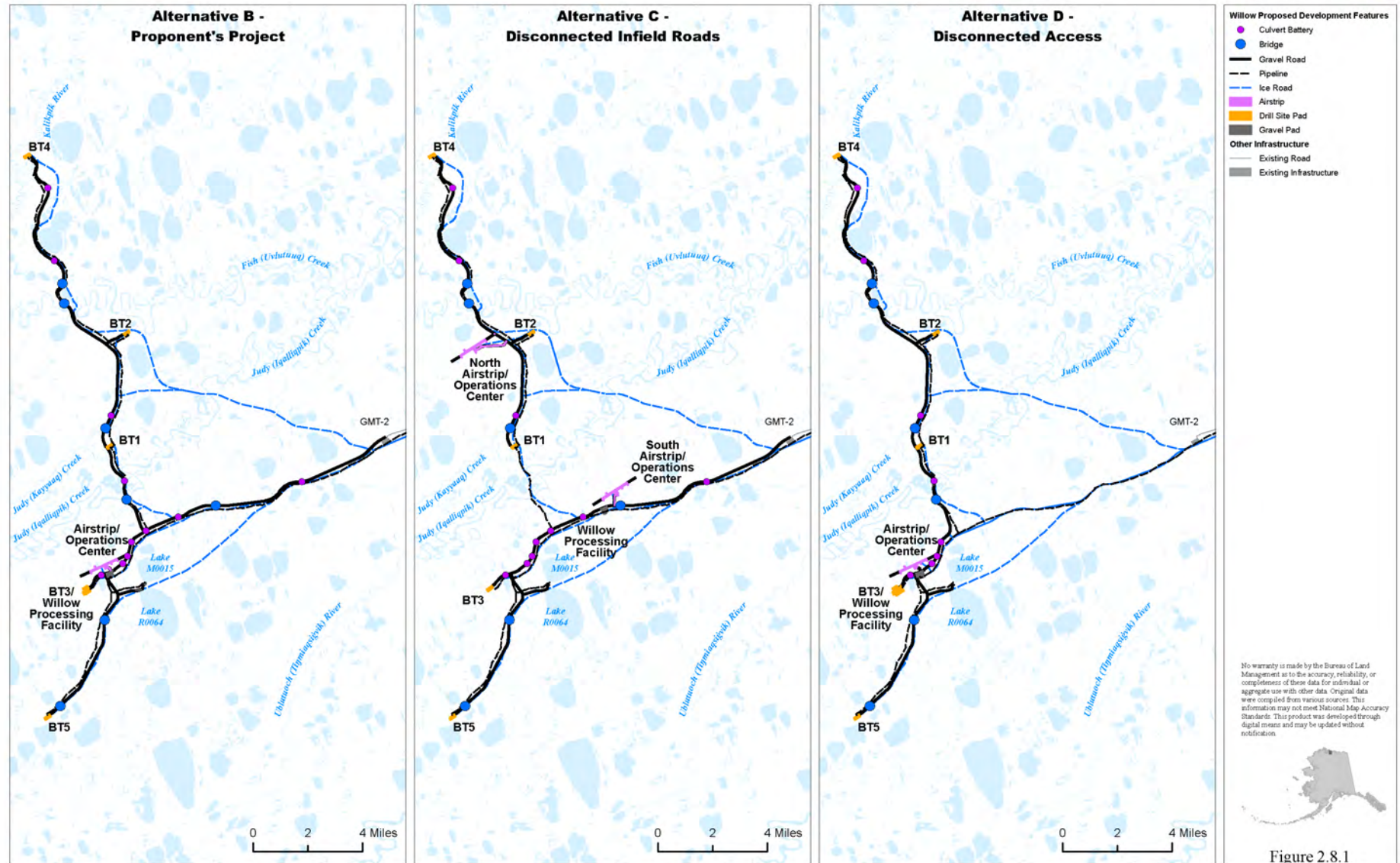


Figure 2.8.1. Comparison of Action Alternatives

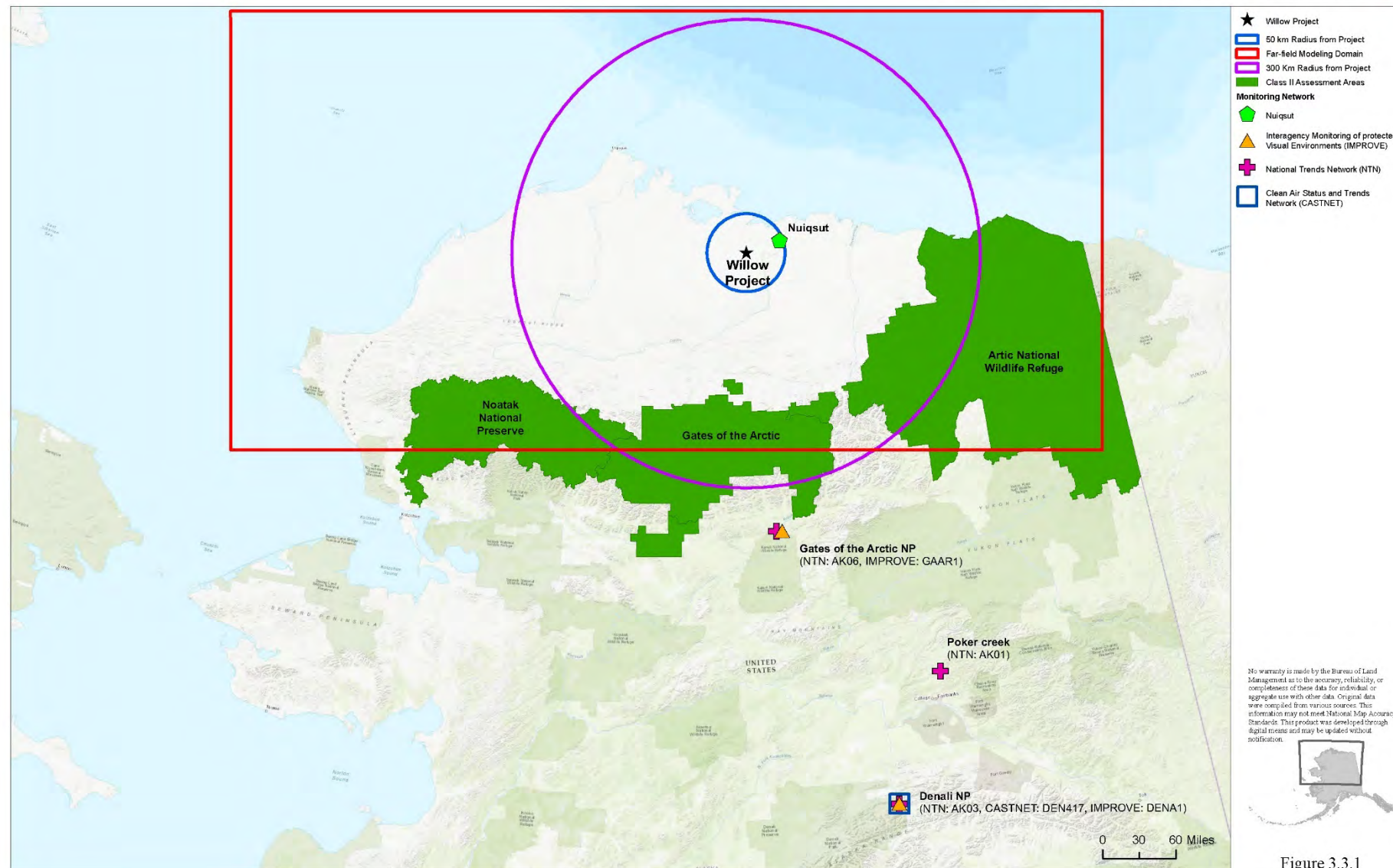


Figure 3.3.1

Figure 3.3.1. Analysis Area for Air Quality

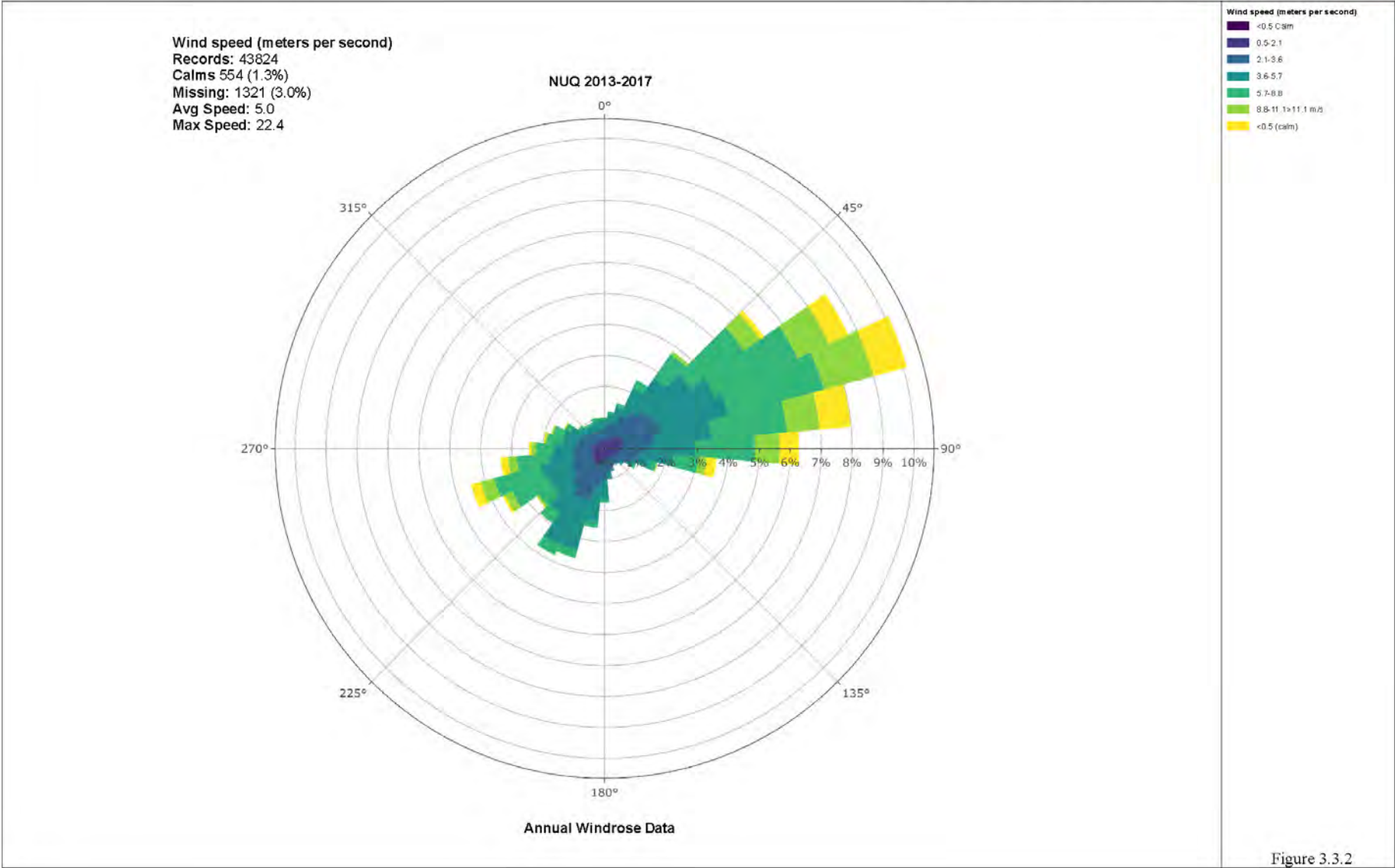


Figure 3.3.2. Nuiqsut Monitoring Station Wind Rose

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Analysis Area for Soils, Permafrost, and Gravel Resources

3.4 - Soils, Permafrost, and Gravel Resources

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Figure 3.4.1. Analysis Area for Soils, Permafrost, and Gravel Resources

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Known Contaminated Sites or Spills within 0.5 mile of the Project
3.5 - Contaminated Sites

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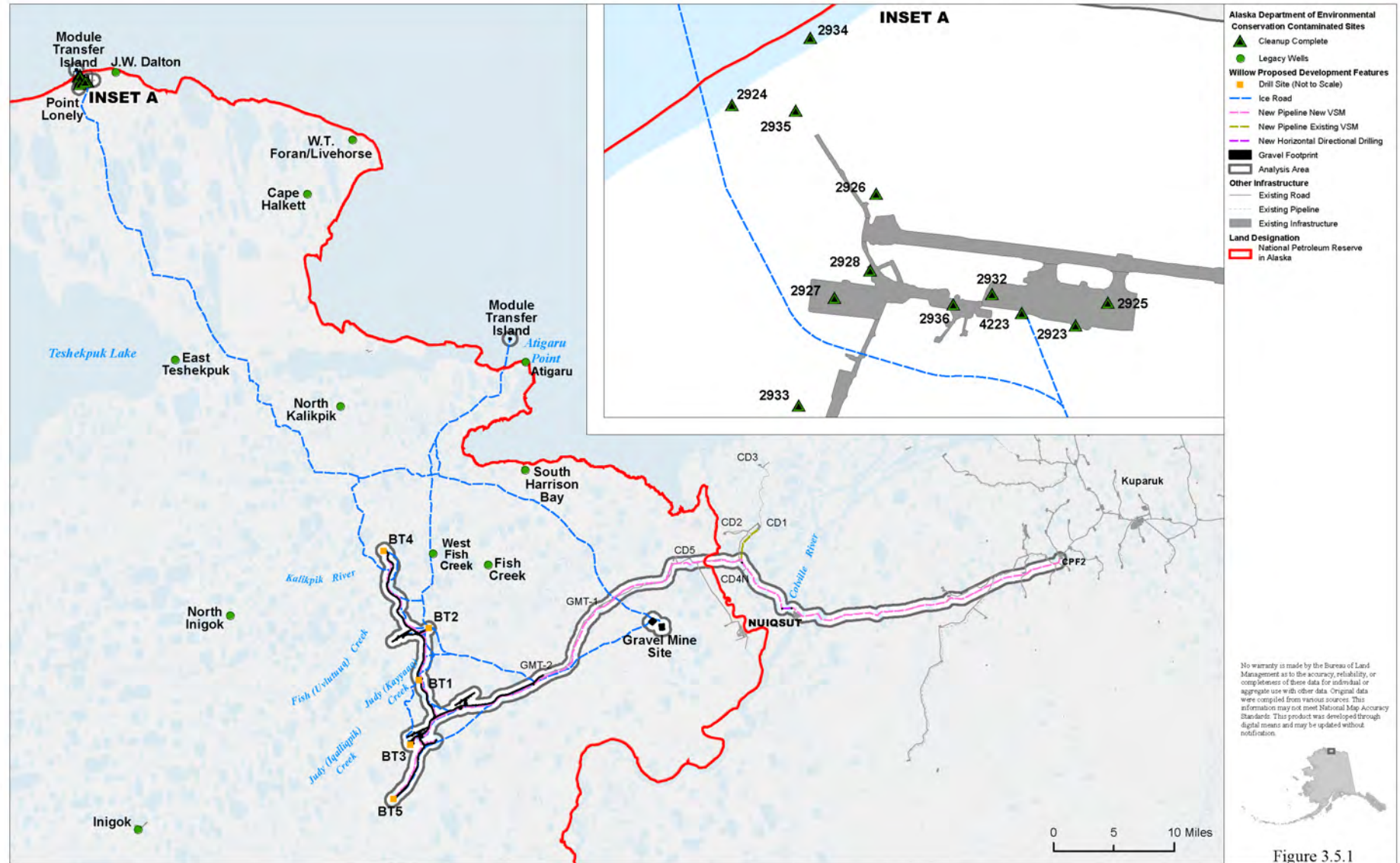


Figure 3.5.1. Known Contaminated Sites or Spills within 0.5 mile of the Project

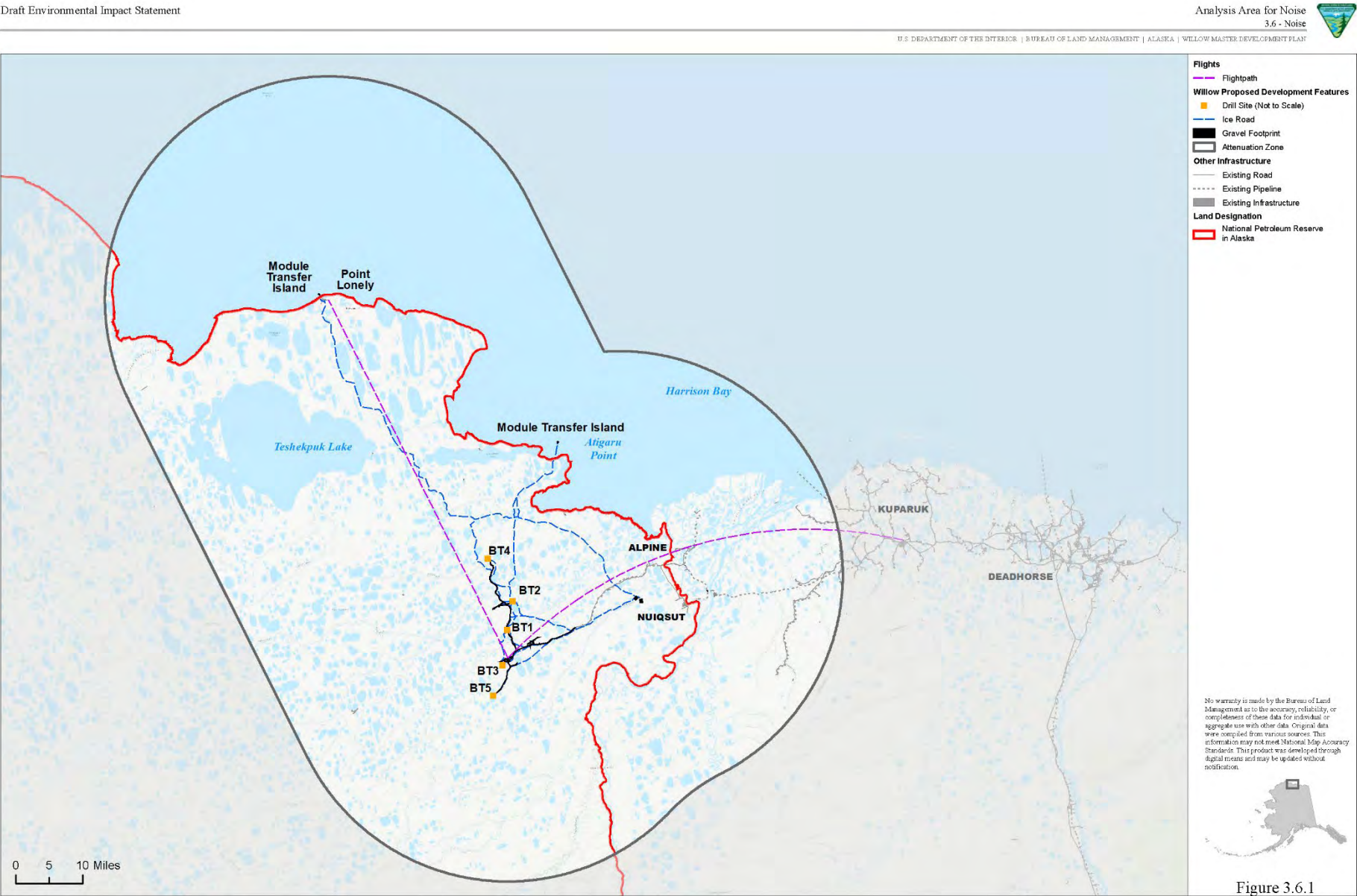


Figure 3.6.1. Analysis Area for Noise

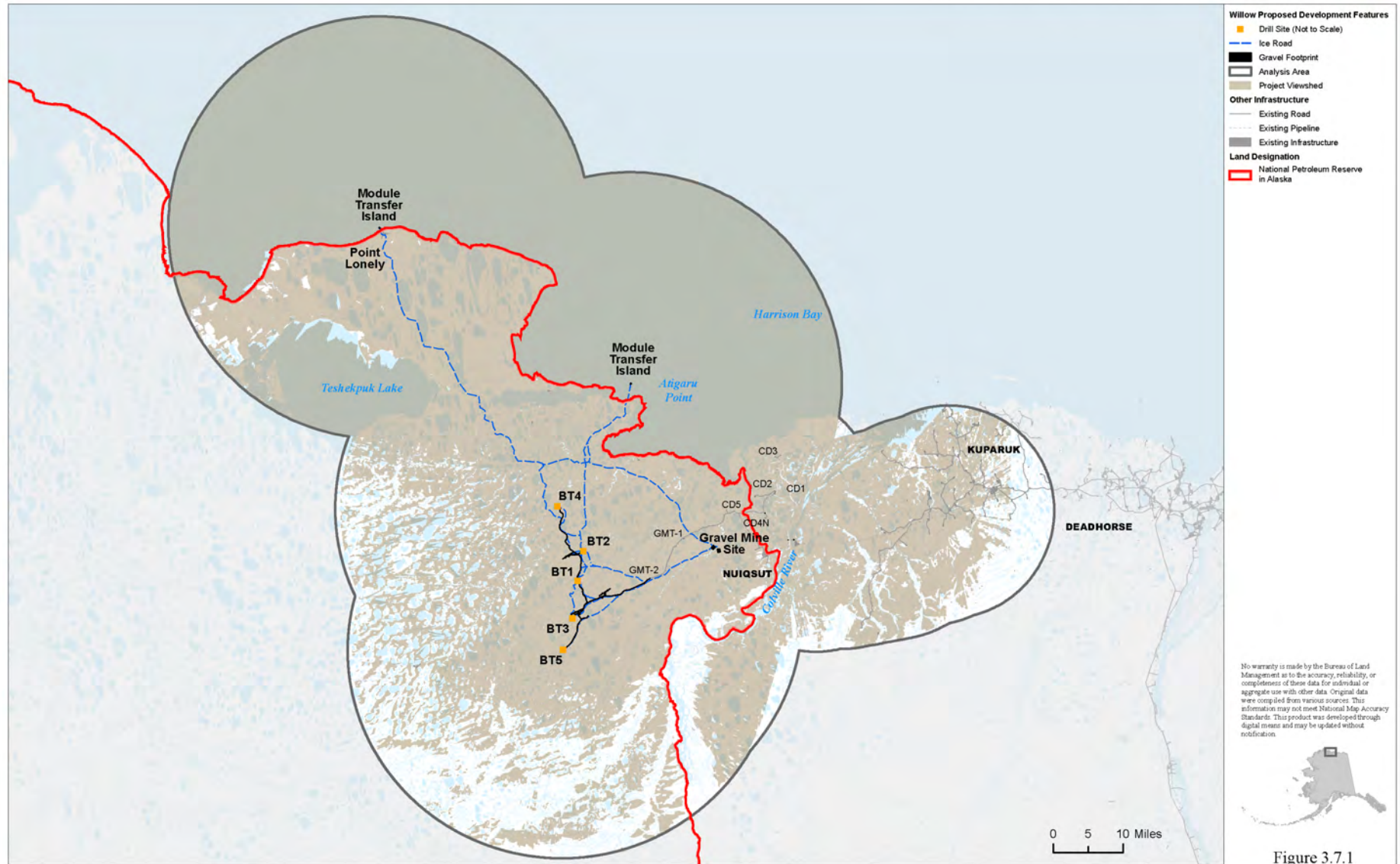


Figure 3.7.1. Visual Resources Analysis Area, Project Viewshed, and Proposed Project Facilities

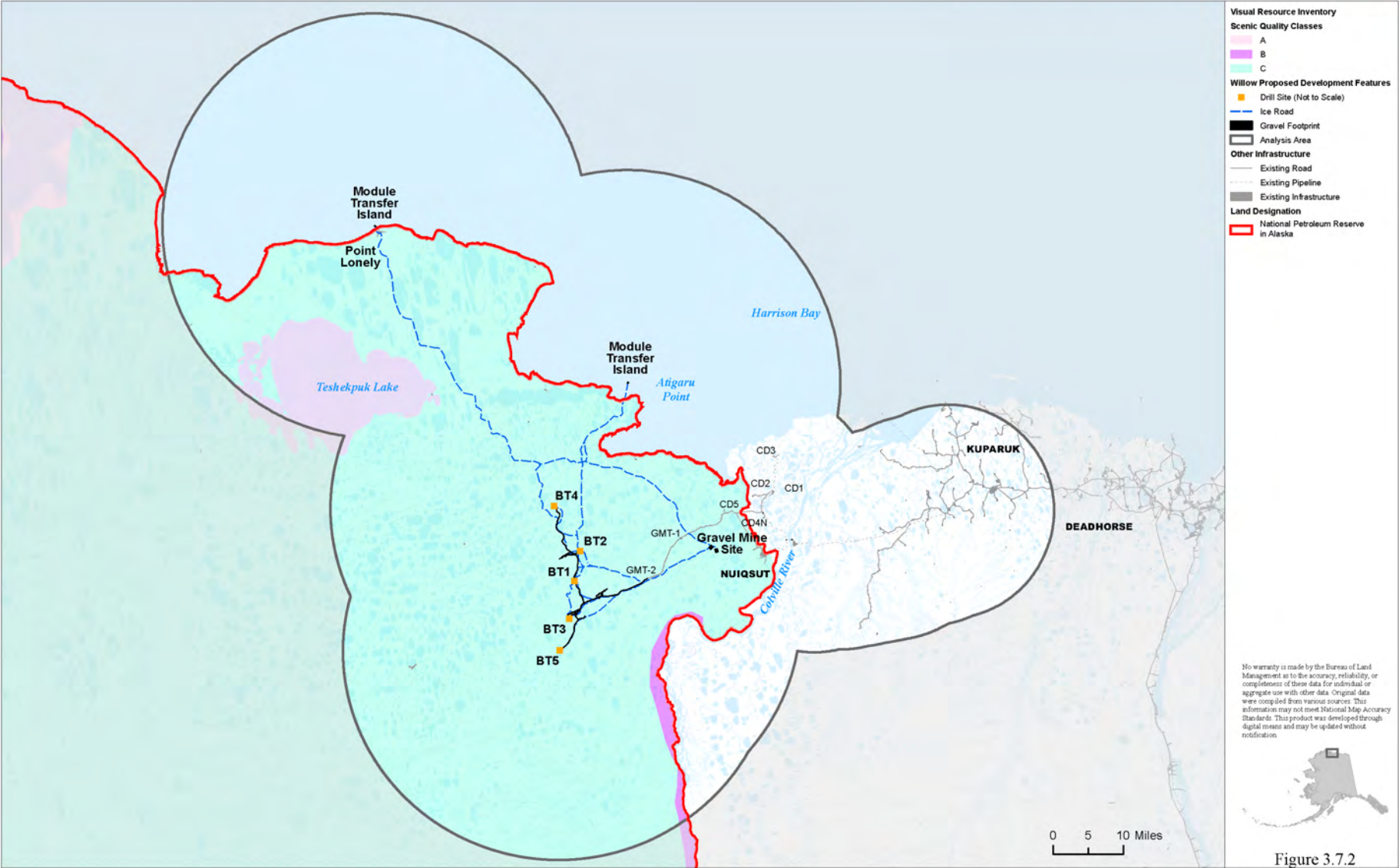


Figure 3.7.2. Visual Resource Inventory Scenic Quality Classes

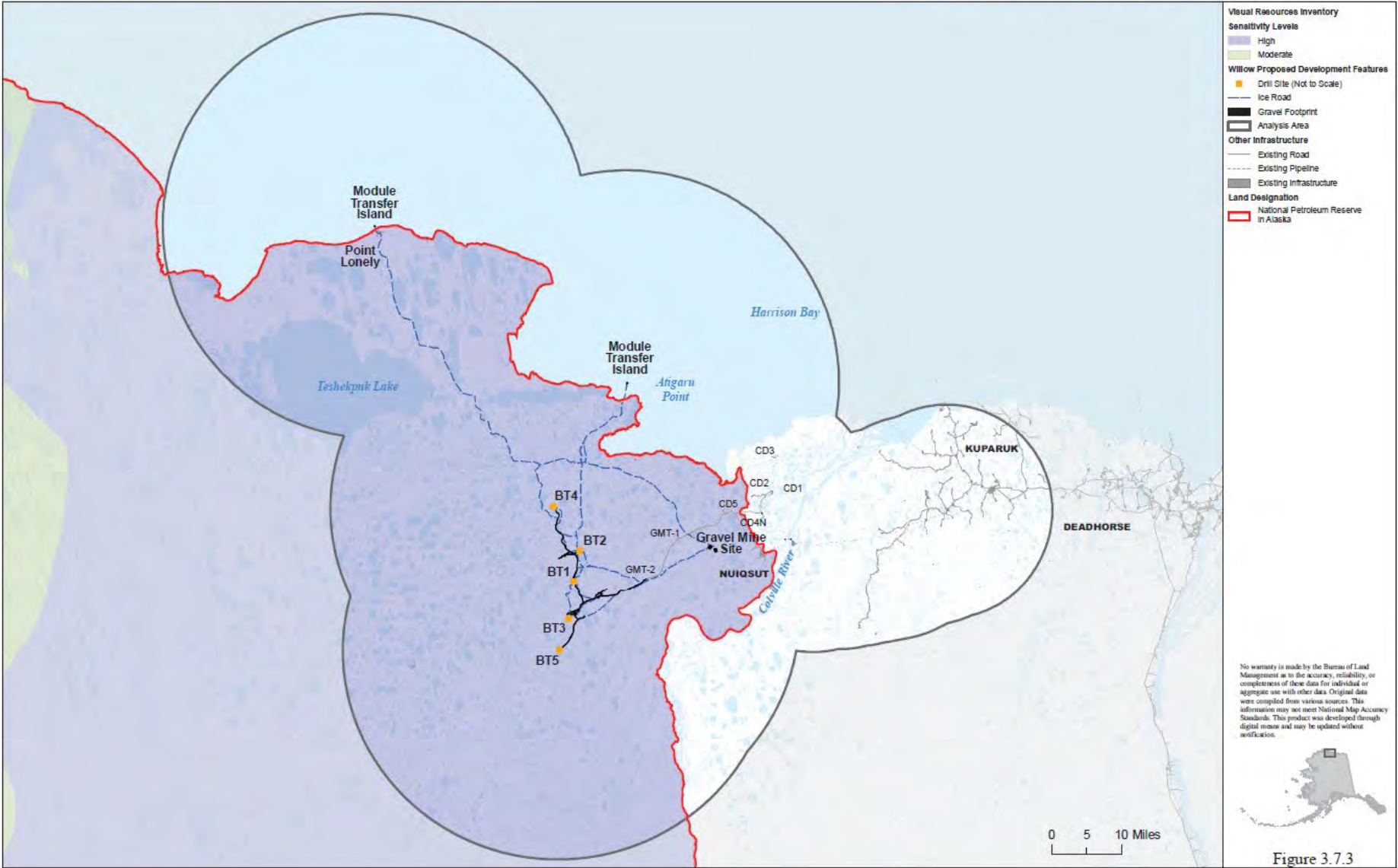


Figure 3.7.3. Visual Resource Inventory Sensitivity Levels

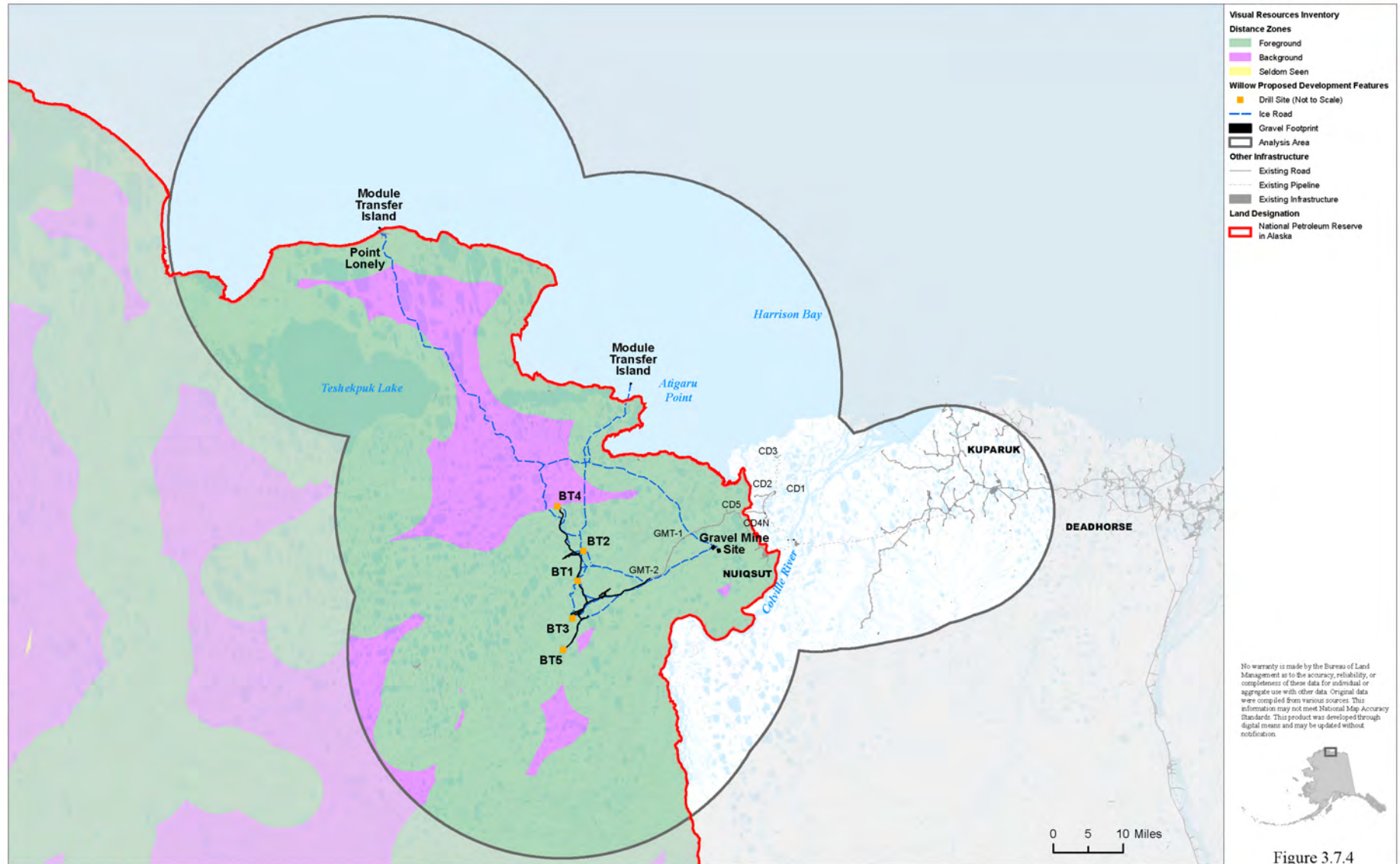


Figure 3.7.4. Visual Resource Inventory Distance Zones

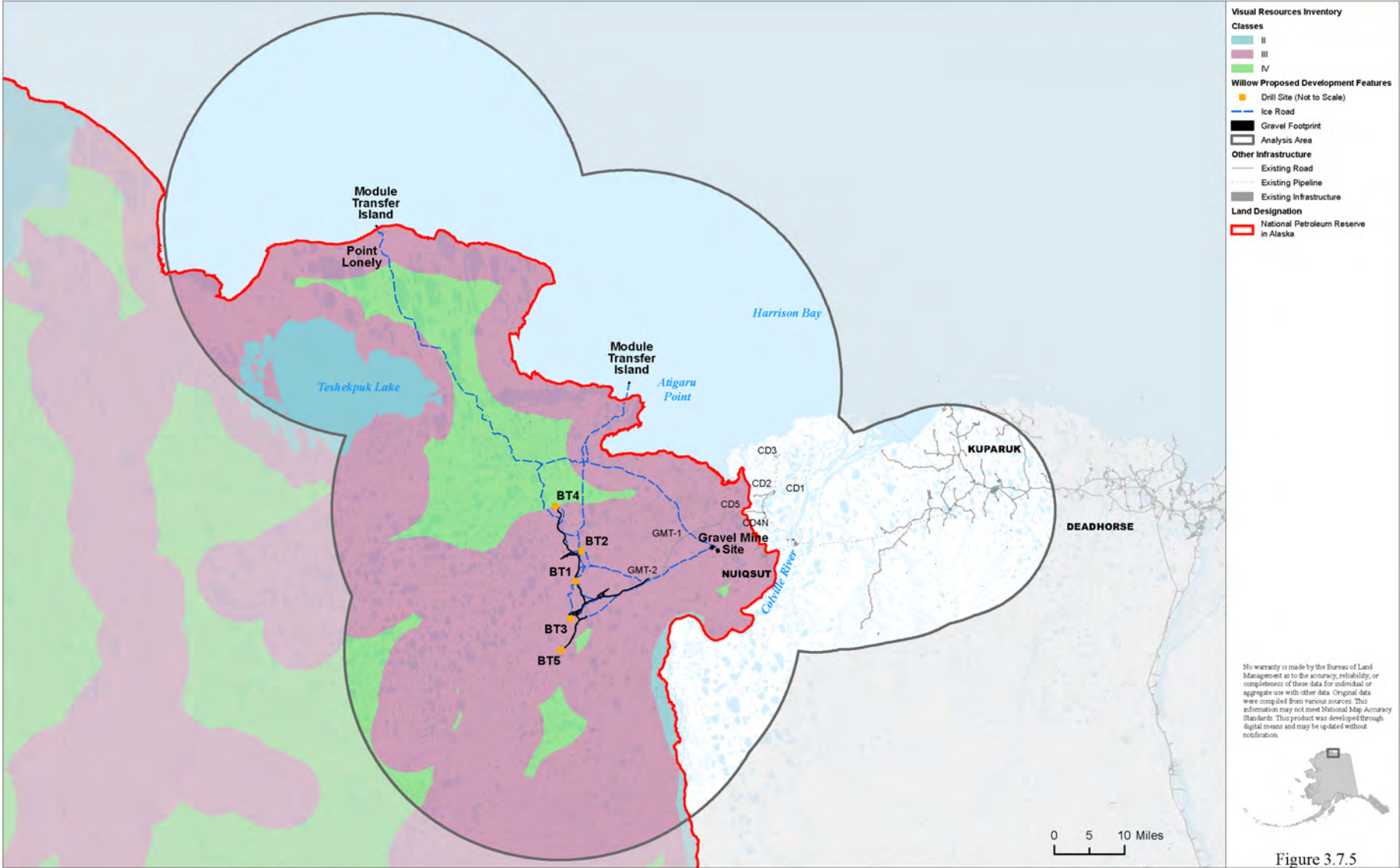


Figure 3.7.5. Visual Resource Inventory Classes

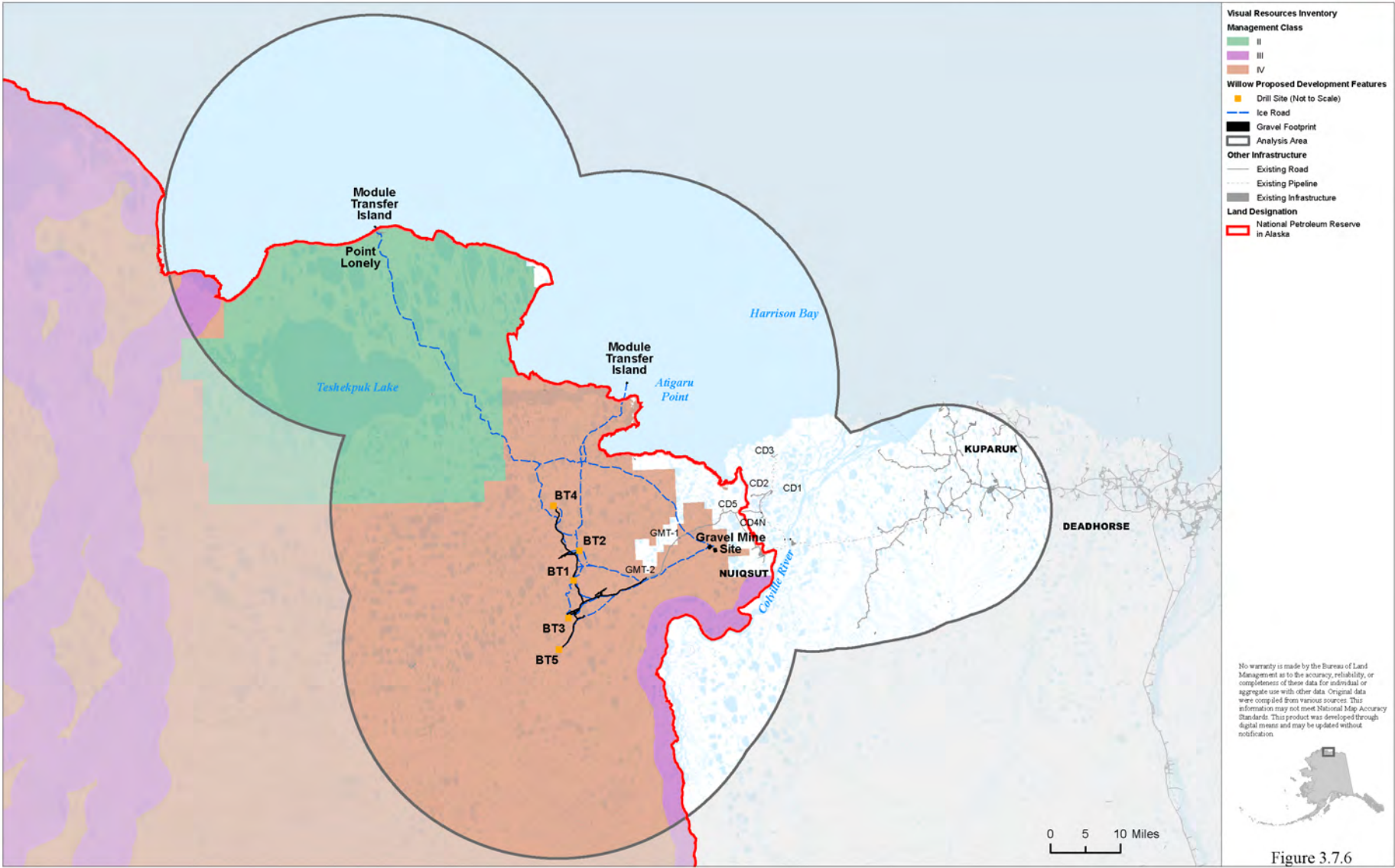


Figure 3.7.6. Visual Resource Management Classes

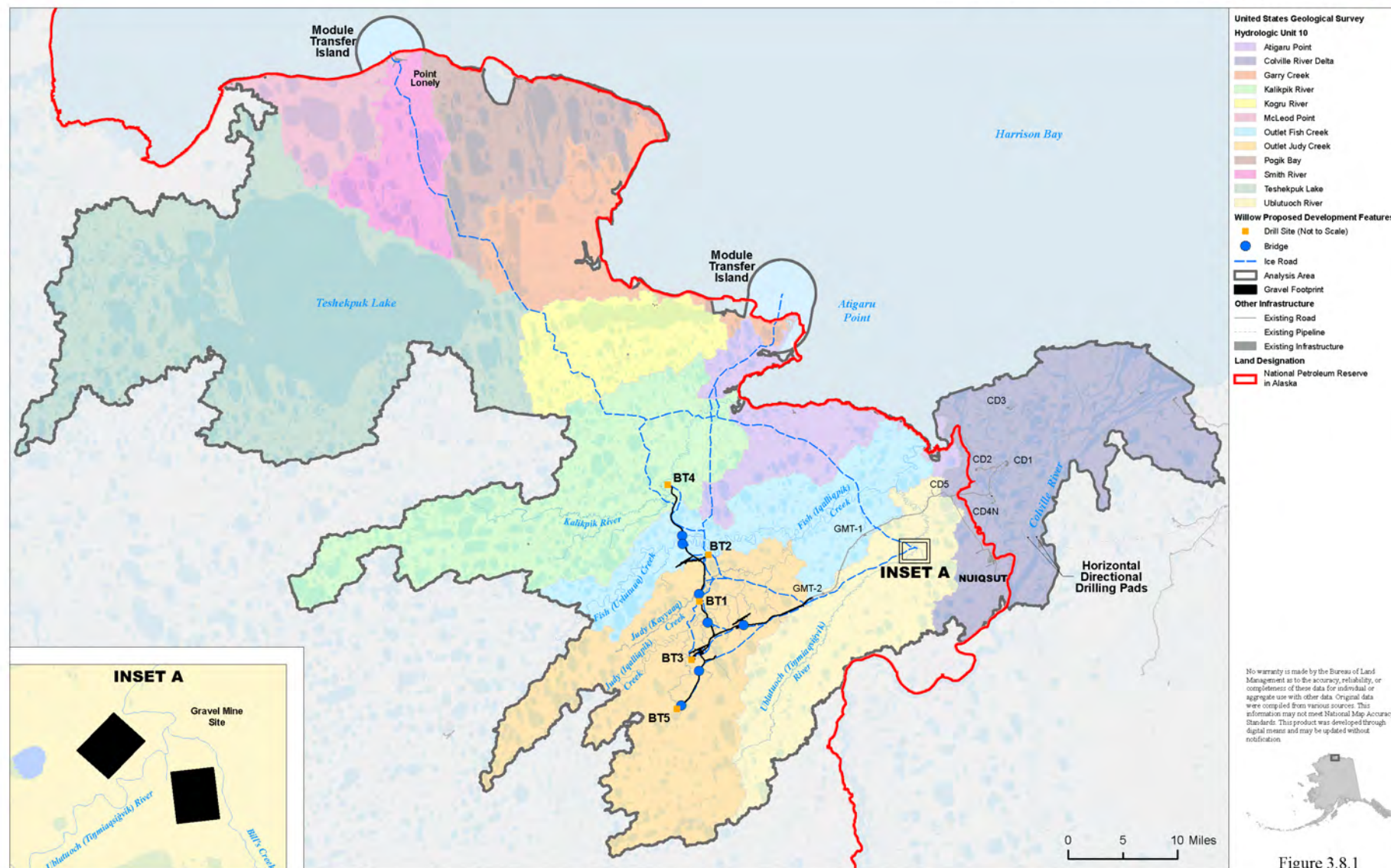


Figure 3.8.1. Watersheds in the Analysis Area for Water Resources

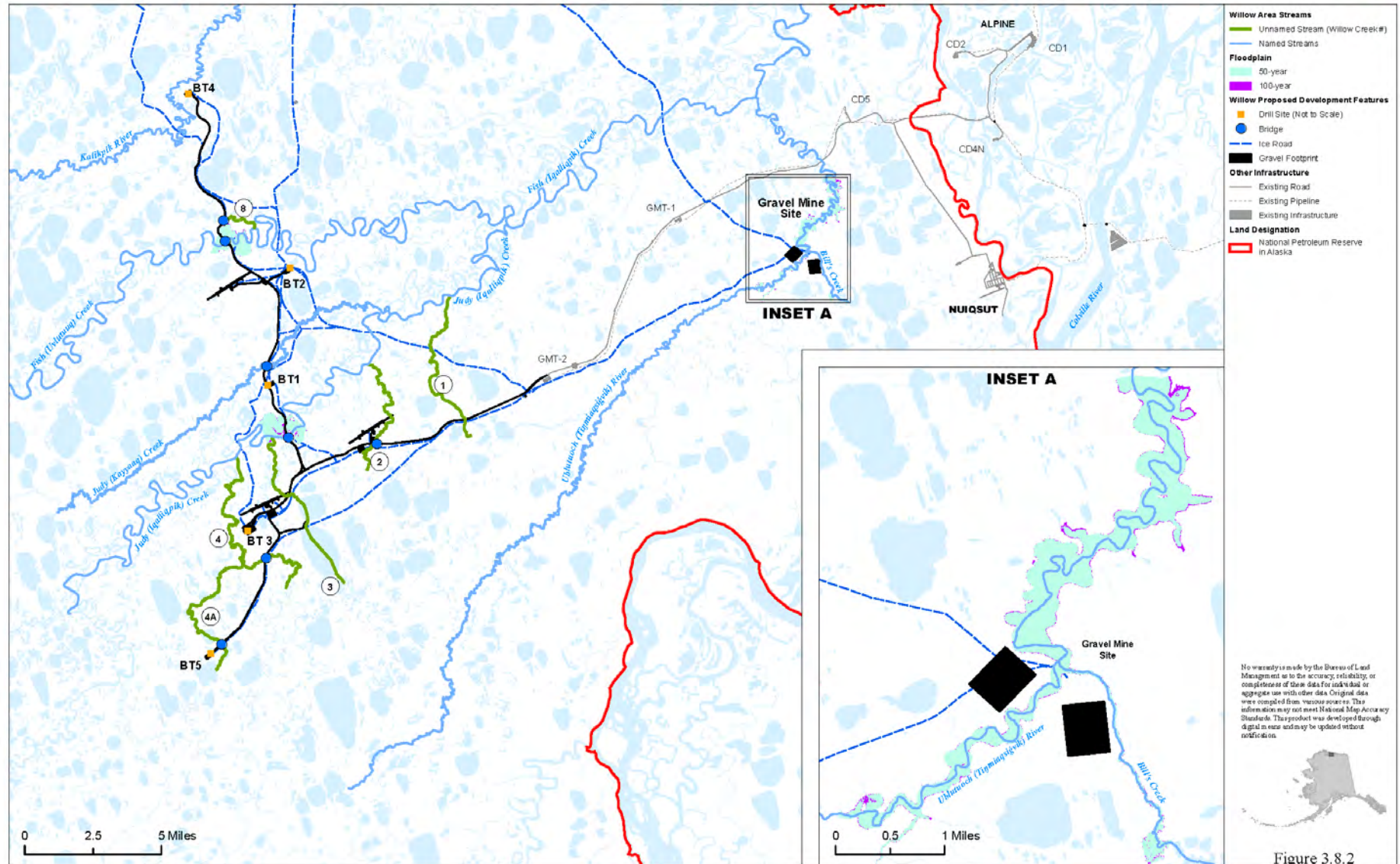


Figure 3.8.2. Streams and Floodplains in the Willow Area

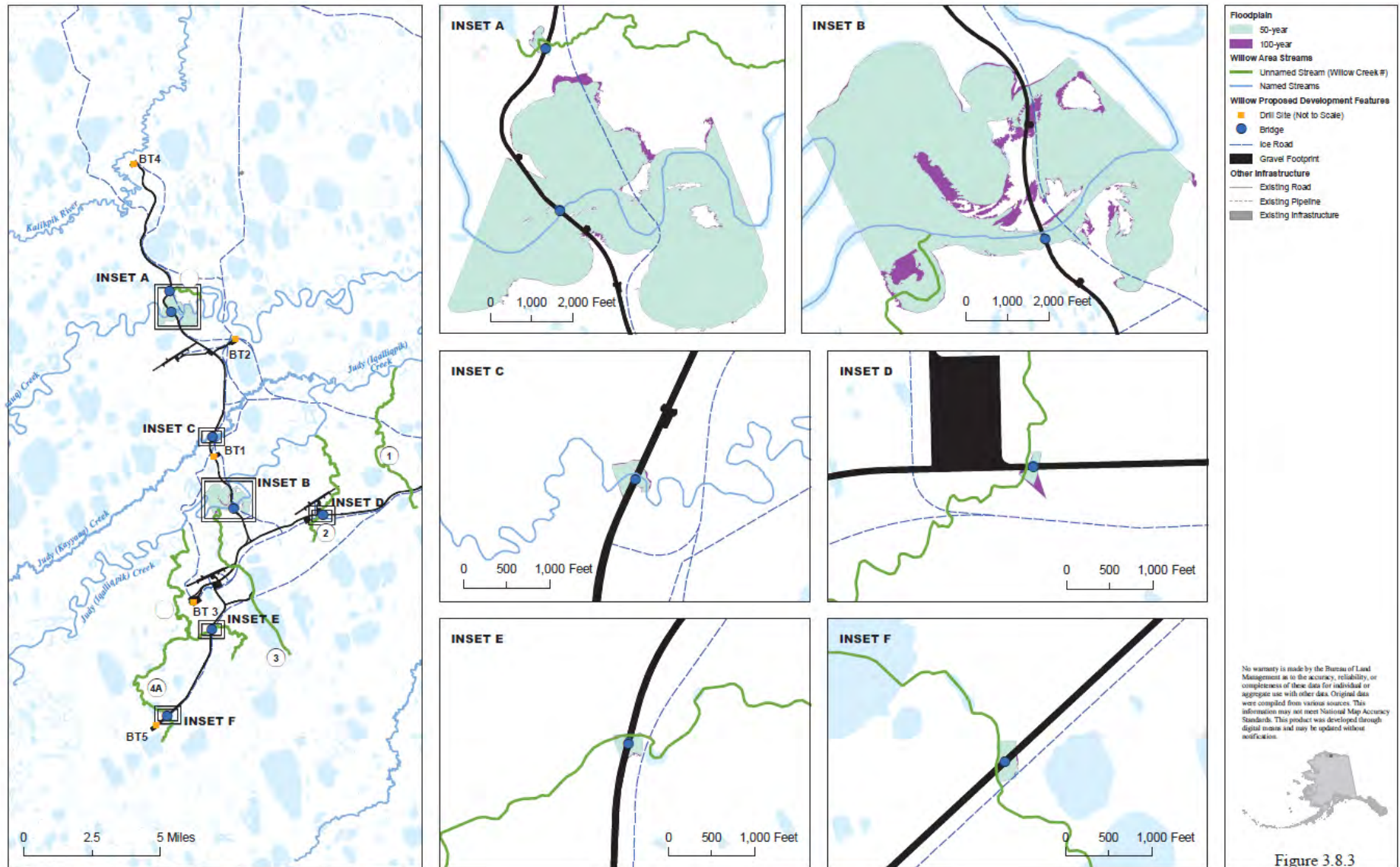


Figure 3.8.3. Floodplain Detail in the Willow Area

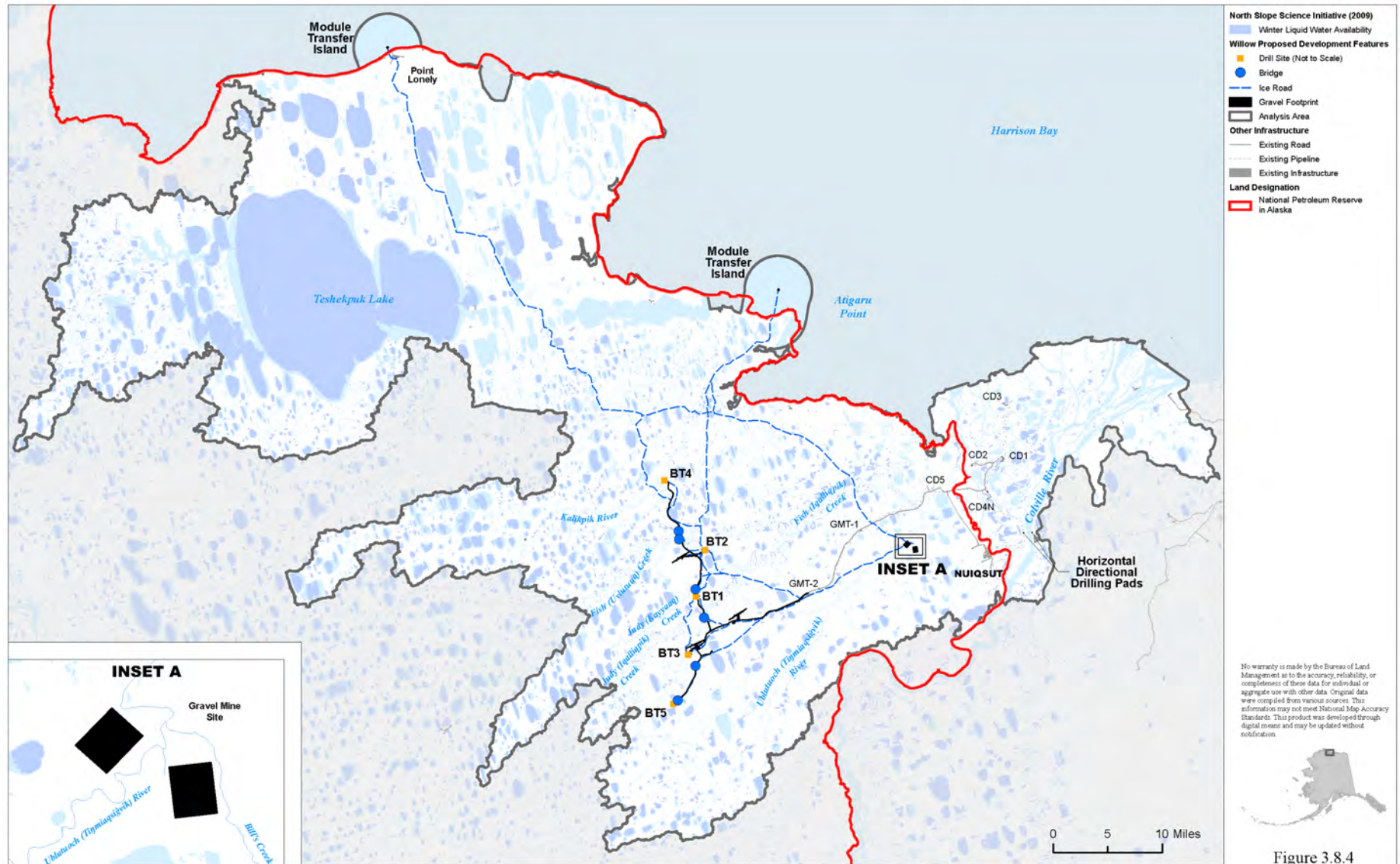


Figure 3.8.4. Lakes in the Water Resources Analysis Area

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Proximity of Water Resources to Shore-based Action Alternatives

3.8 - Water Resources

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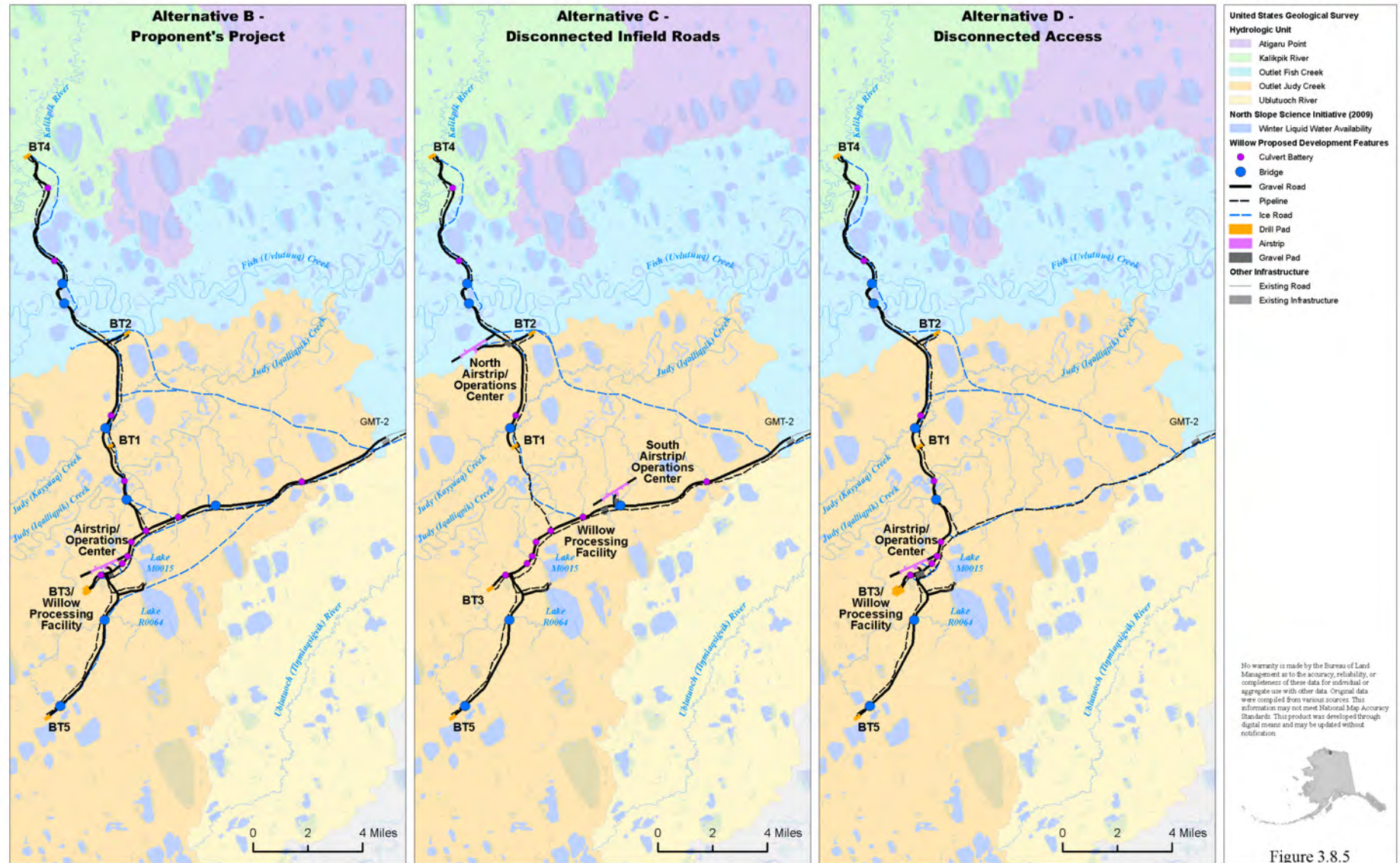


Figure 3.8.5. Proximity of Water Resources to Shore-based Action Alternatives

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Analysis Area for Wetlands and Vegetation
3.9 - Wetlands and Vegetation

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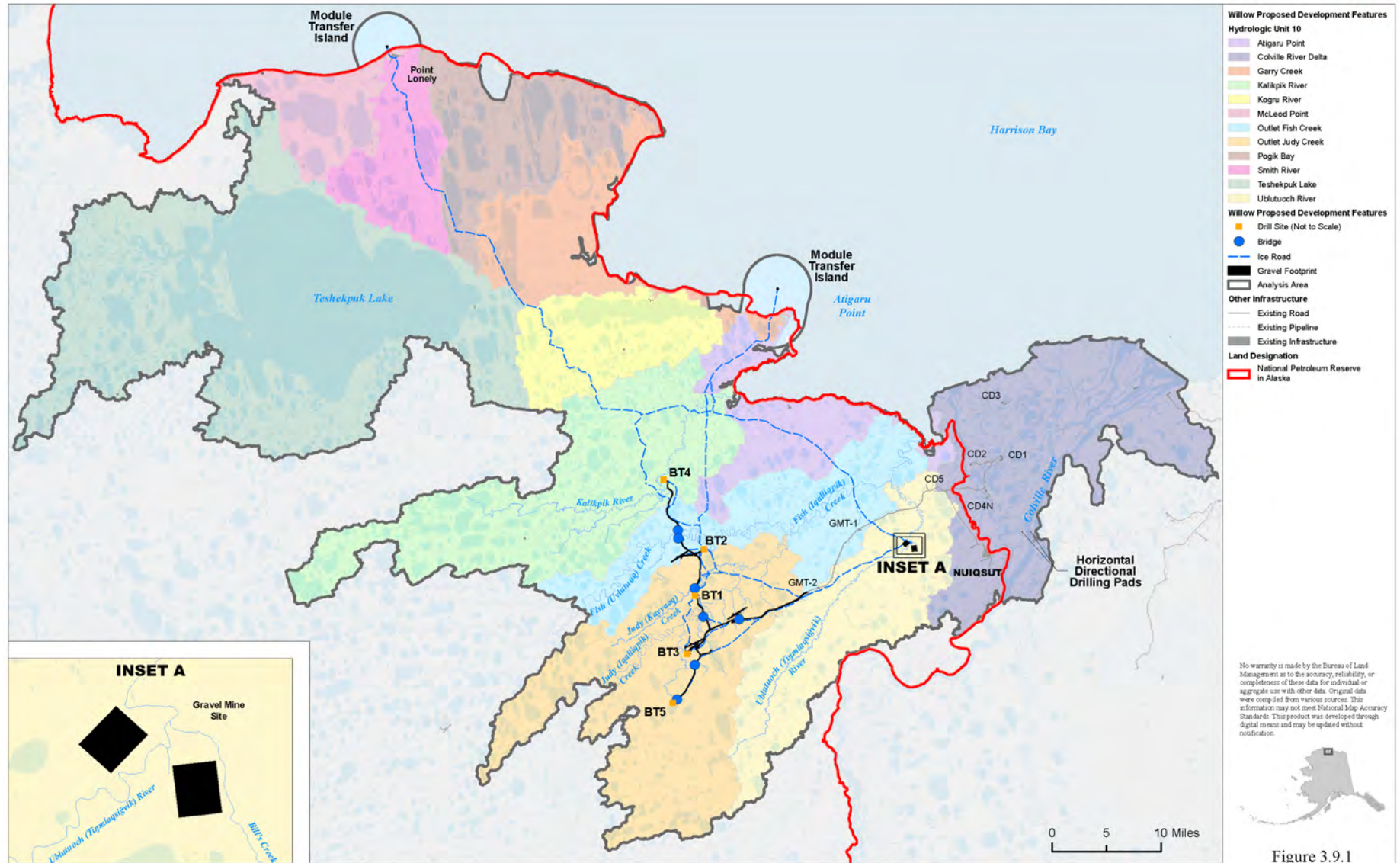


Figure 3.9.1. Analysis Area for Wetlands and Vegetation



Figure 3.9.2

Figure 3.9.2. Wetlands in the Analysis Area

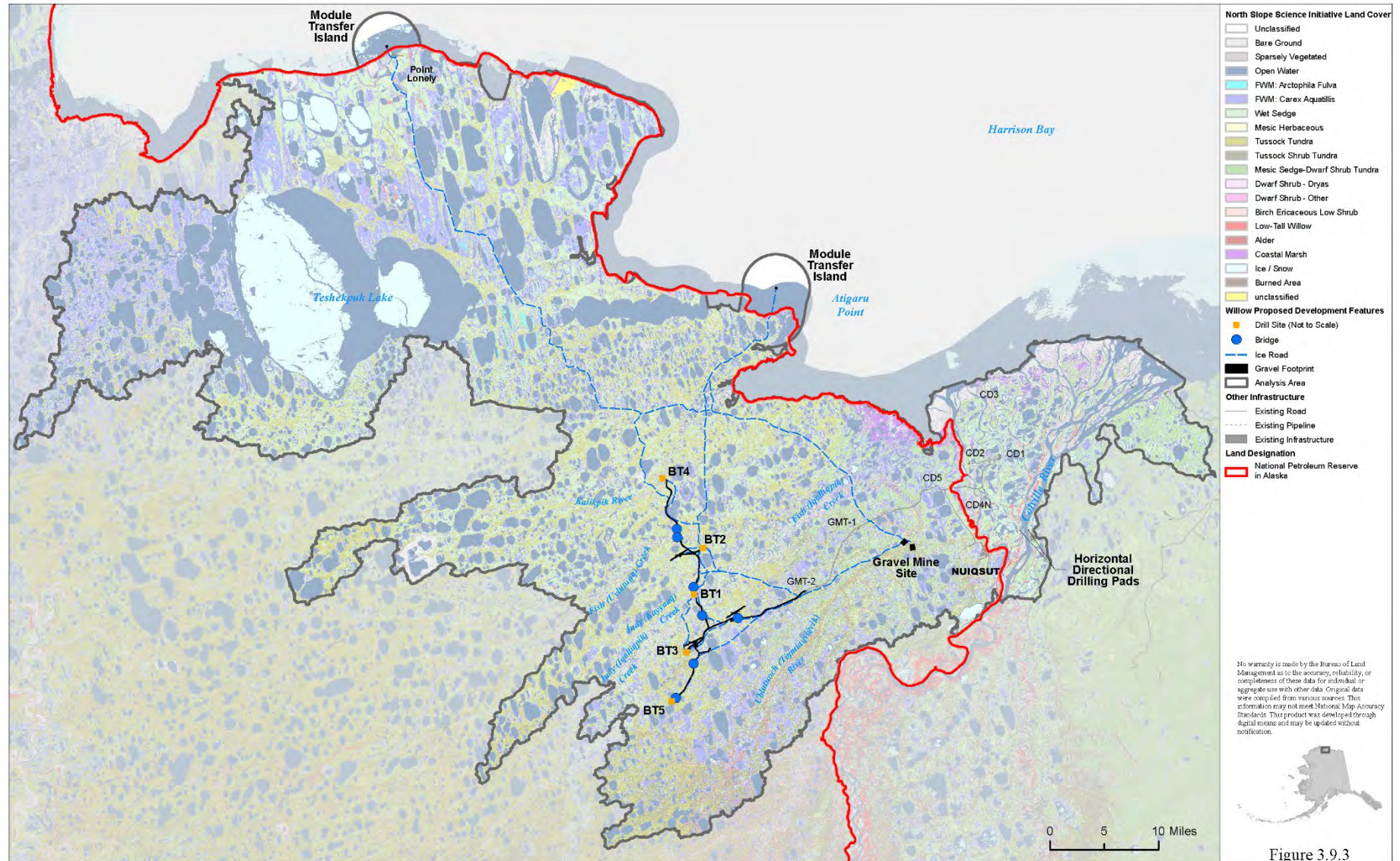


Figure 3.9.3

Figure 3.9.3. Land Cover Classes in the Analysis Area

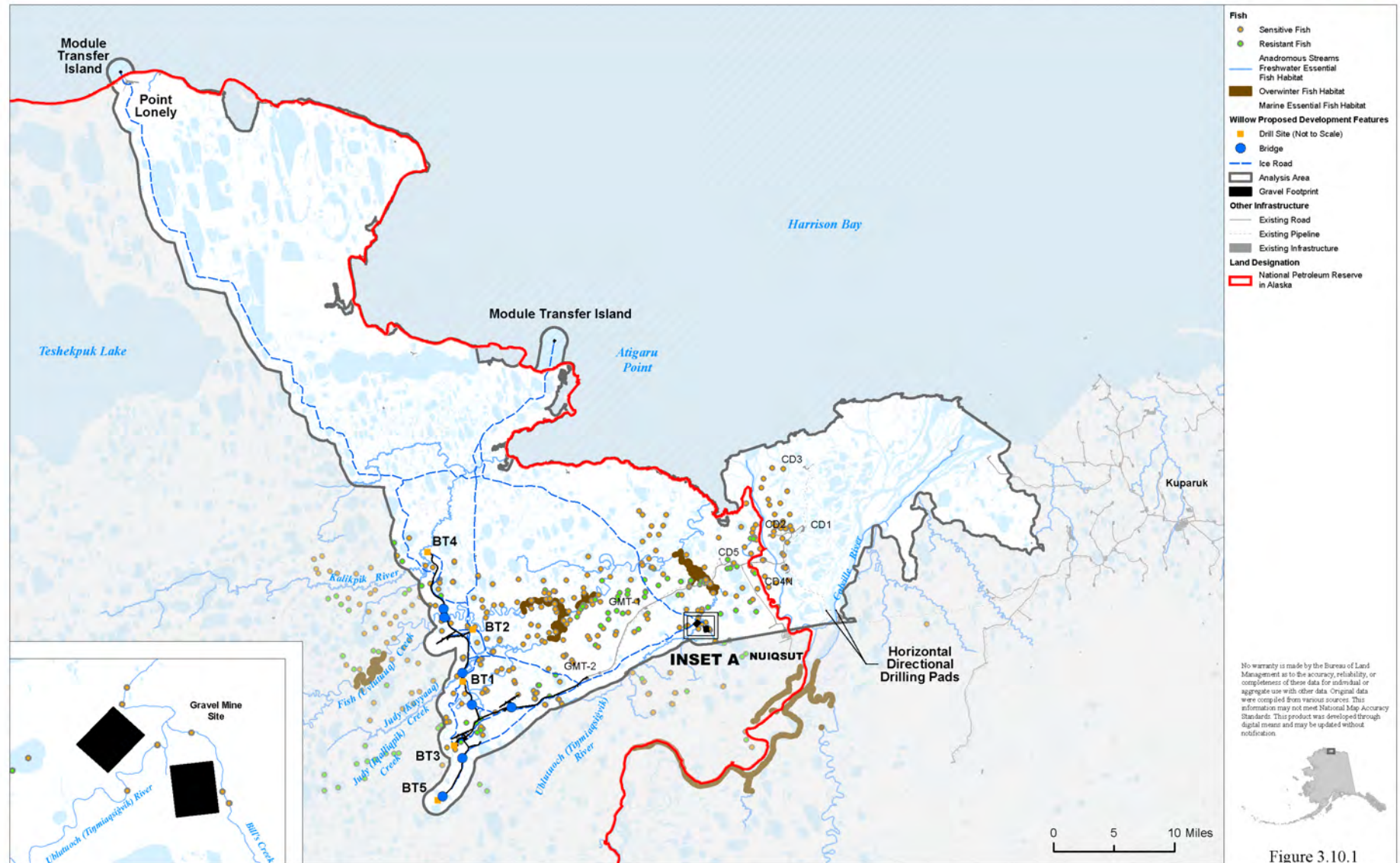


Figure 3.10.1. Essential Fish Habitat in the Analysis Area

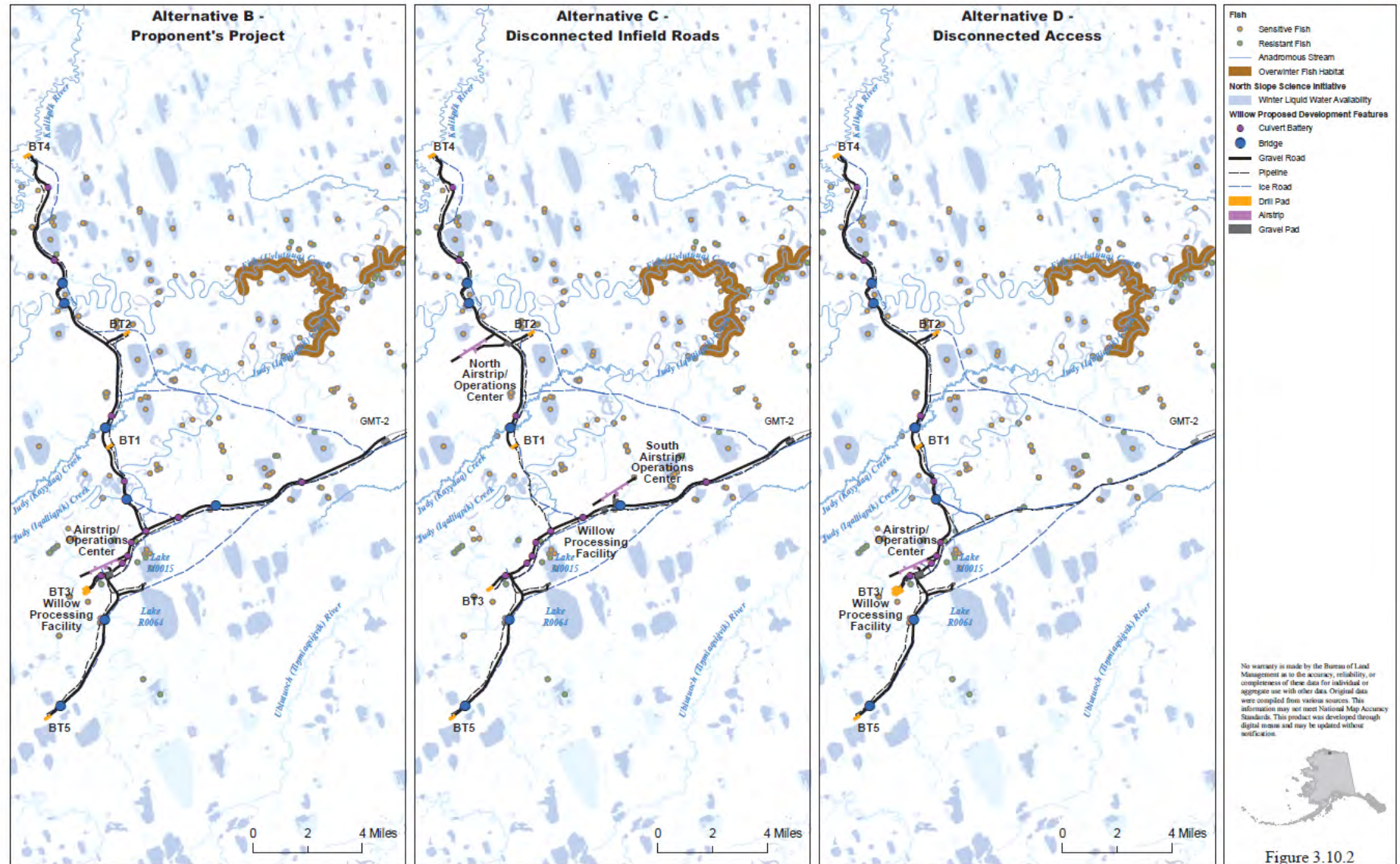


Figure 3.10.2. Fish Habitat in the Willow Area

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Bird Habitat Use and Analysis Area

3.11 - Birds

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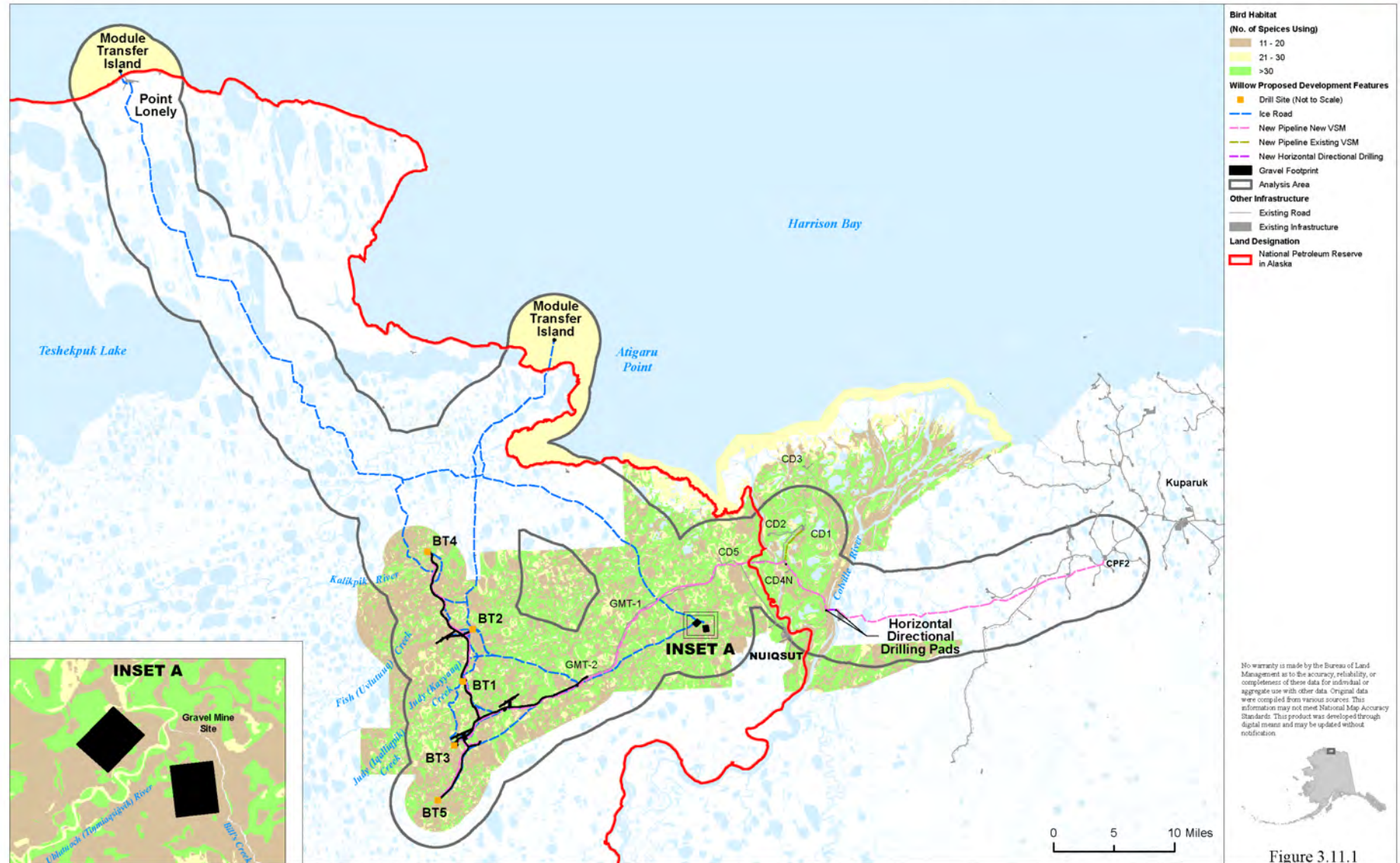


Figure 3.11.1. Bird Habitat Use and Analysis Area

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Spectacled Eider Pre-Breeding Density in the Analysis Area

3.11 - Birds

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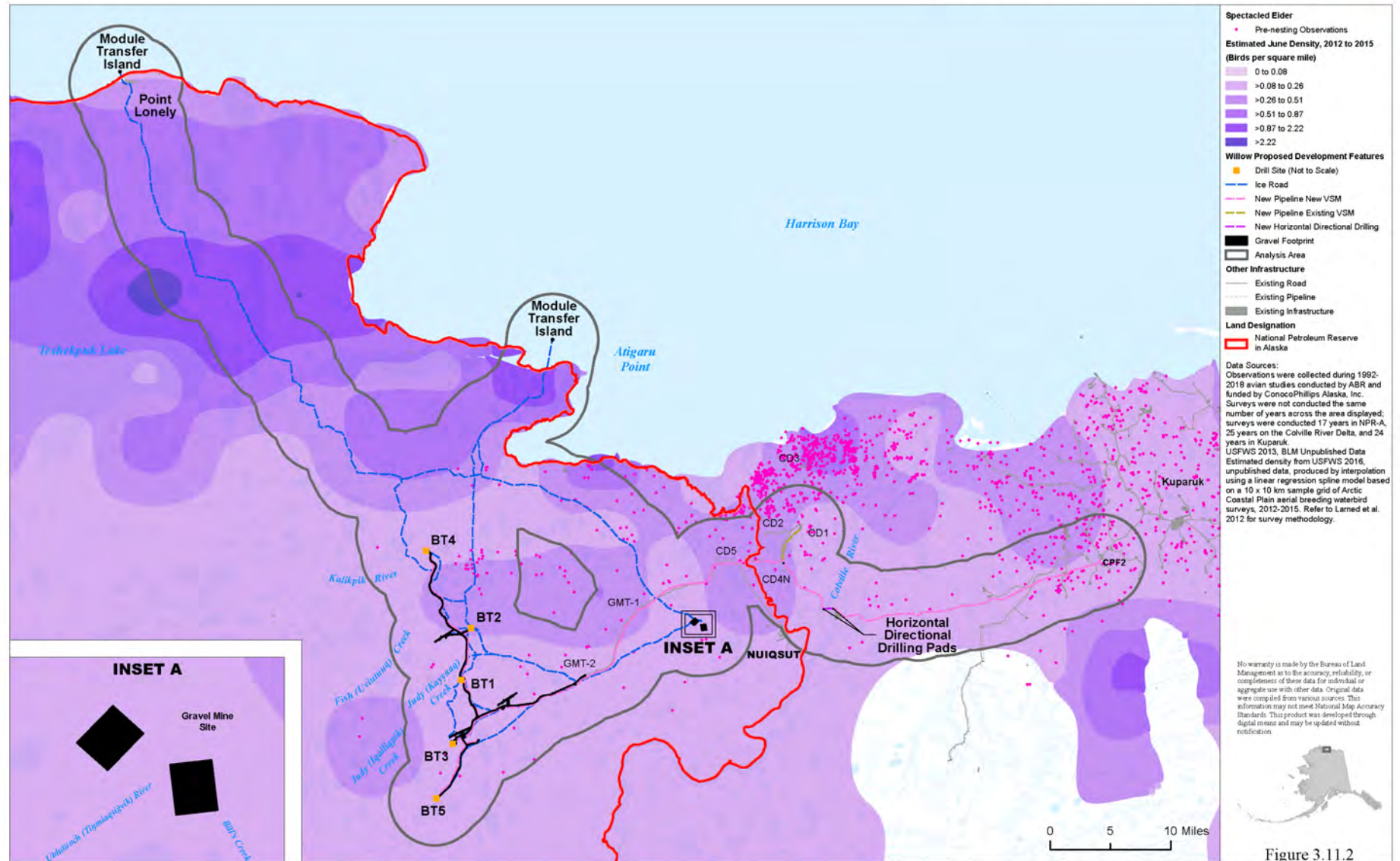


Figure 3.11.2. Spectacled Eider Pre-Breeding Density in the Analysis Area

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Yellow-Billed Loon Density and Nests in the Analysis Area
3.11 - Birds

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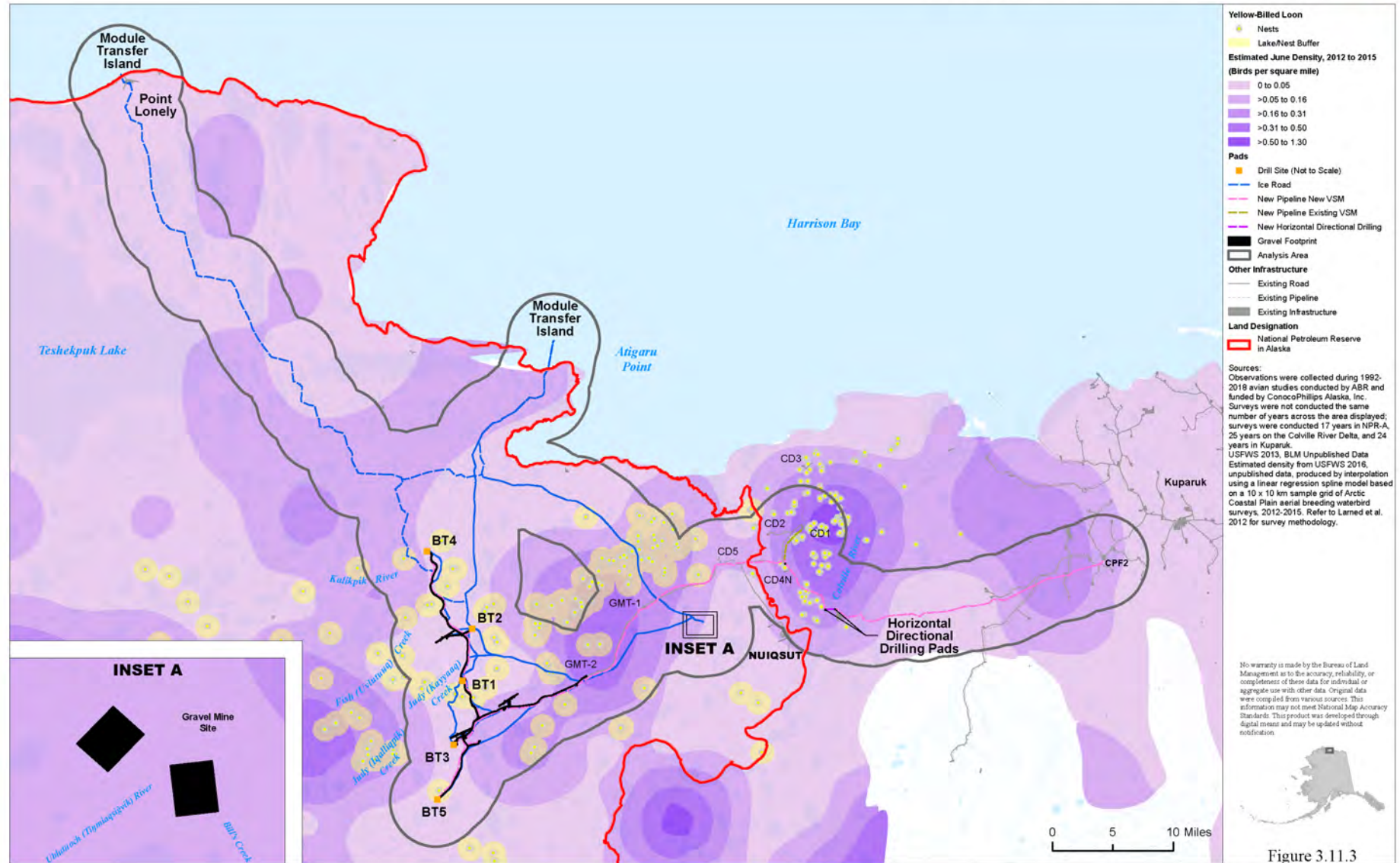


Figure 3.11.3. Yellow-Billed Loon Density and Nests in the Analysis Area

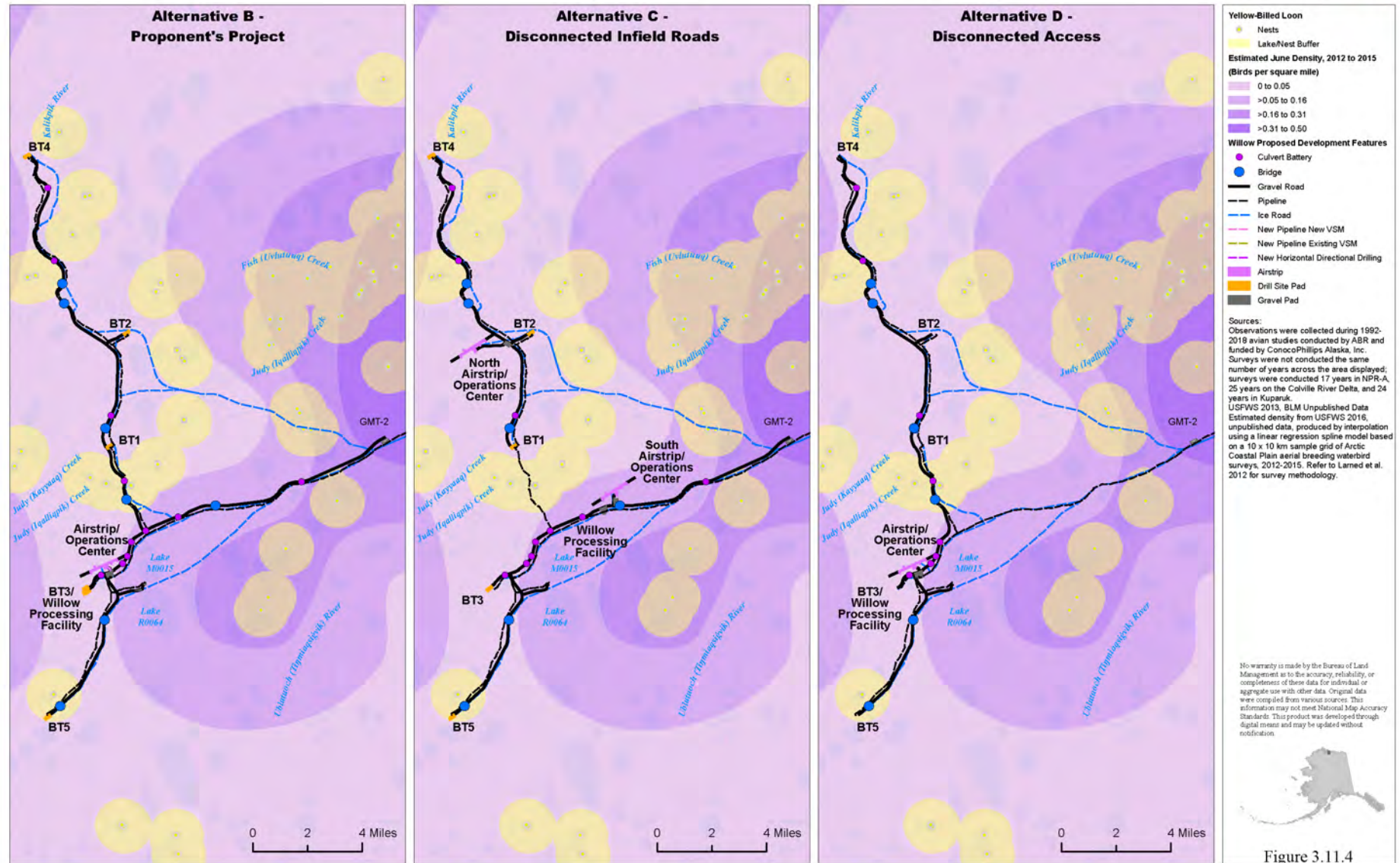


Figure 3.11.4. Yellow-Billed Loon Density and Nests in the Willow Area

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Bird Habitat Use in the Willow Area

3.11 - Birds



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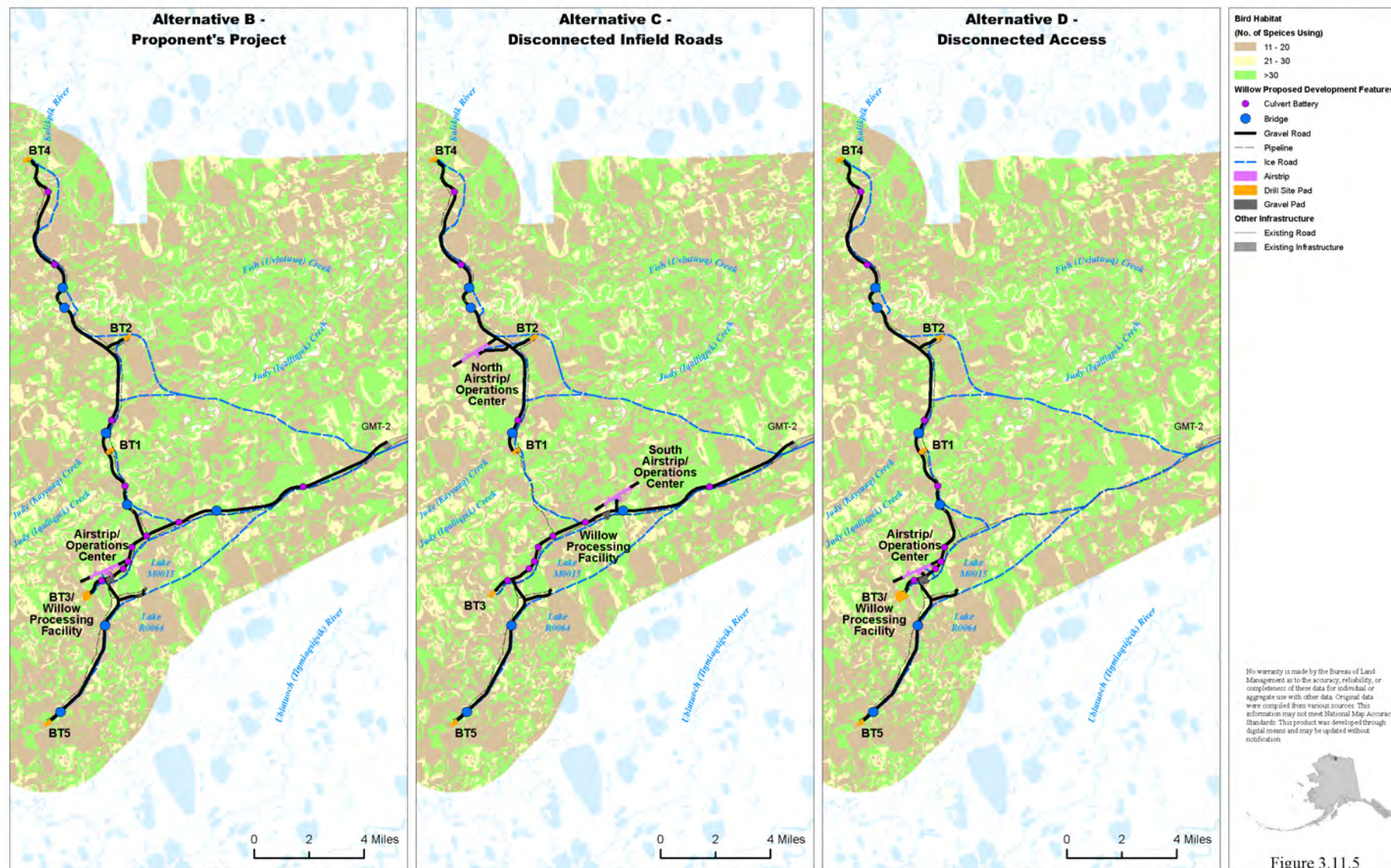


Figure 3.11.5. Bird Habitat Use in the Willow Area

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Analysis Area for Terrestrial Mammals

3.12 - Terrestrial Mammals

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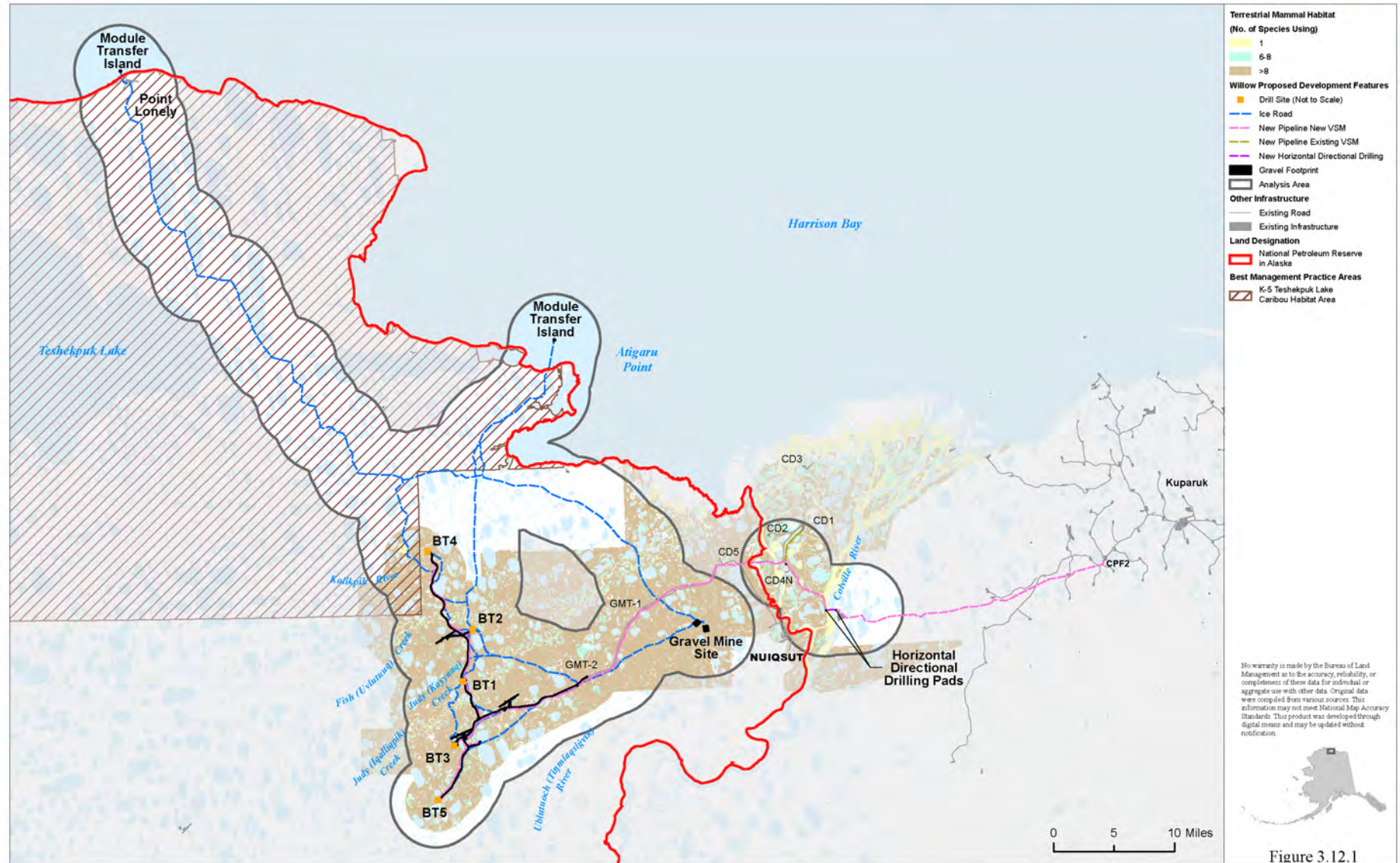


Figure 3.12.1. Analysis Area for Terrestrial Mammals

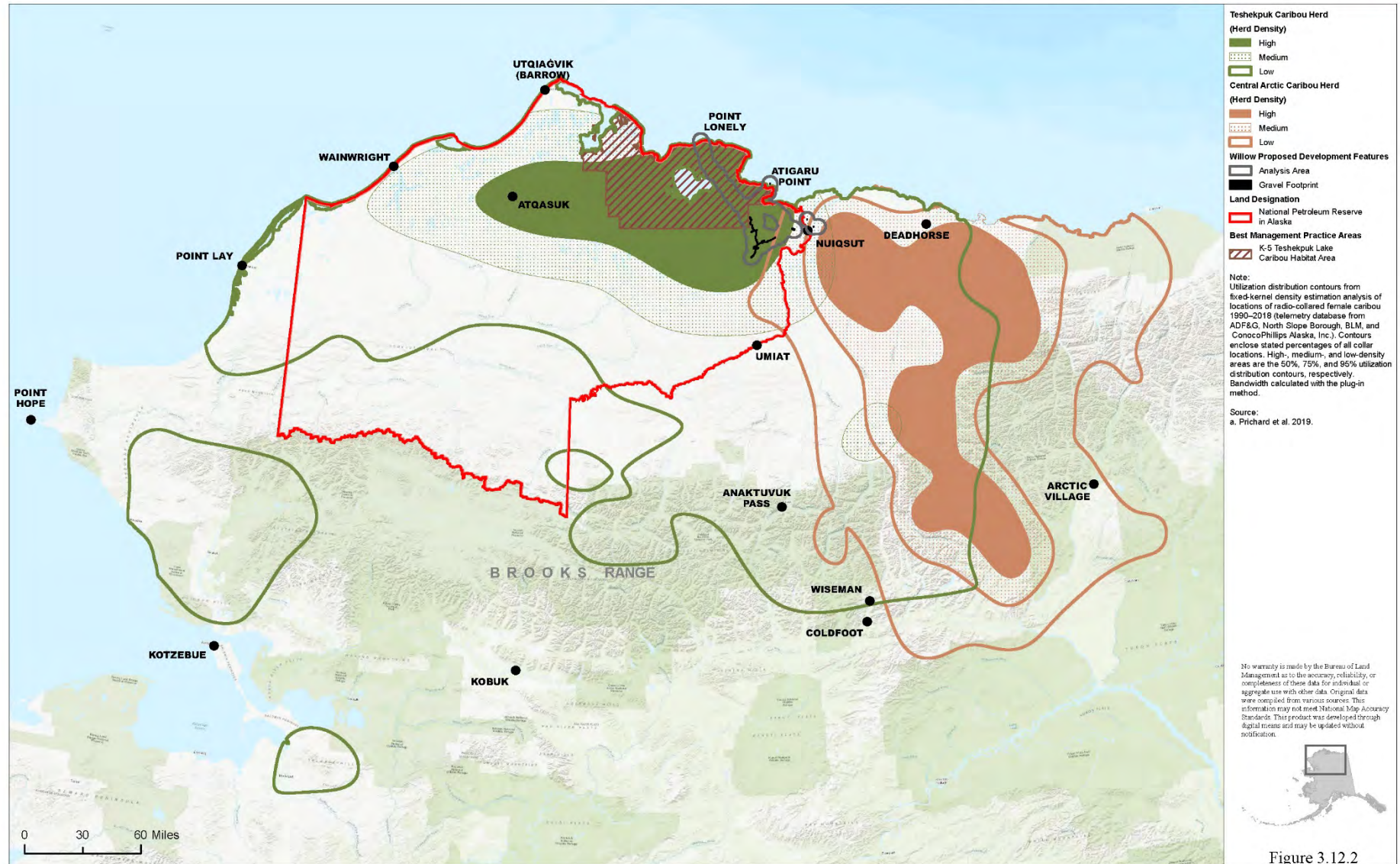


Figure 3.12.2

Figure 3.12.2. Annual Ranges of the Central Arctic and Teshekpuk Caribou Herds

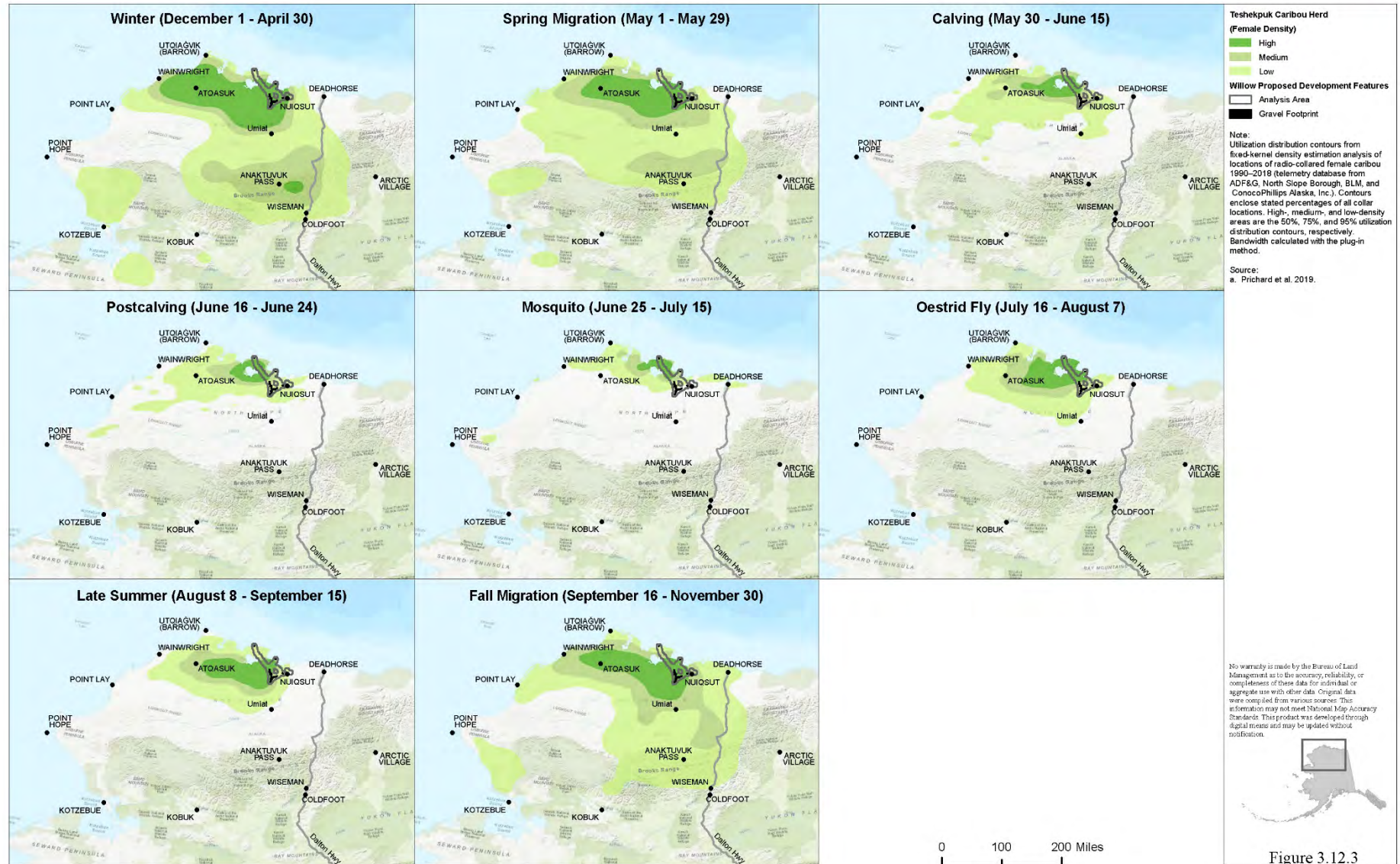


Figure 3.12.3. Seasonal Distribution of Female Caribou in the Teshekpuk Caribou Herd

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Movement of GPS-Collared Caribou of the Teshekpuk Caribou Herd 2004–2018

3.12 - Terrestrial Mammals

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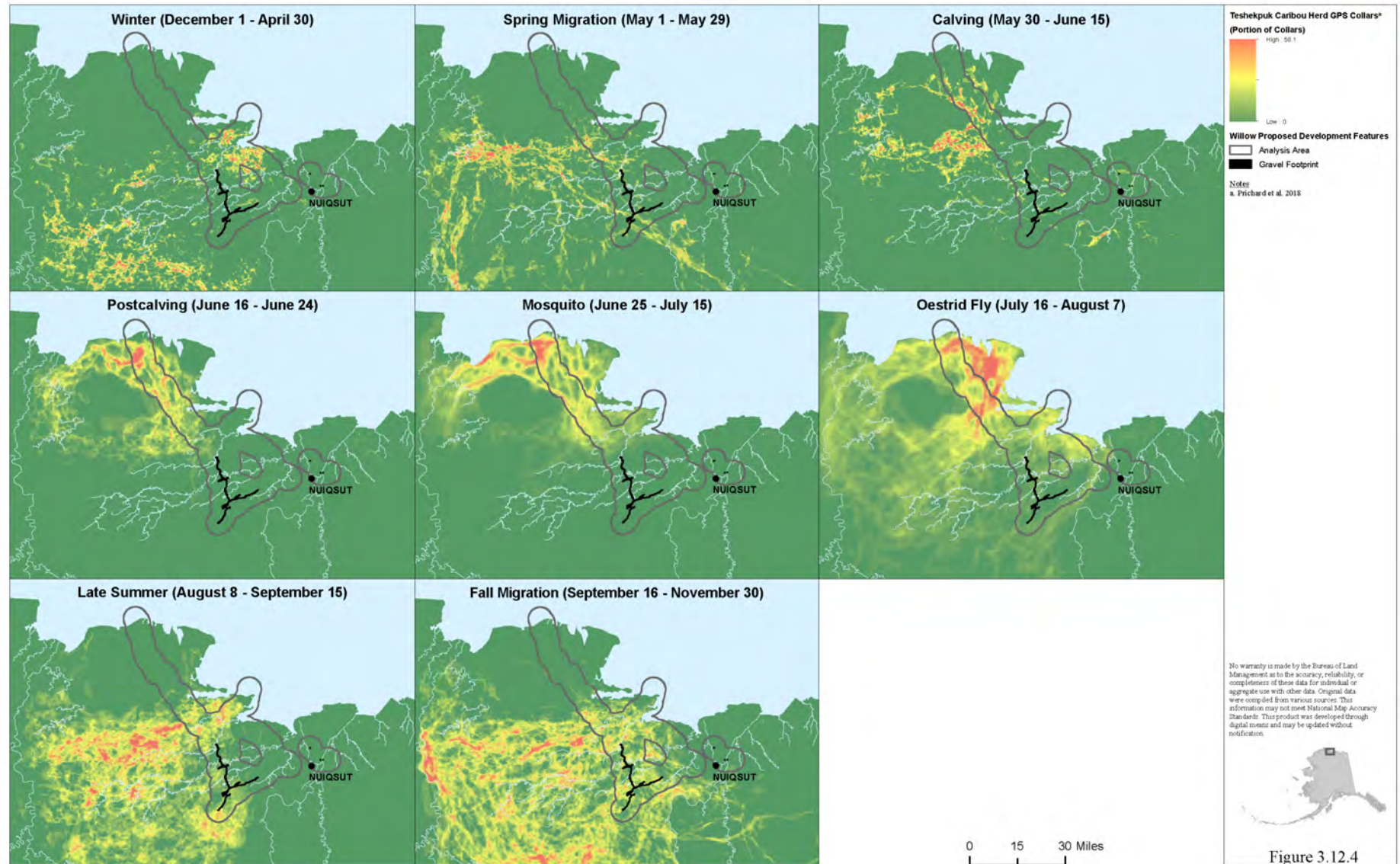


Figure 3.12.4. Movement of GPS-Collared Caribou of the Teshekpuk Caribou Herd 2004–2018

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Distribution of Calving Caribou of the Teshekpuk Caribou Herd 1990–2018

3.12 - Terrestrial Mammals

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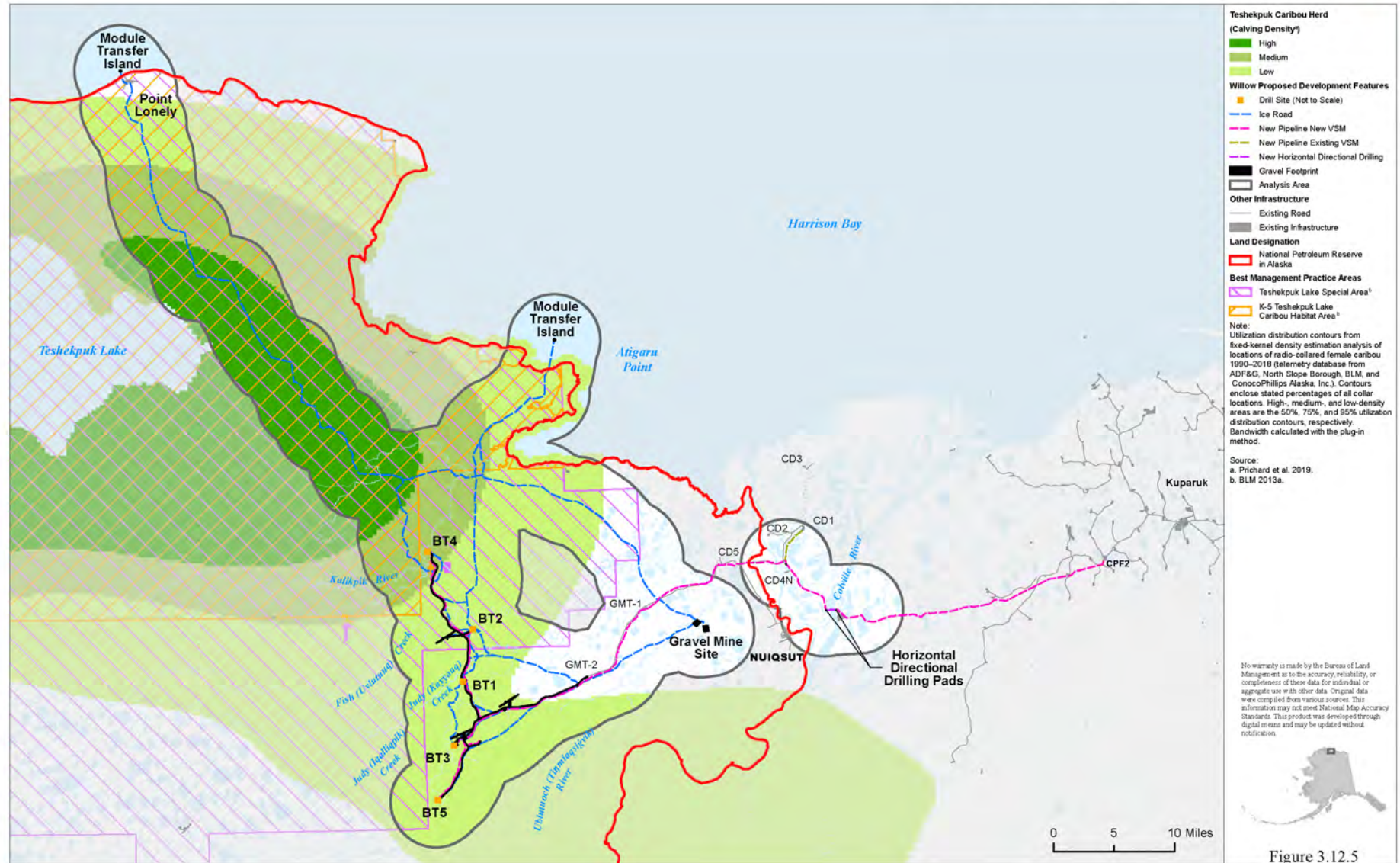


Figure 3.12.5. Distribution of Calving Caribou of the Teshekpuk Caribou Herd 1990–2018

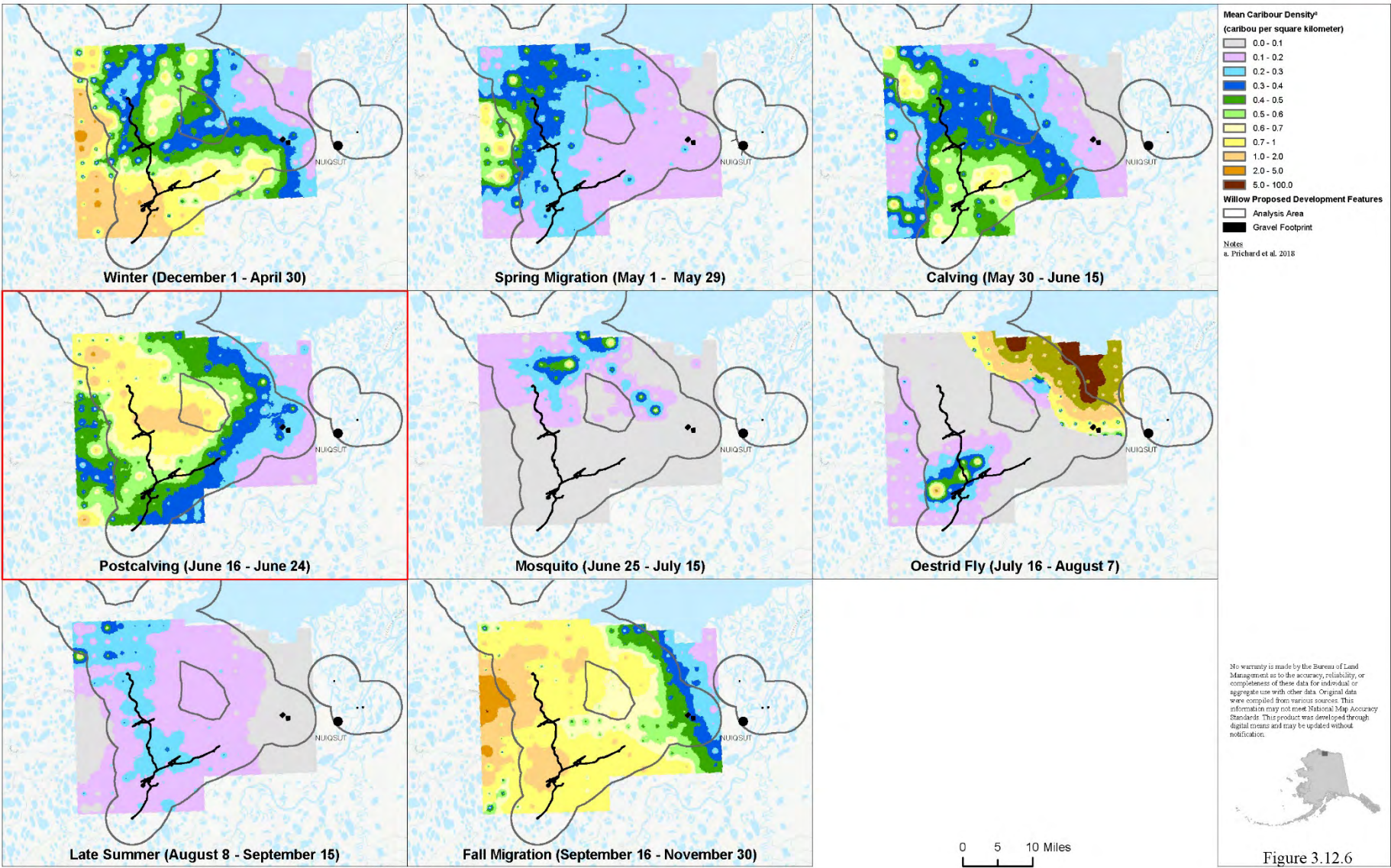


Figure 3.12.6. Mean Caribou Density by Season 2001–2018

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Polar Bear Dens, Critical Habitat, and Potential Terrestrial Denning Habitat

3.13 - Marine Mammals

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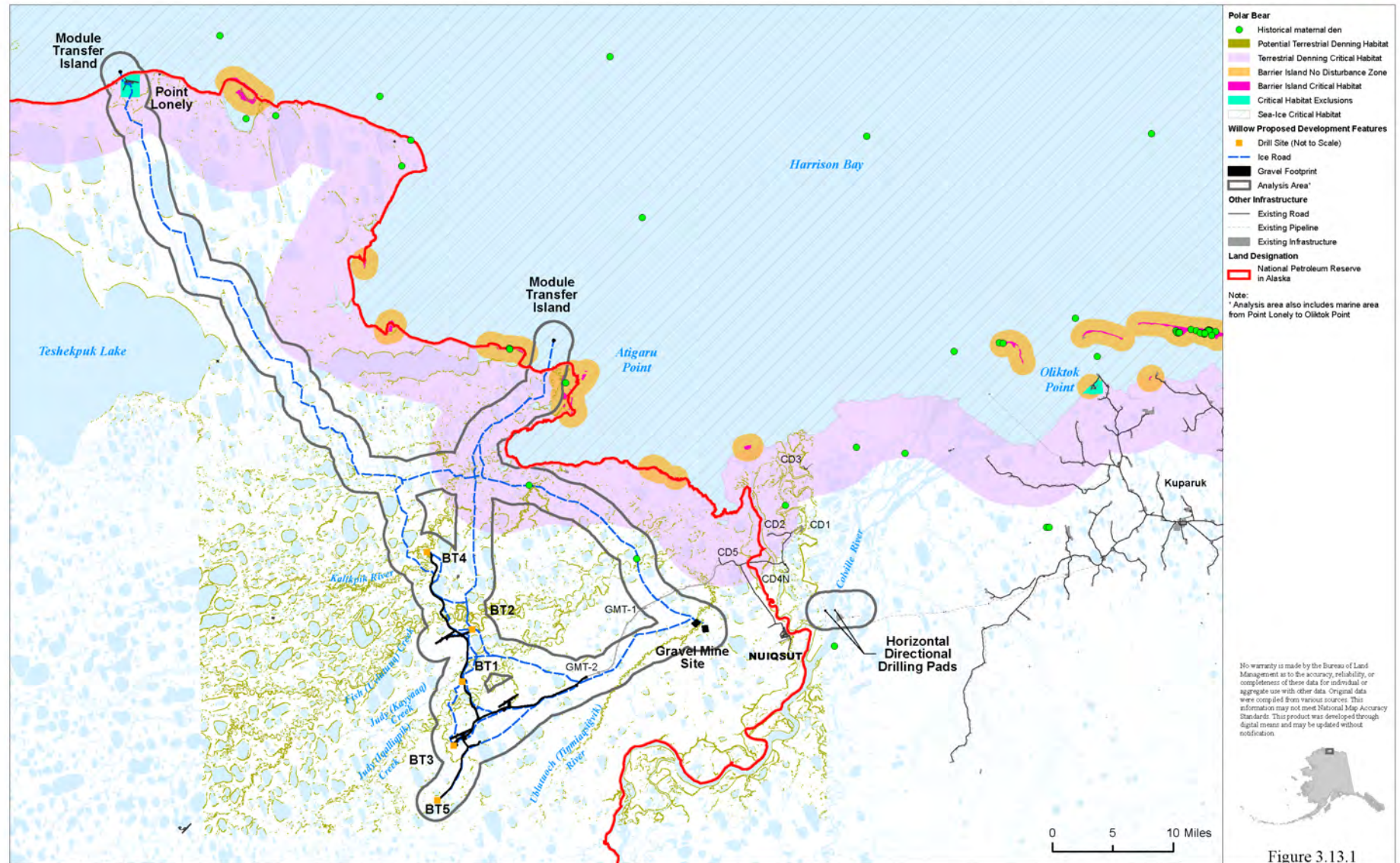


Figure 3.13.1. Polar Bear Dens, Critical Habitat, and Potential Terrestrial Denning Habitat

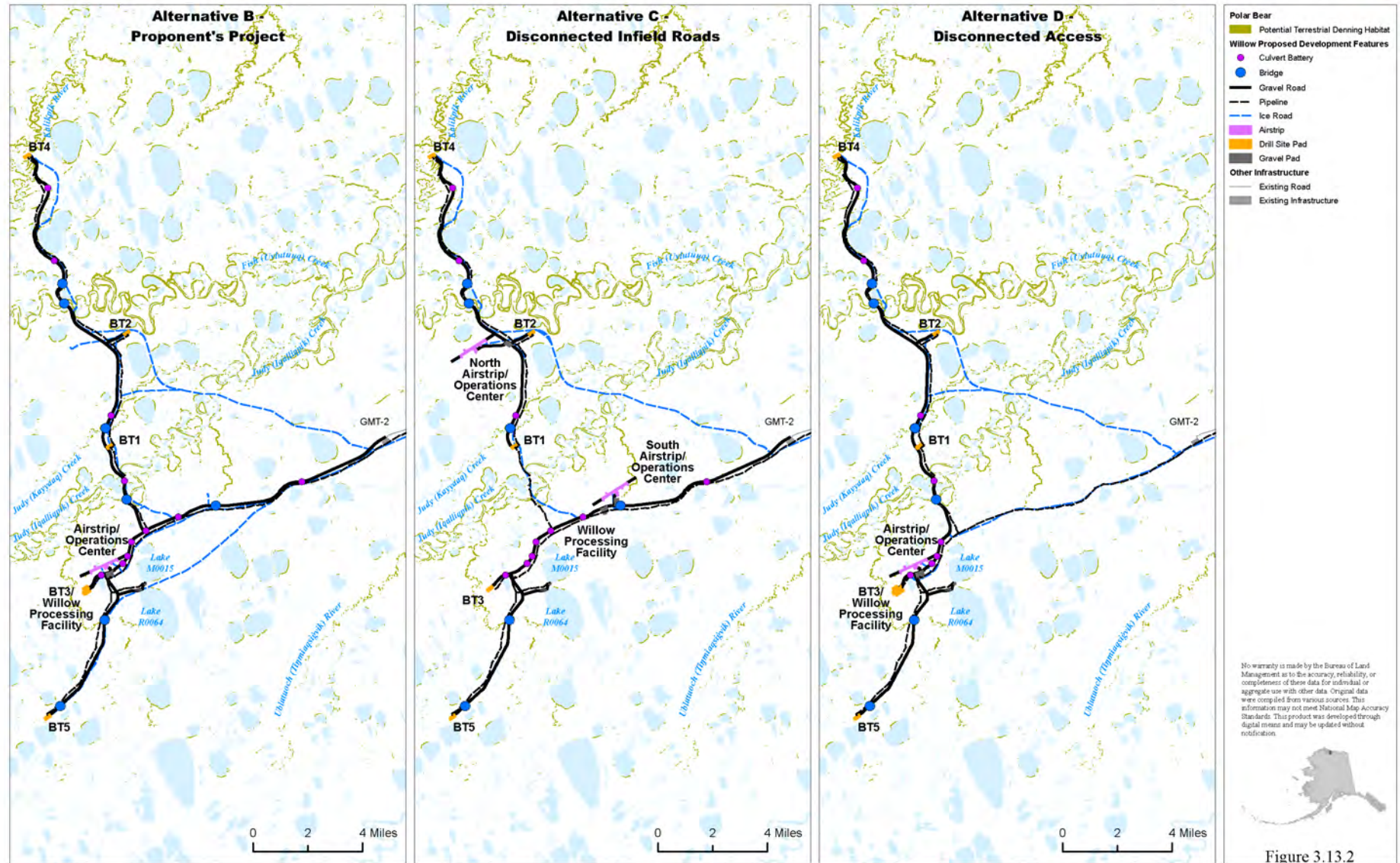


Figure 3.13.2. Polar Bear Potential Terrestrial Denning Habitat in the Willow Area

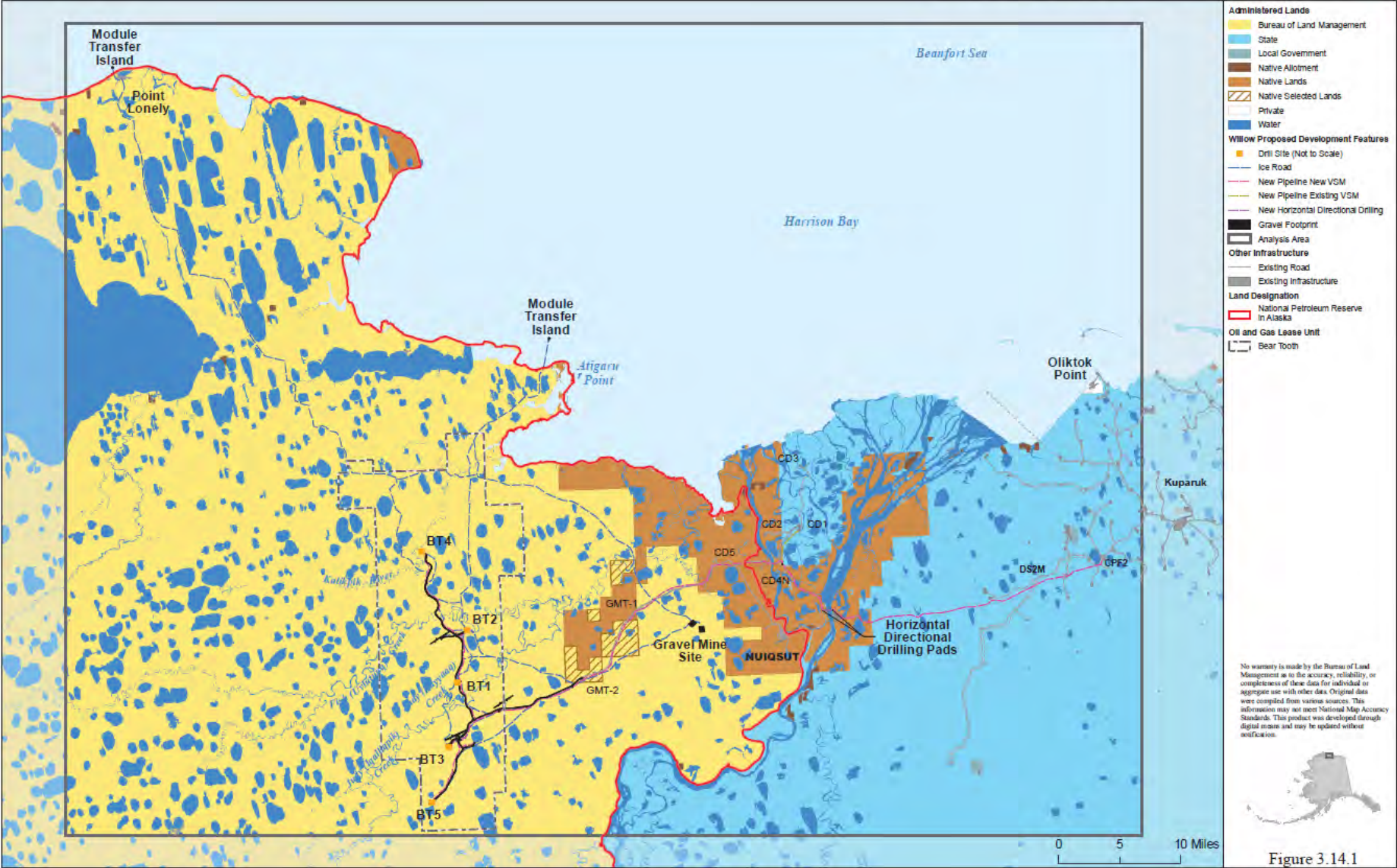


Figure 3.14.1. Map of Surface Land Ownership in the Analysis Area

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Map of Subsurface Land Management in the Bear Tooth Unit

3.14 - Land Ownership and Use

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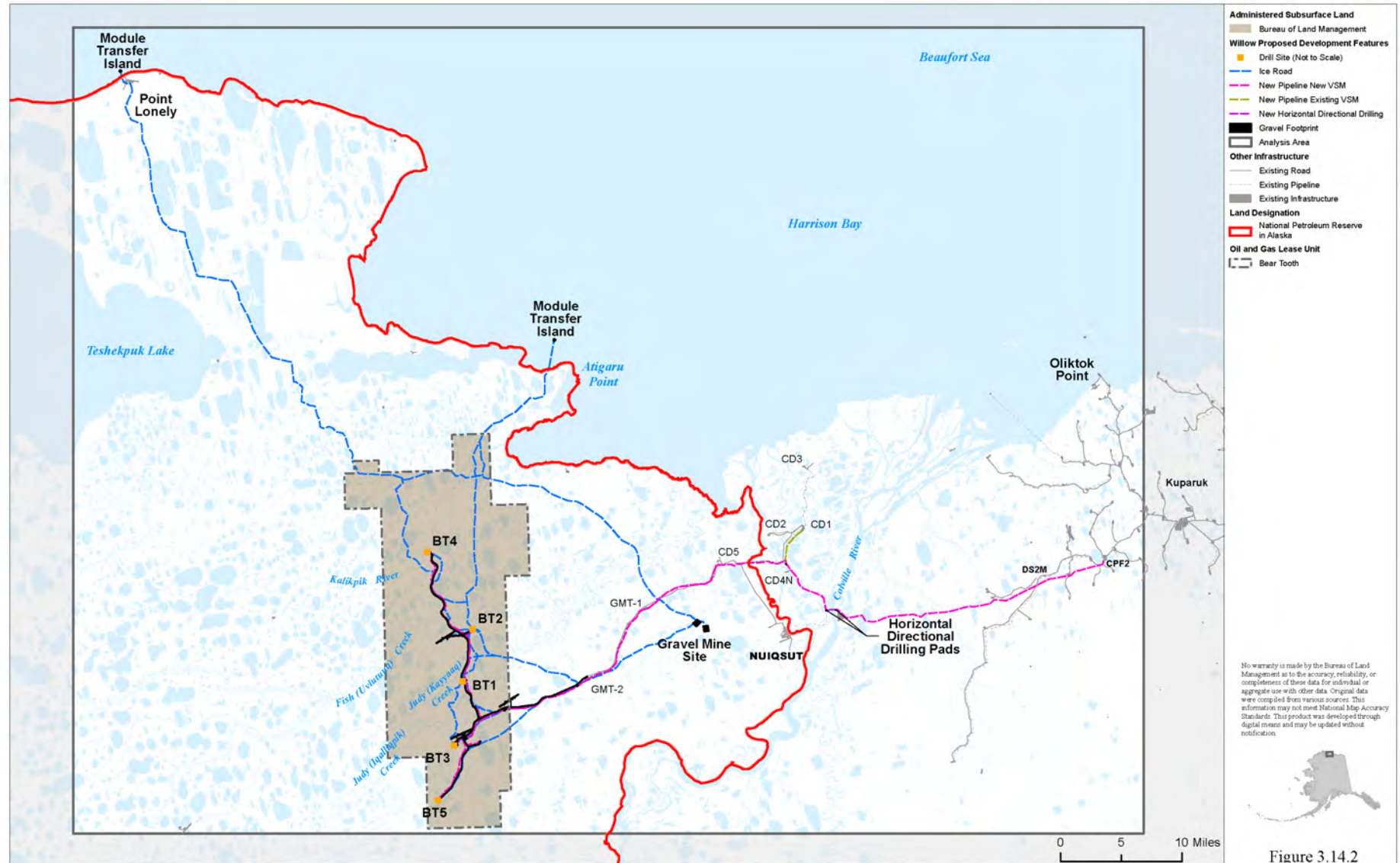


Figure 3.14.2. Map of Subsurface Land Management in the Bear Tooth Unit

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North Slope Borough Zoning Districts in the Analysis Area

3.14 - Land Ownership and Use

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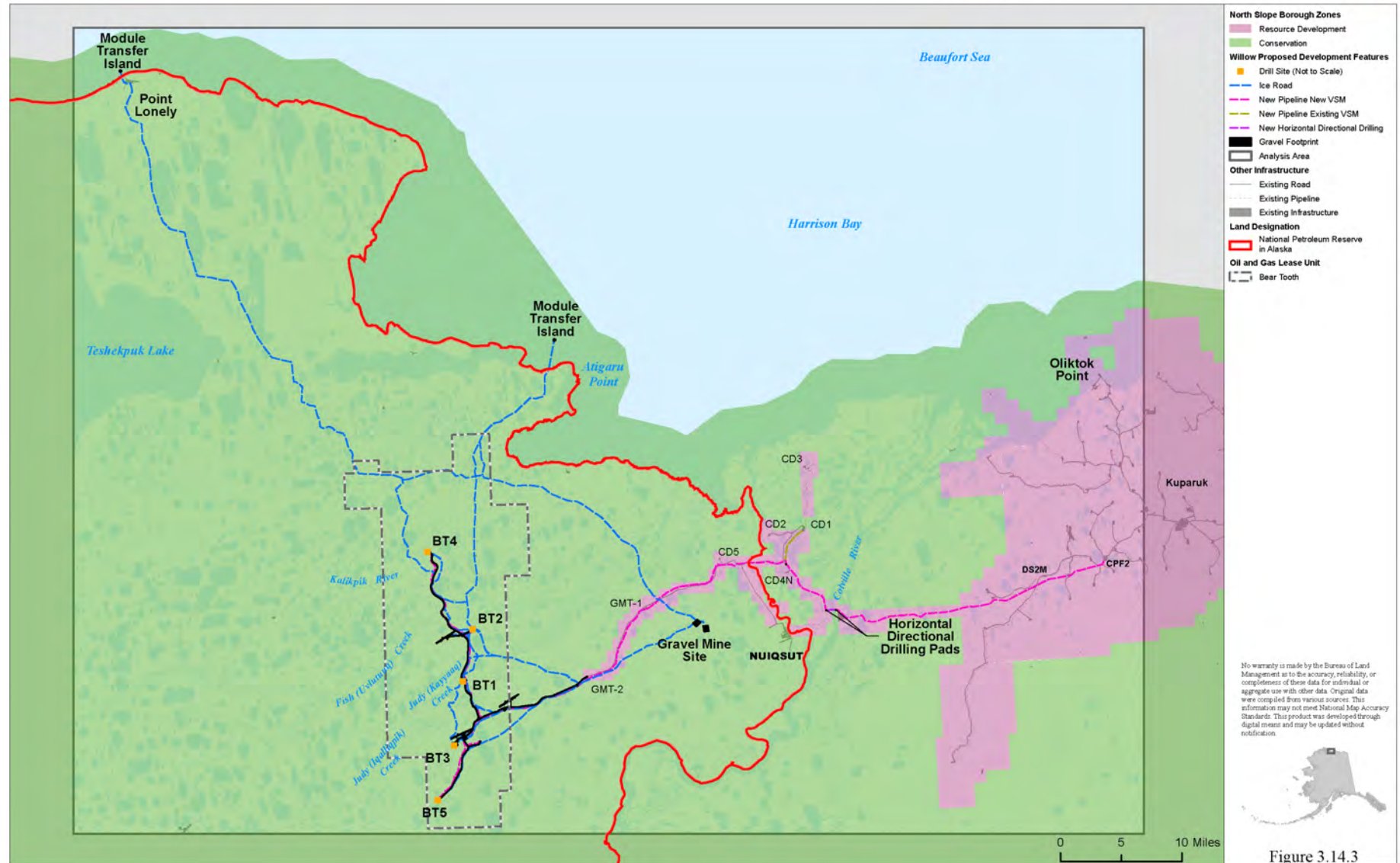


Figure 3.14.3. North Slope Borough Zoning Districts in the Analysis Area

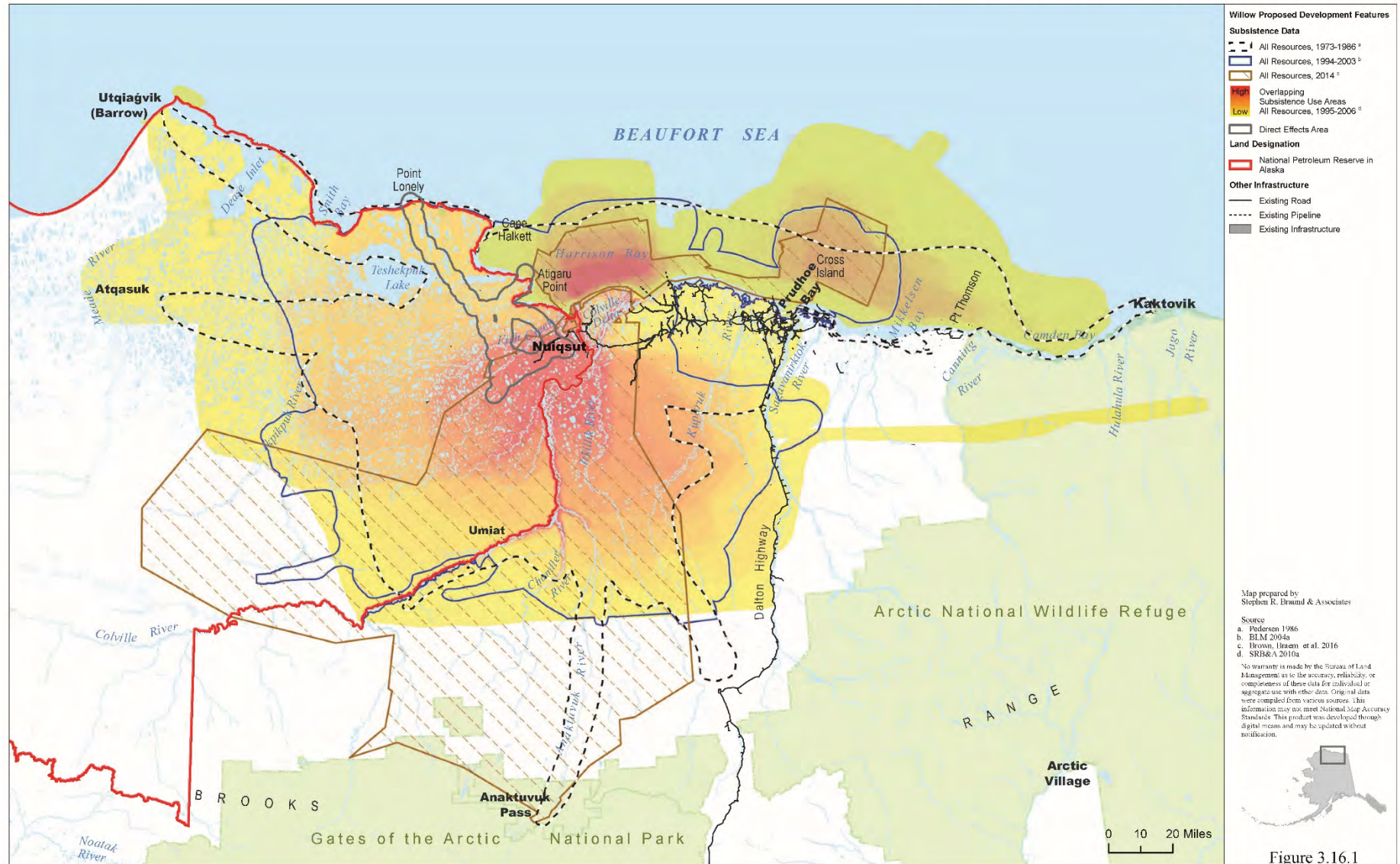


Figure 3.16.1. Nuiqsut Contemporary Subsistence Use Areas with Direct Effects Area, All Resources



Figure 3.16.2. Nuiqsut Historic and Lifetime Subsistence Use Areas with Direct Effects Area, All Resources

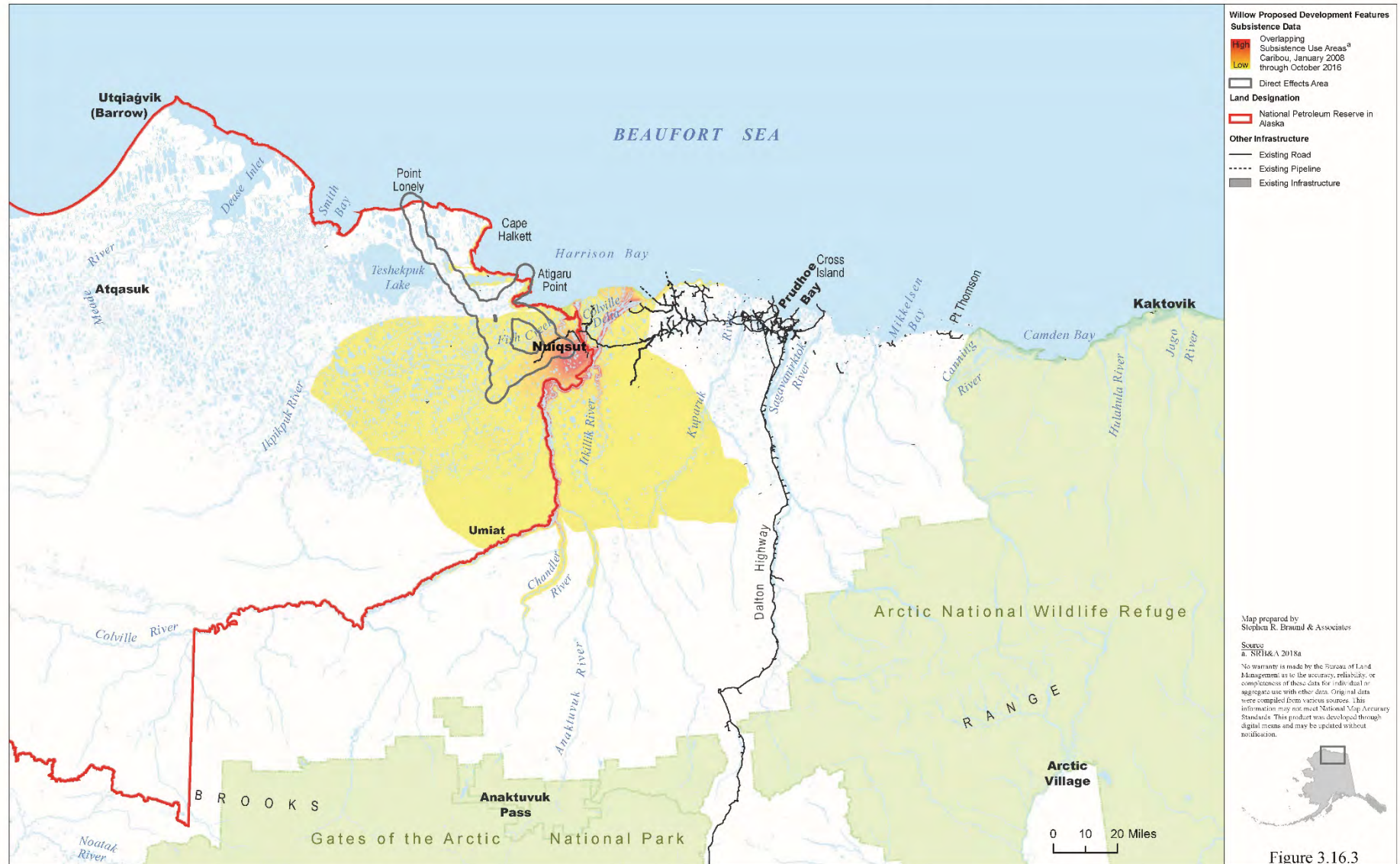


Figure 3.16.3. Nuiqsut Caribou Subsistence Use Areas with Direct Effects Area, 2008–2016

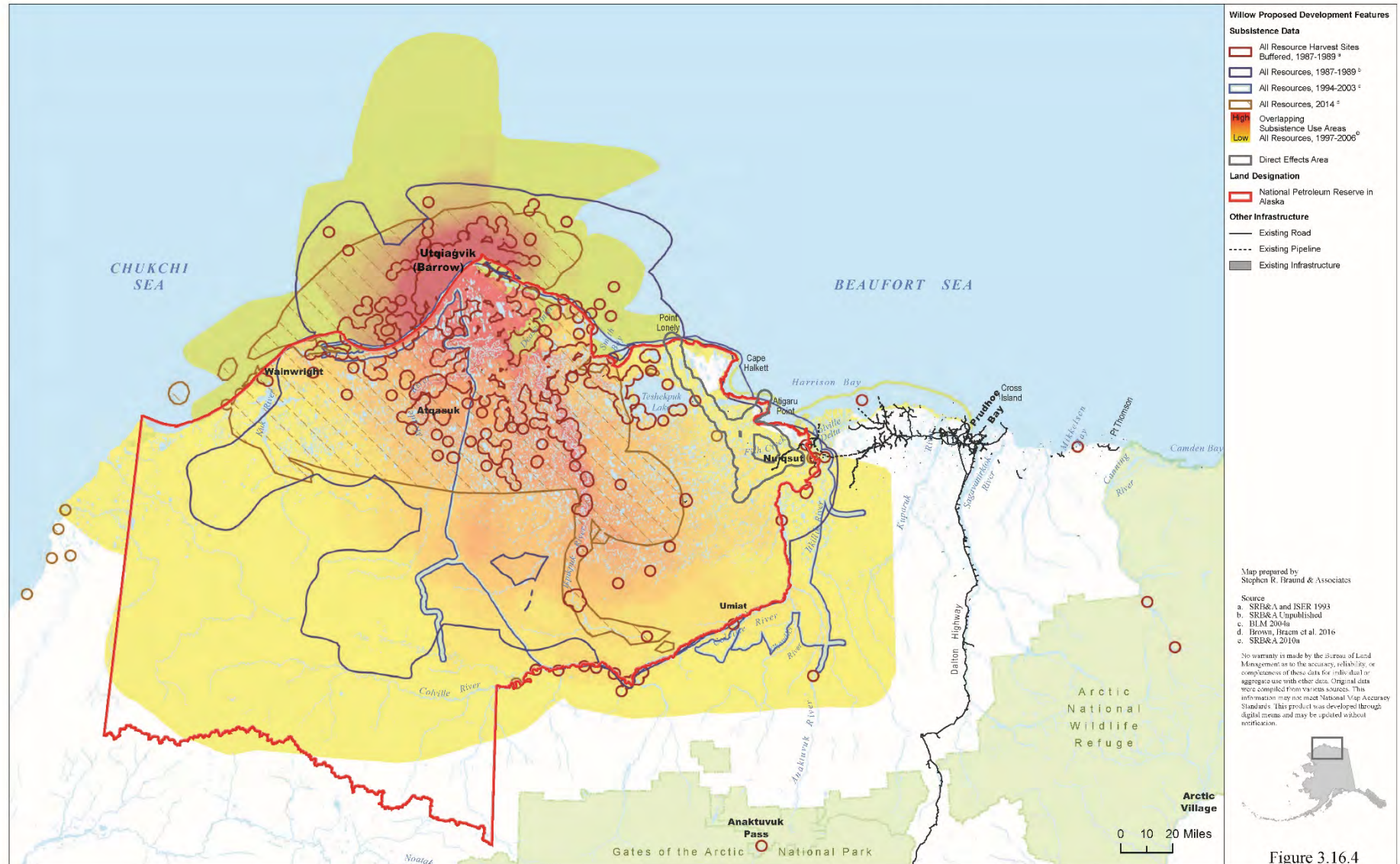


Figure 3.16.4. Utqiagvik (Barrow) Contemporary Subsistence Use Areas with Direct Effects Area, All Resources



Figure 3.16.5. Utqiagvik (Barrow) Lifetime Subsistence Use Areas with Direct Effects Area, All Resources

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All Resource Subsistence Use Areas by Alternative, Nuiqsut, 1995-2006

3.16 - Subsistence and Sociocultural Systems

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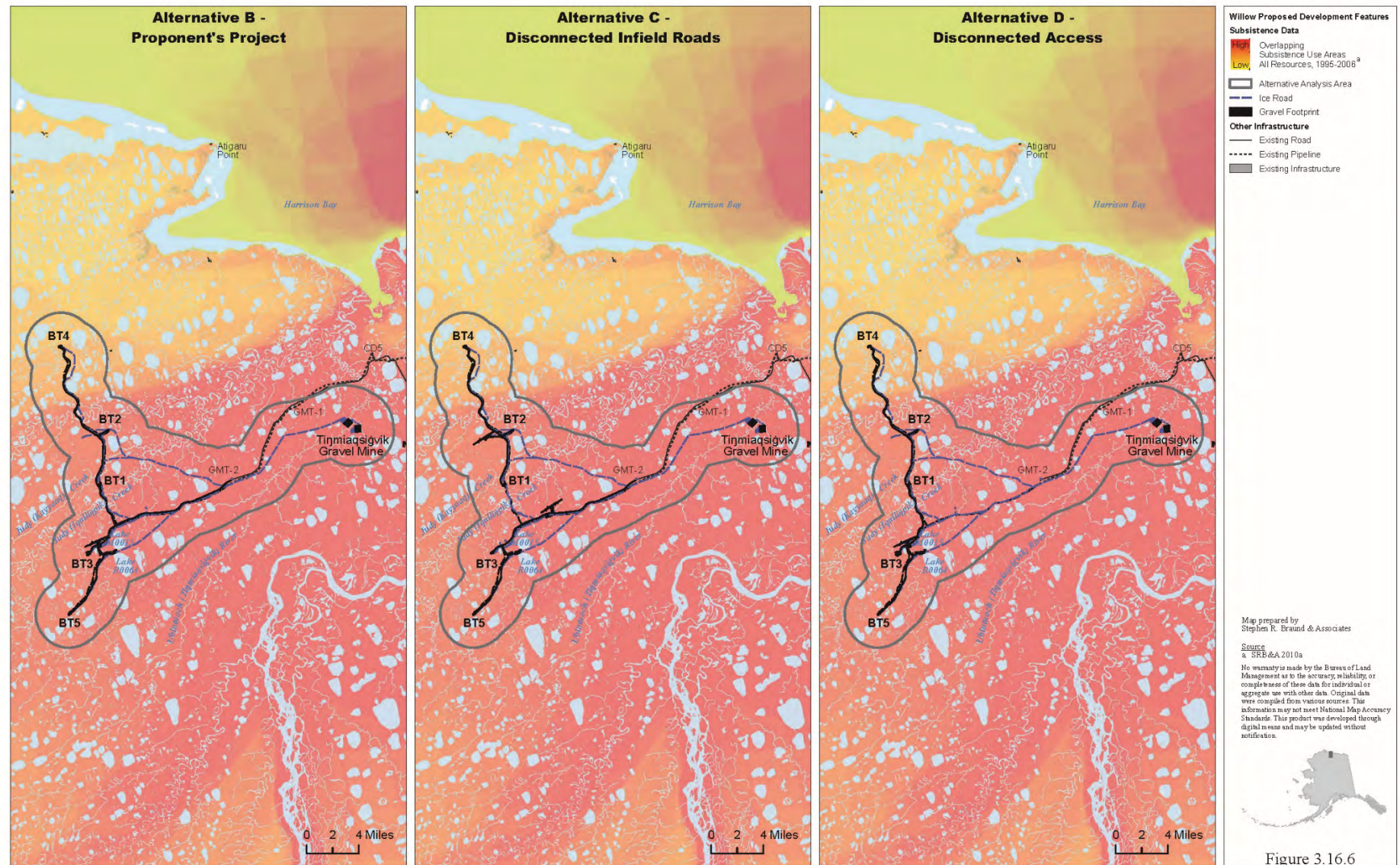


Figure 3.16.6. All Resource Subsistence Use Areas by Alternative, Nuiqsut, 1995–2006

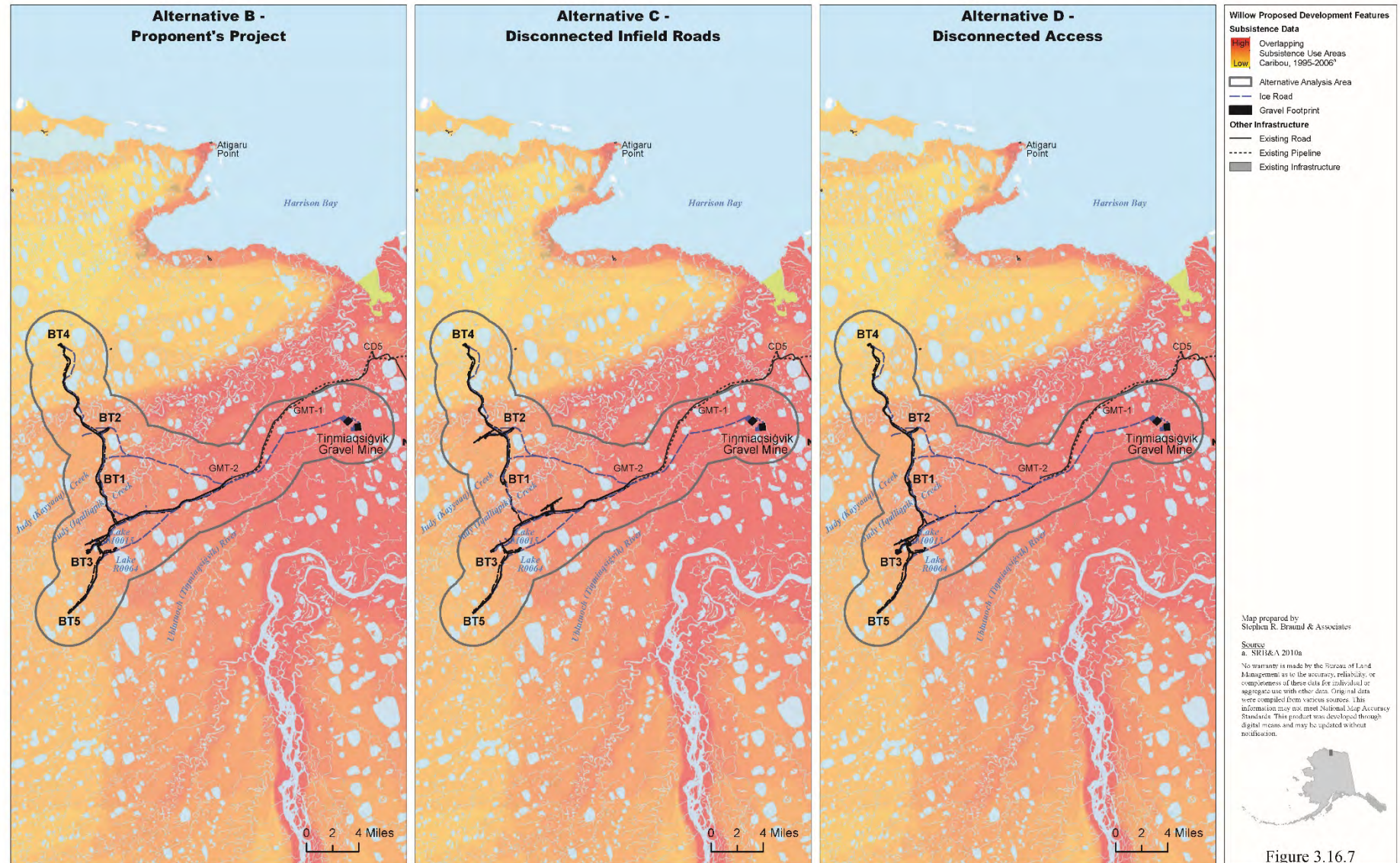


Figure 3.16.7. Caribou Subsistence Use Areas by Alternative, Nuiqsut, 1995–2006

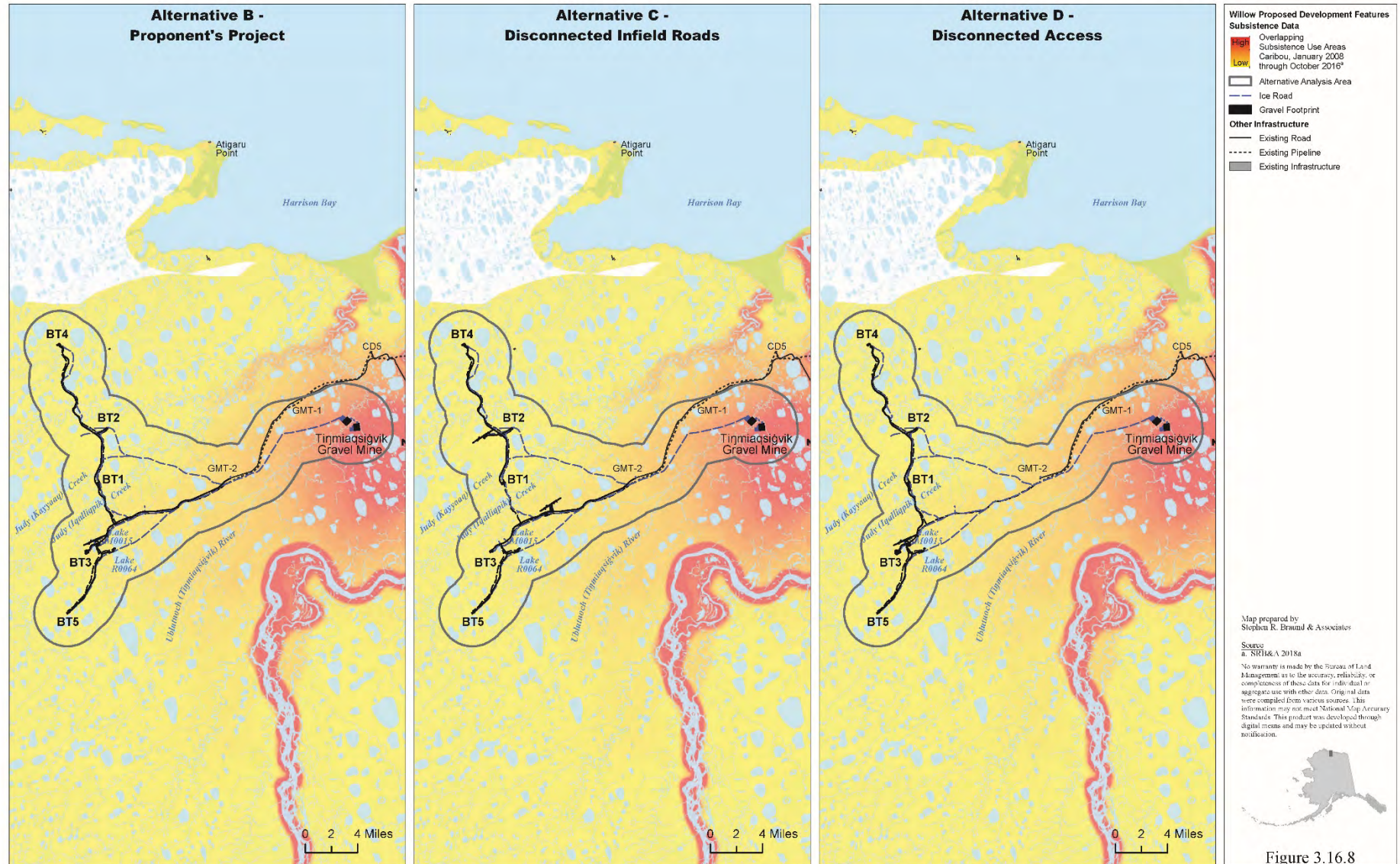


Figure 3.16.8. Caribou Subsistence Use Areas by Alternative, Nuiqsut, 2008–2016

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Wolf and Wolverine Subsistence Use Areas by Alternative, Nuiqsut, 1995-2006

3.16 - Subsistence and Sociocultural Systems

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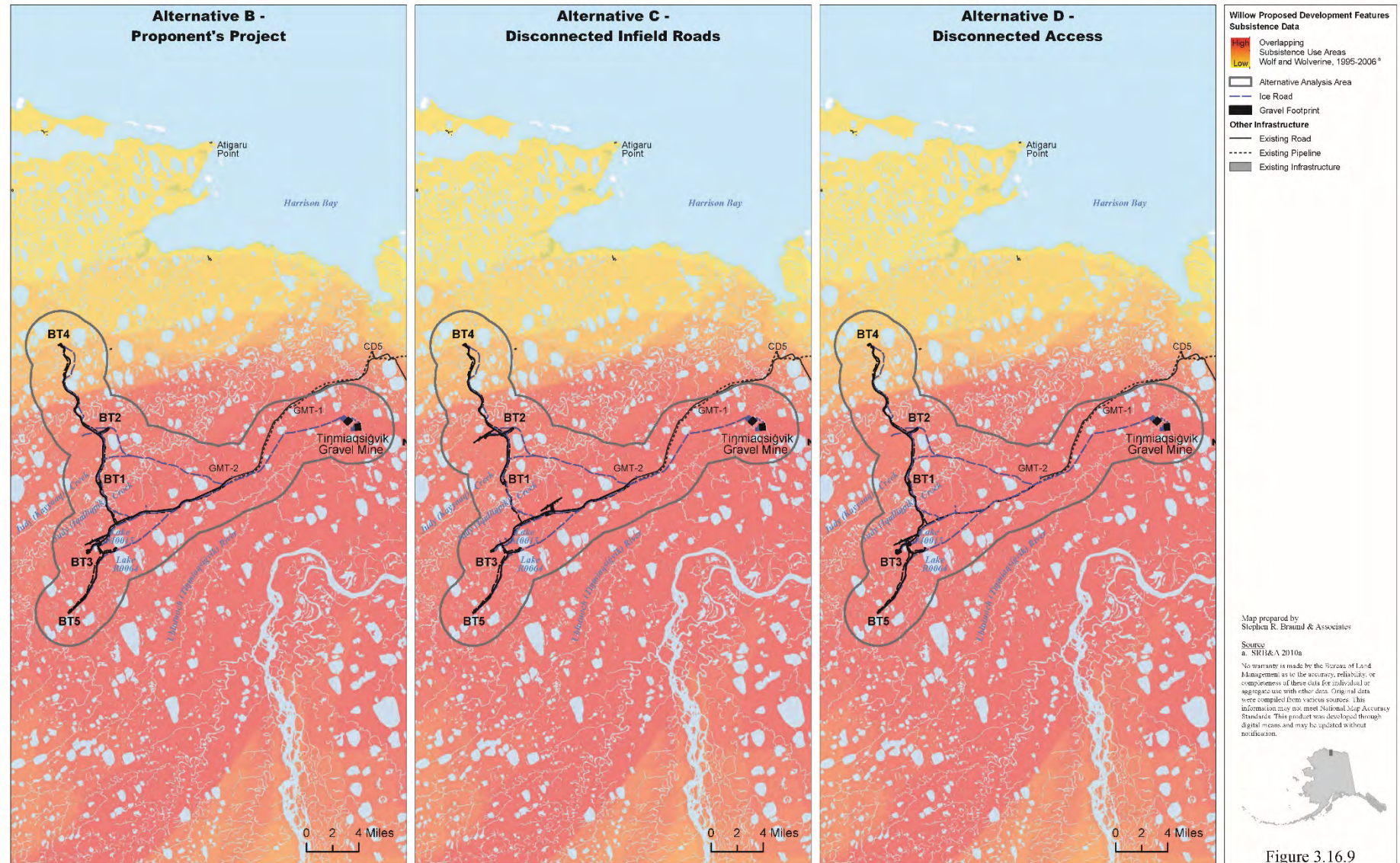


Figure 3.16.9. Wolf and Wolverine Subsistence Use Areas by Alternative, Nuiqsut, 1995–2006

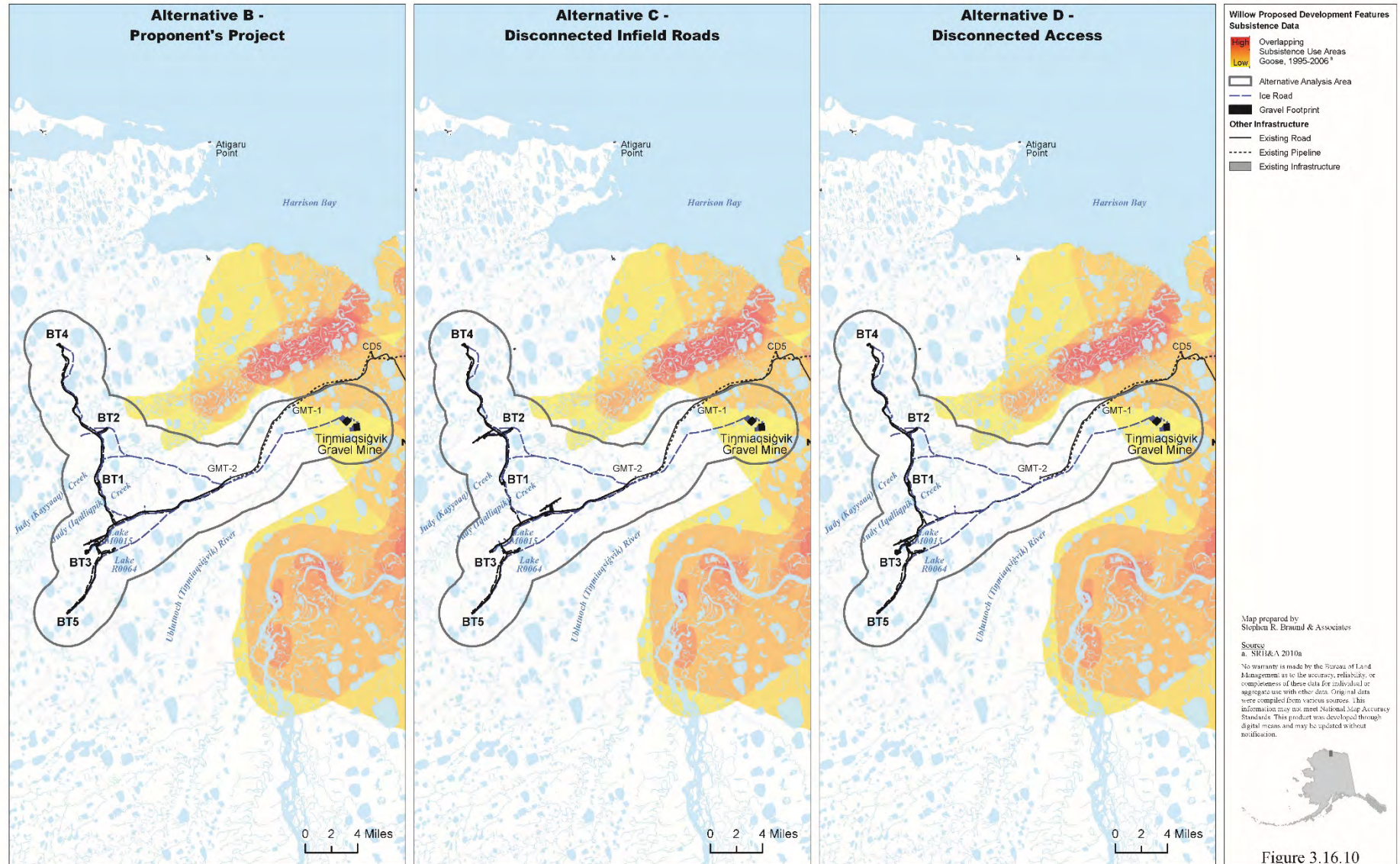


Figure 3.16.10. Goose Subsistence Use Areas by Alternative, Nuiqsut, 1995–2006

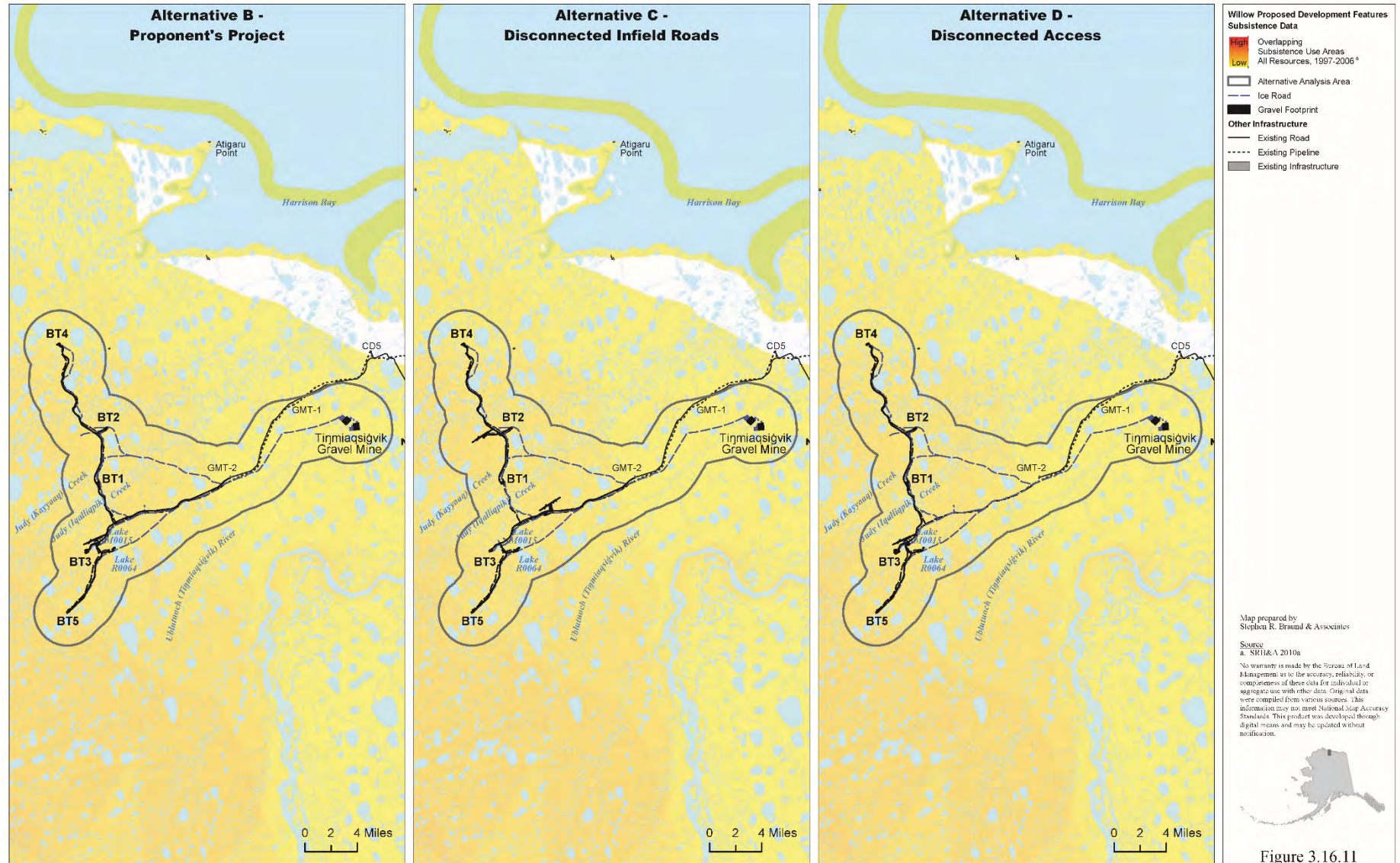


Figure 3.16.11. All Resource Subsistence Use Areas by Alternative, Utqiagvik (Barrow), 1997-2006

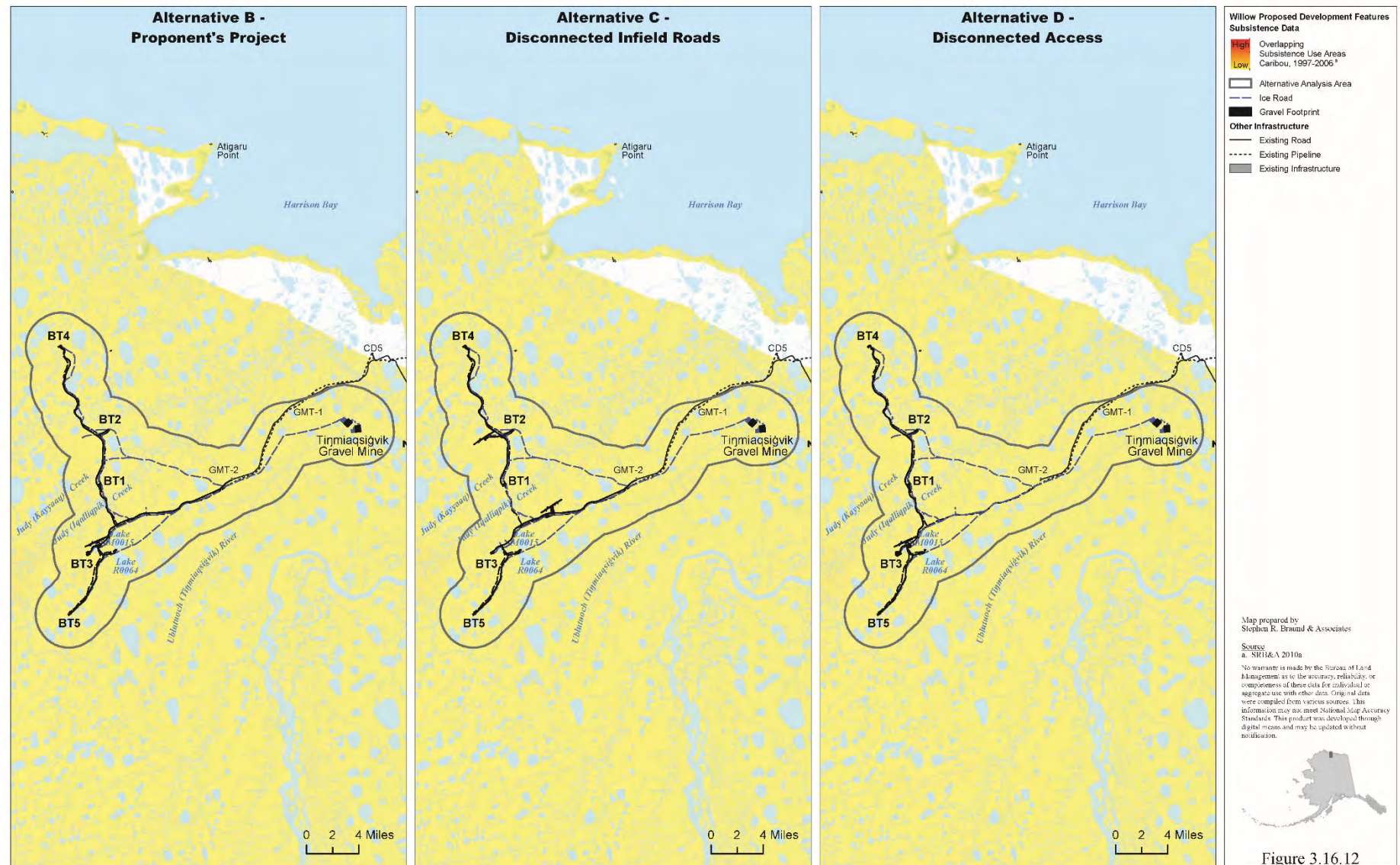


Figure 3.16.12. Caribou Subsistence Use Areas by Alternative, Utqiagvik (Barrow), 1997–2006

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Wolf and Wolverine Subsistence Use Areas by Alternative, Utqiagvik (Barrow), 1997-2006

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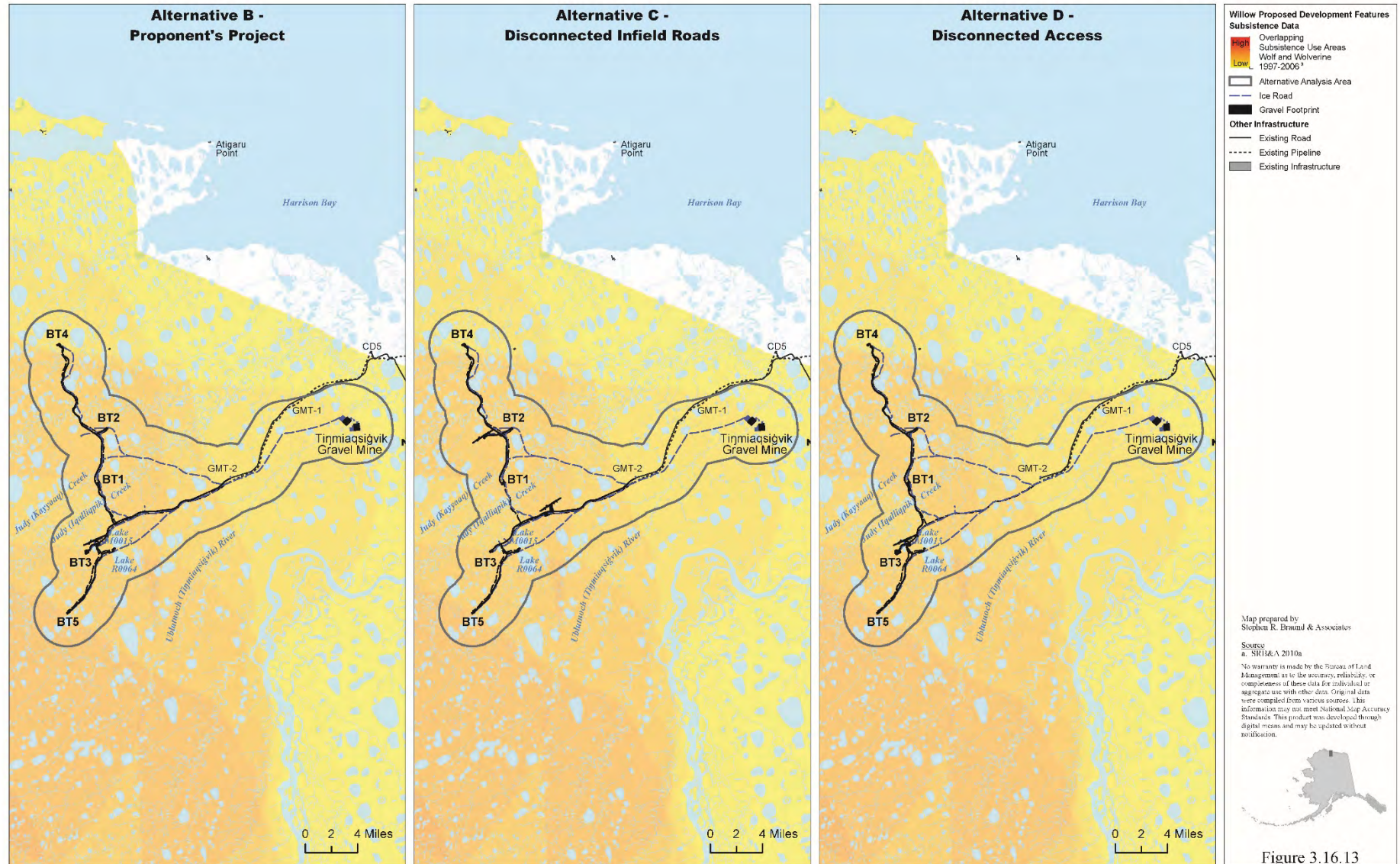


Figure 3.16.13. Wolf and Wolverine Subsistence Use Areas by Alternative, Utqiagvik (Barrow), 1997–2006

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All Resource Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995-2006

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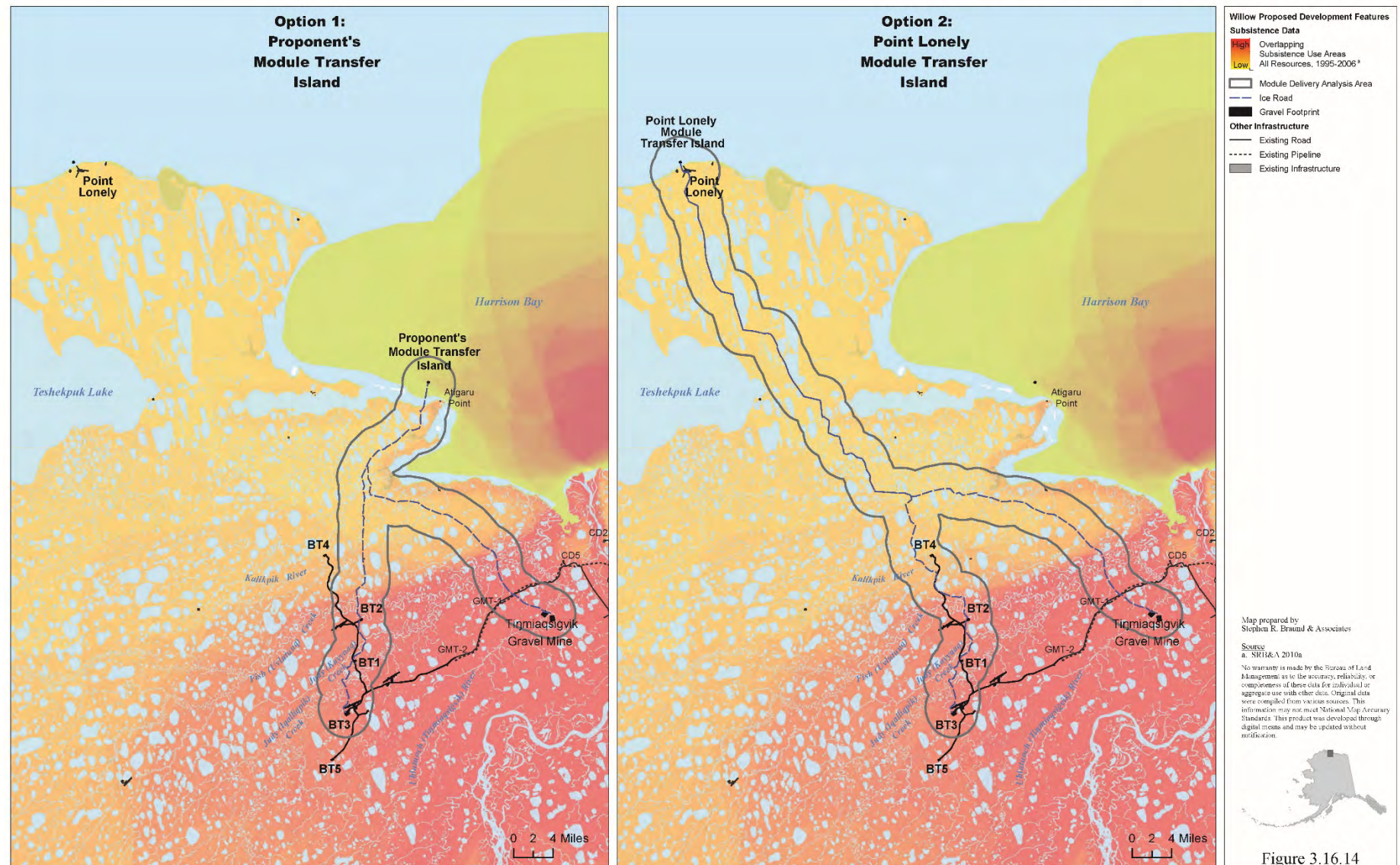


Figure 3.16.14. All Resource Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

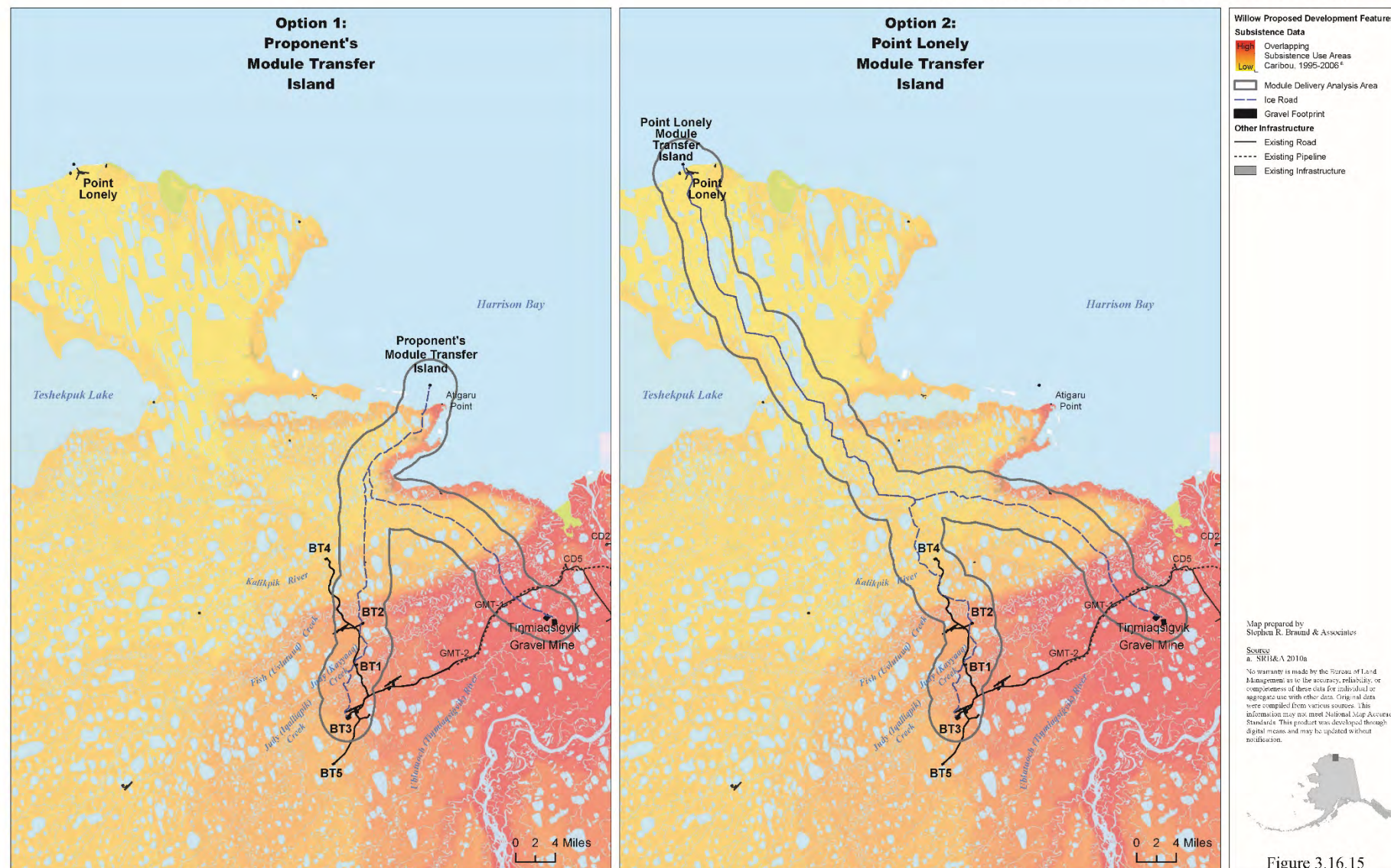


Figure 3.16.15. Caribou Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

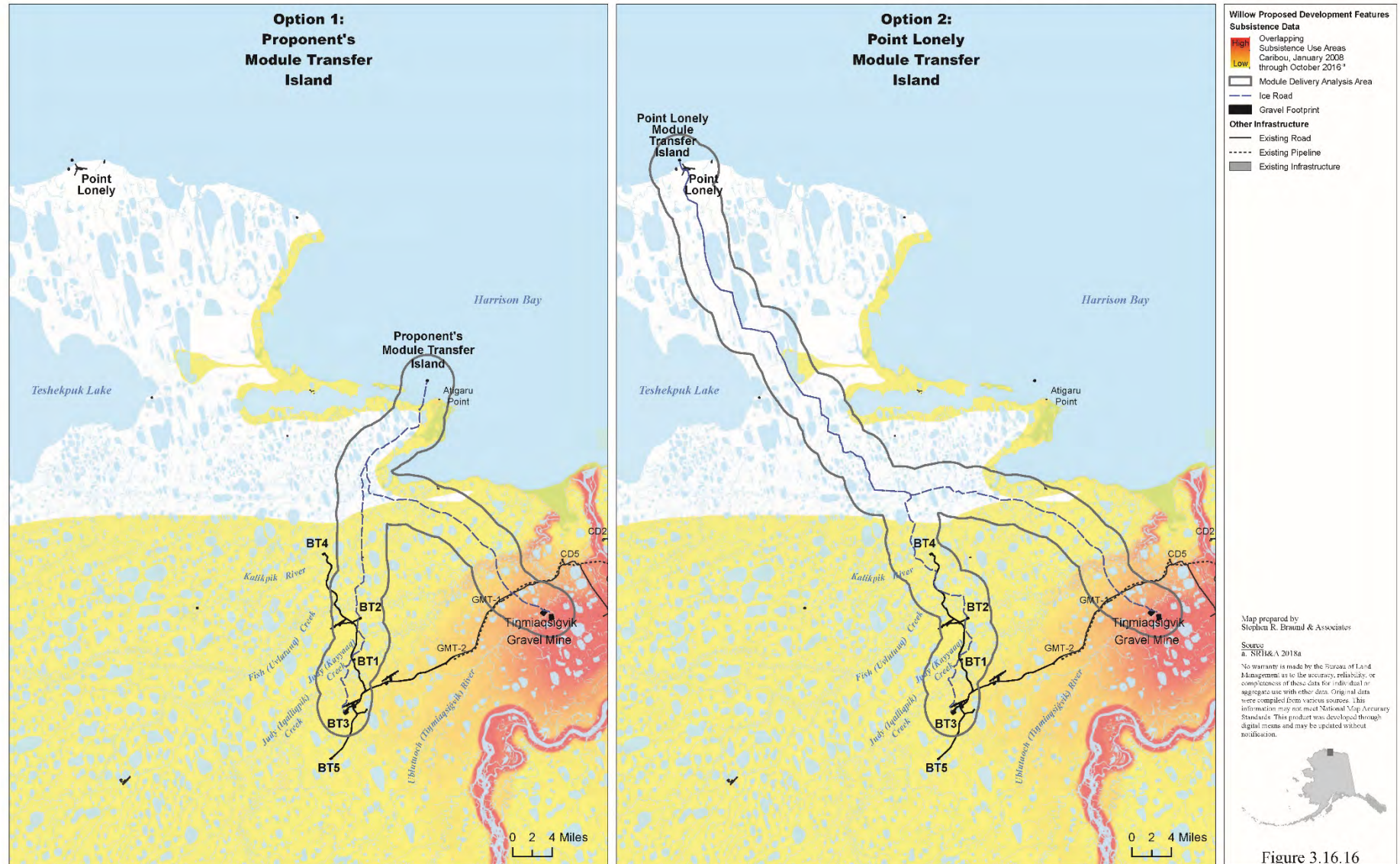


Figure 3.16.16. Caribou Subsistence Use Areas by Module Delivery Option, Nuiqsut, 2008–2016

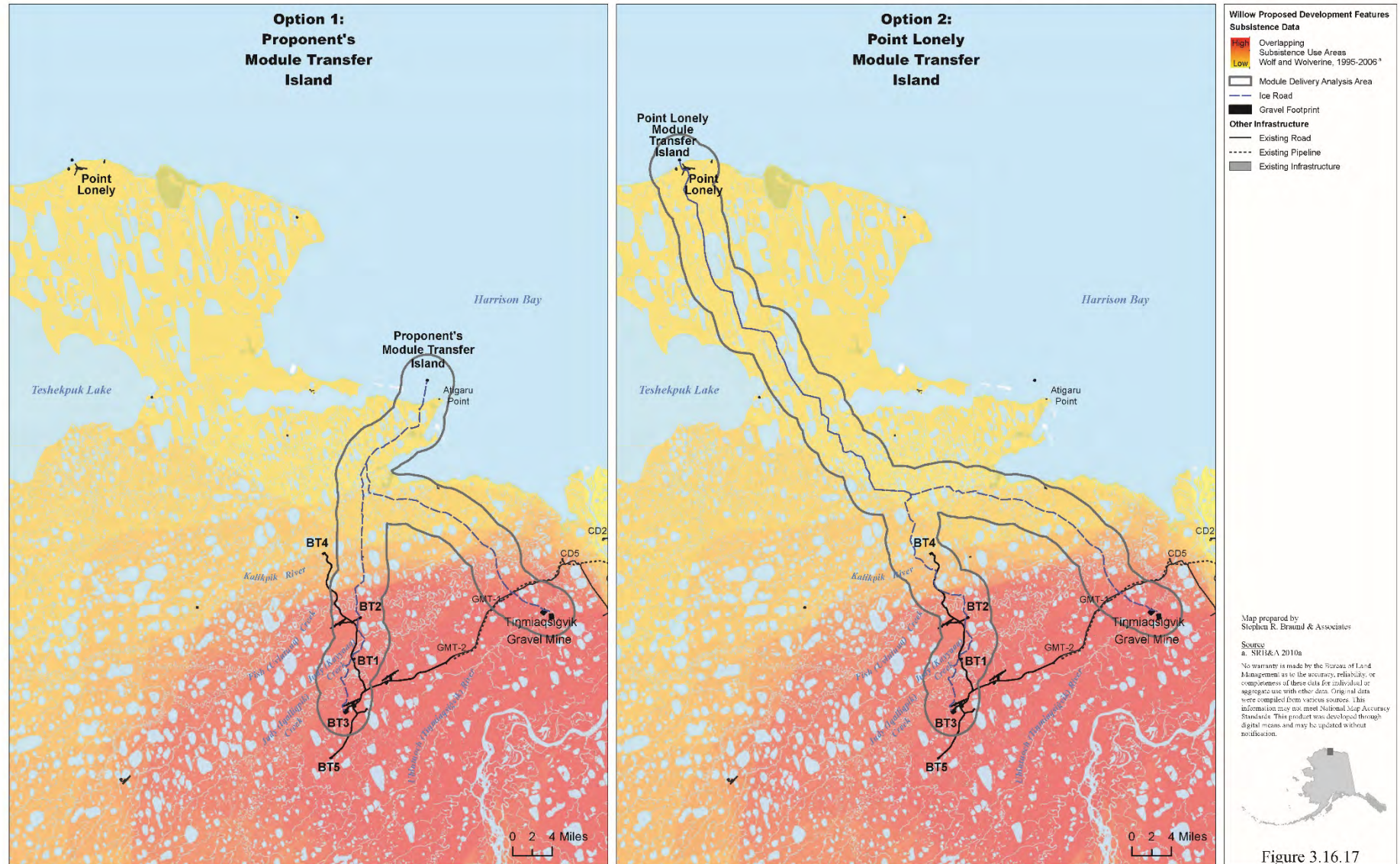


Figure 3.16.17. Wolf and Wolverine Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

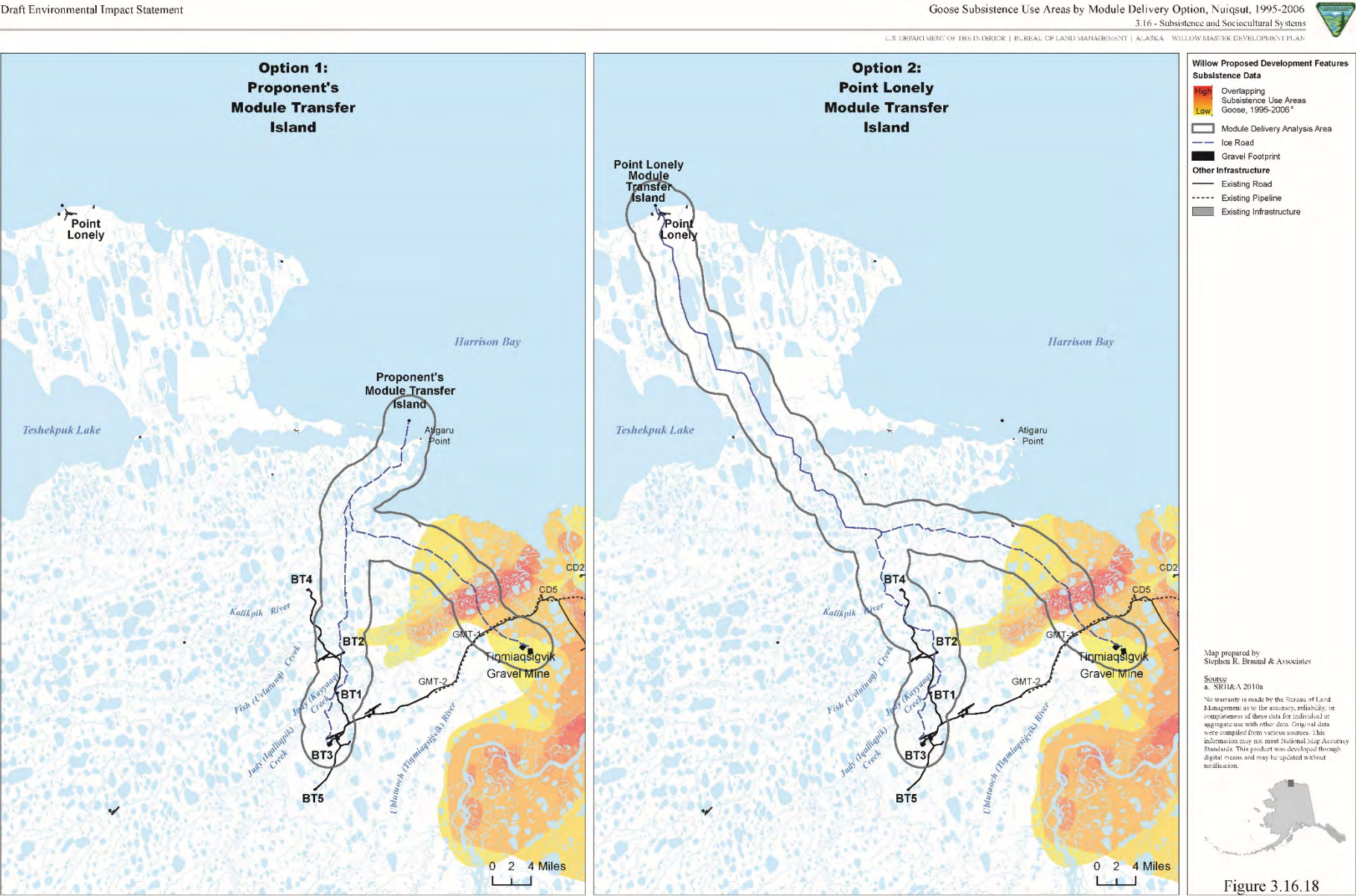


Figure 3.16.18. Goose Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

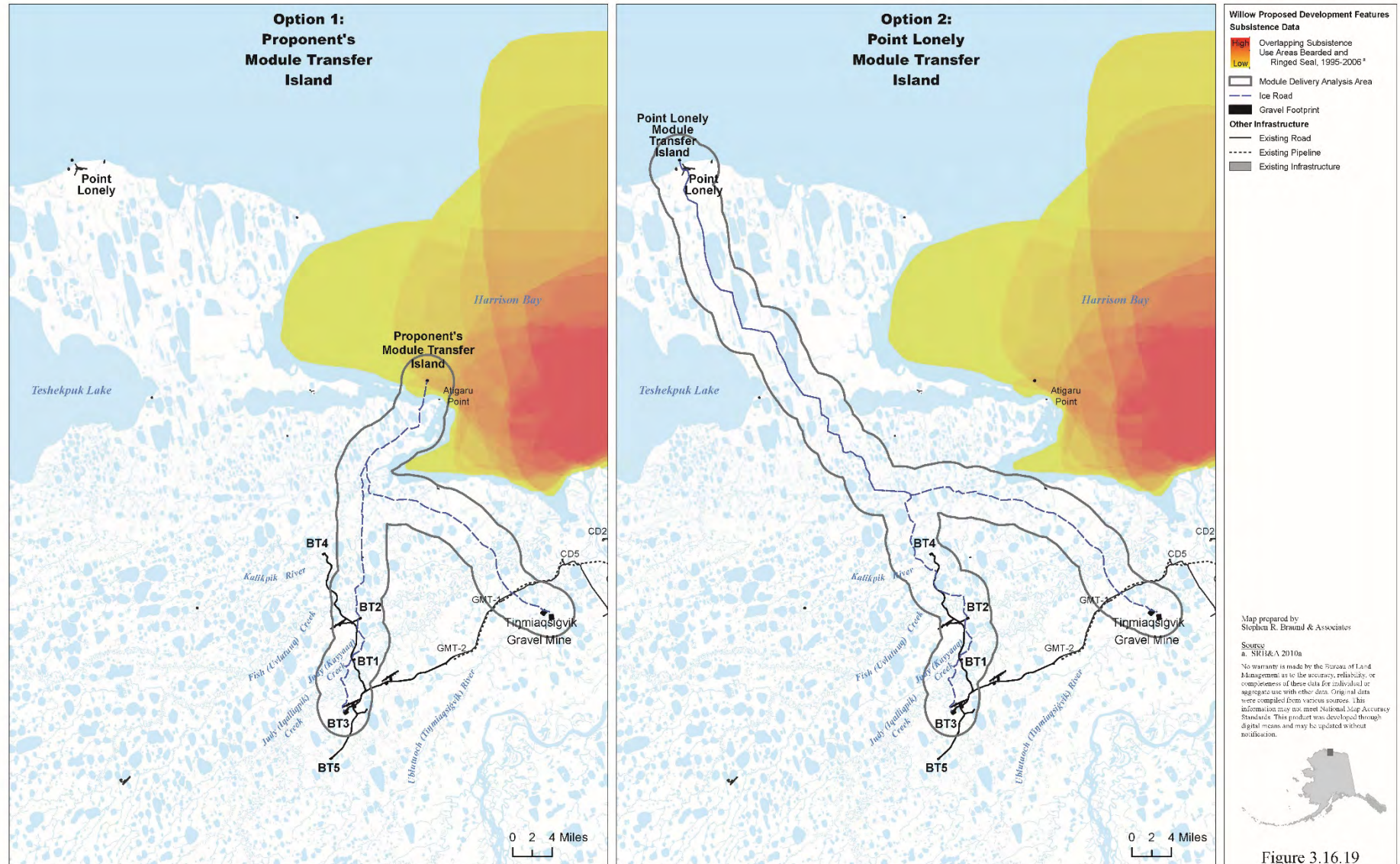


Figure 3.16.19. Seal Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

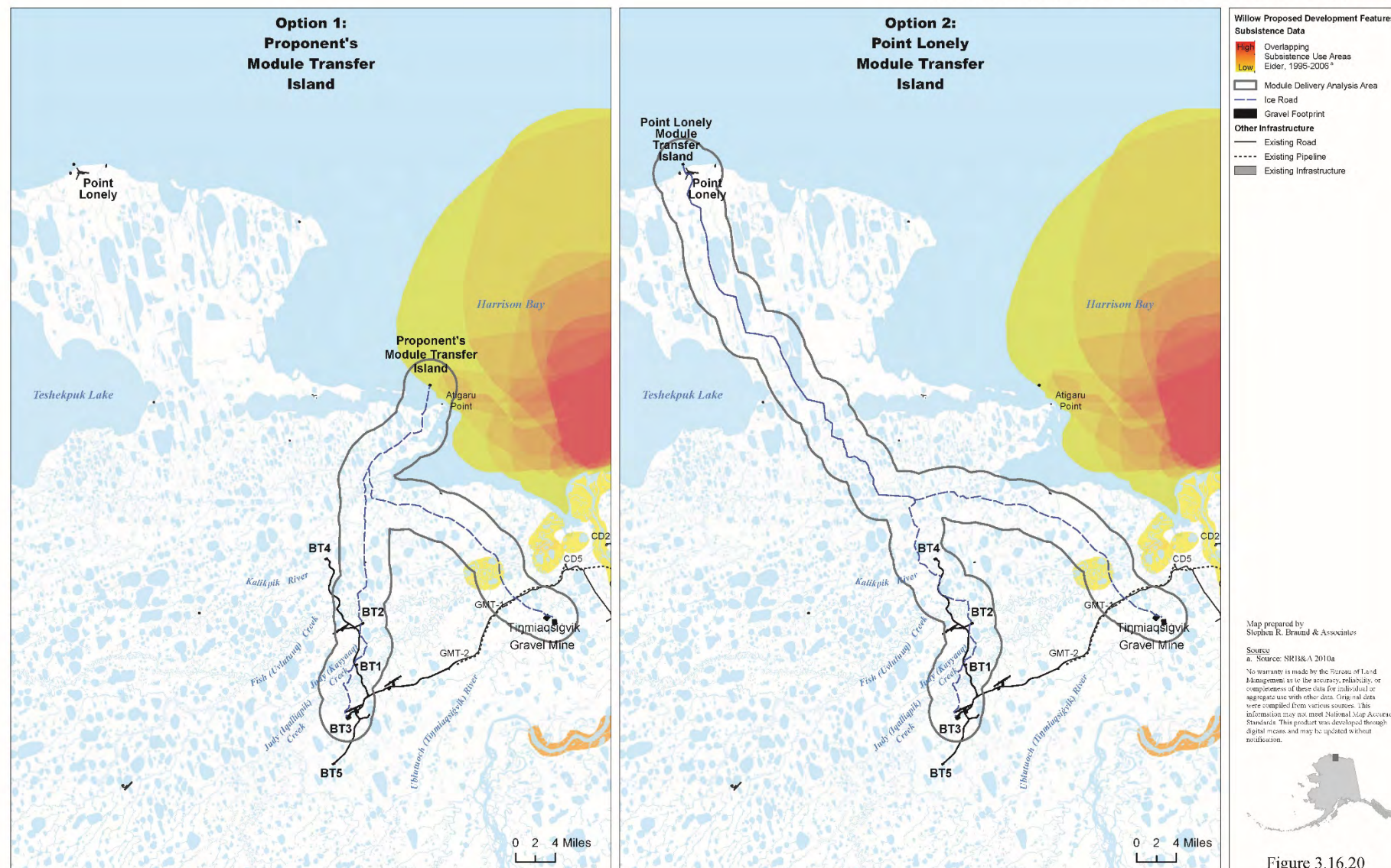


Figure 3.16.20. Eider Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

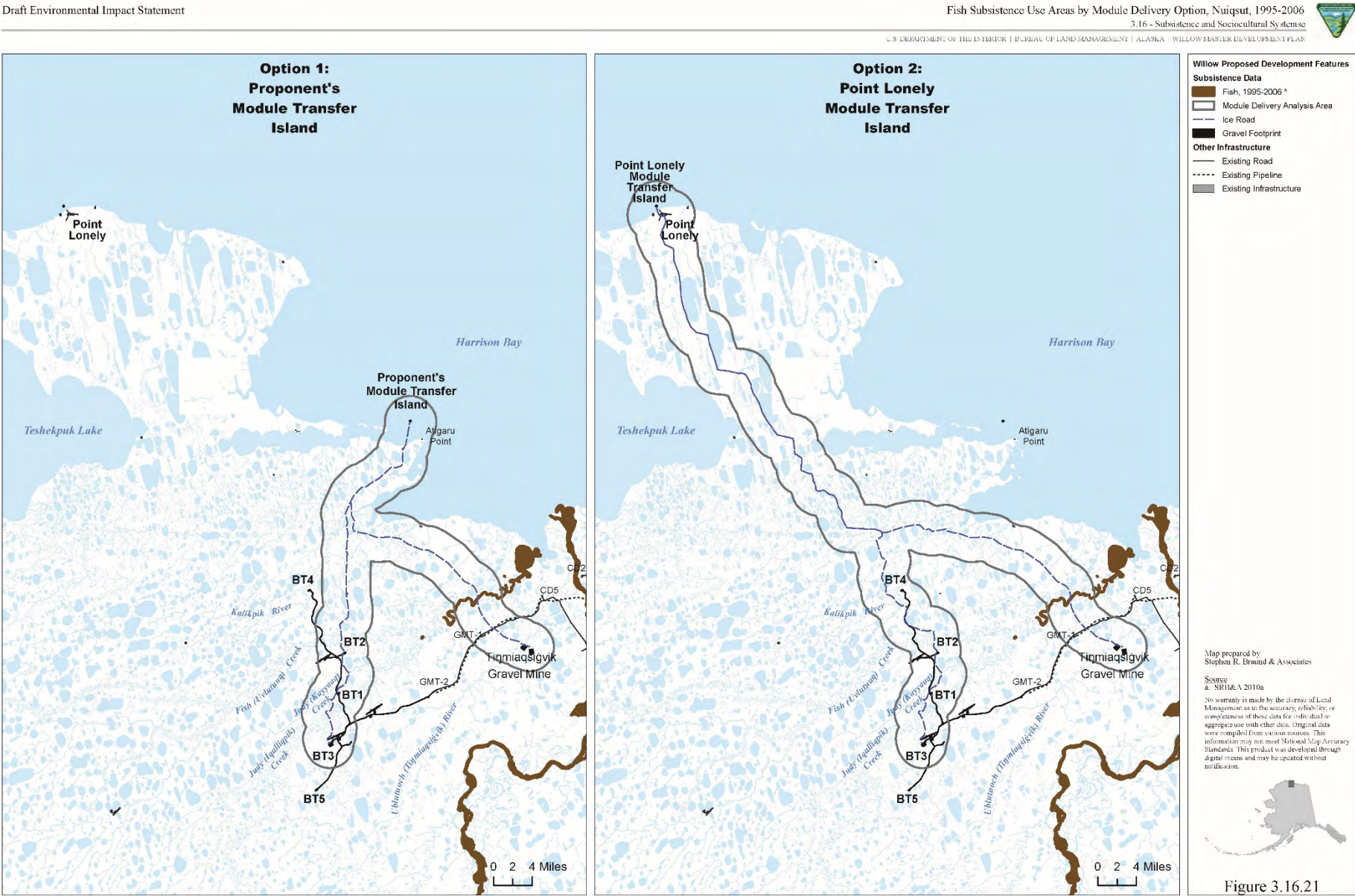


Figure 3.16.21. Fish Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

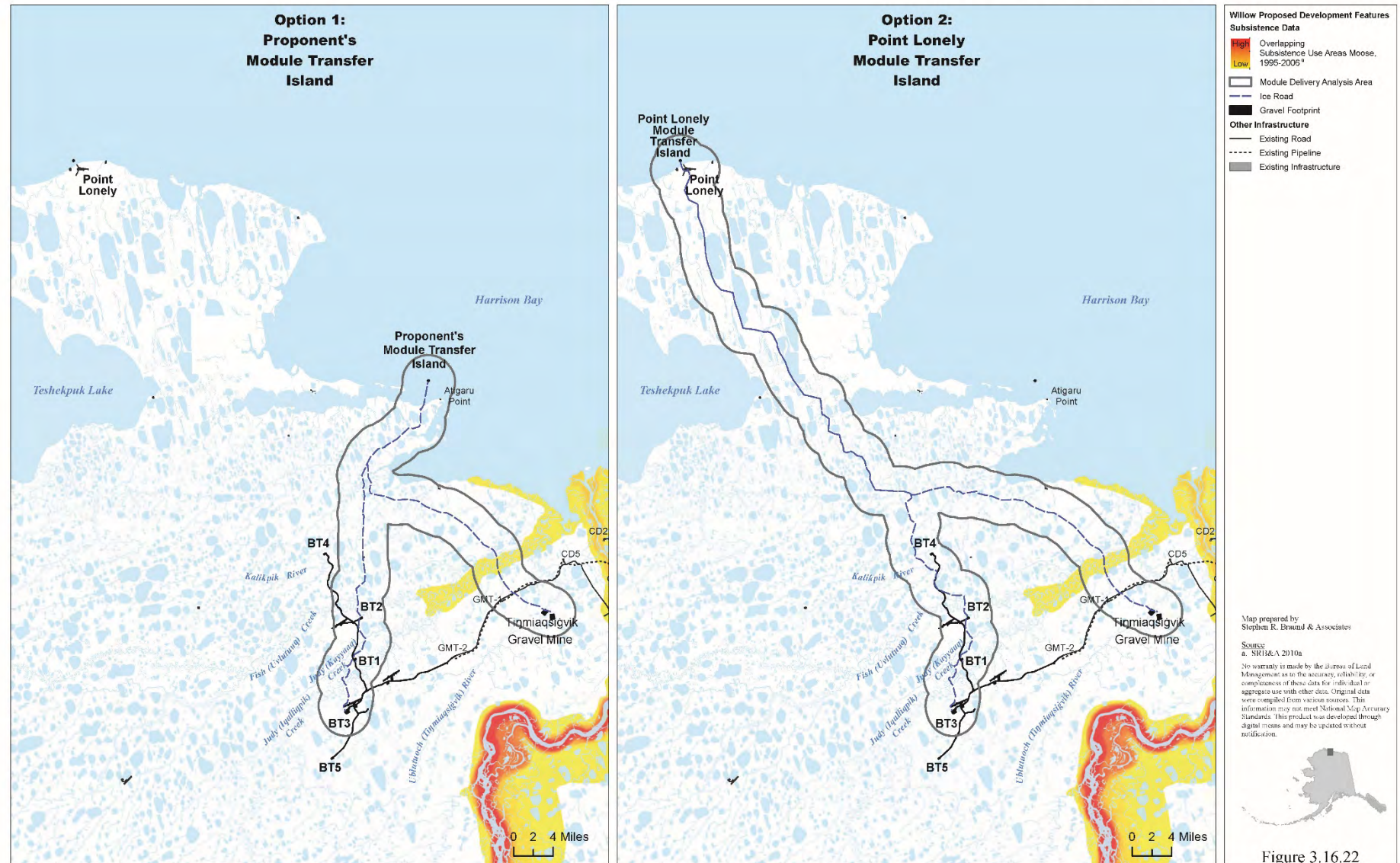


Figure 3.16.22. Moose Subsistence Use Areas by Module Delivery Option, Nuiqsut, 1995–2006

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All Resource Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1997-2008

3.16 - Subsistence and Sociocultural Systems

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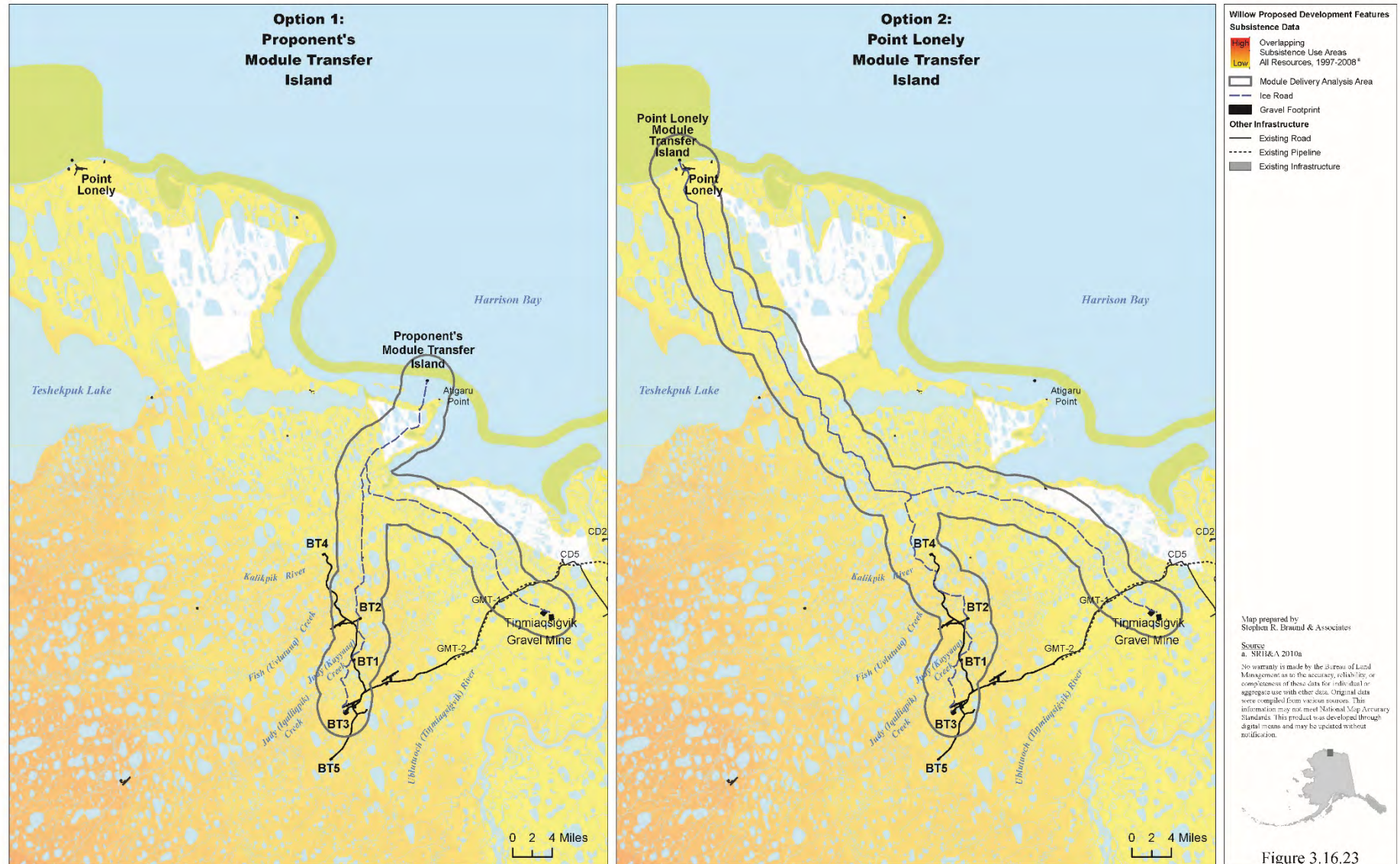


Figure 3.16.23. All Resource Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1997-2008

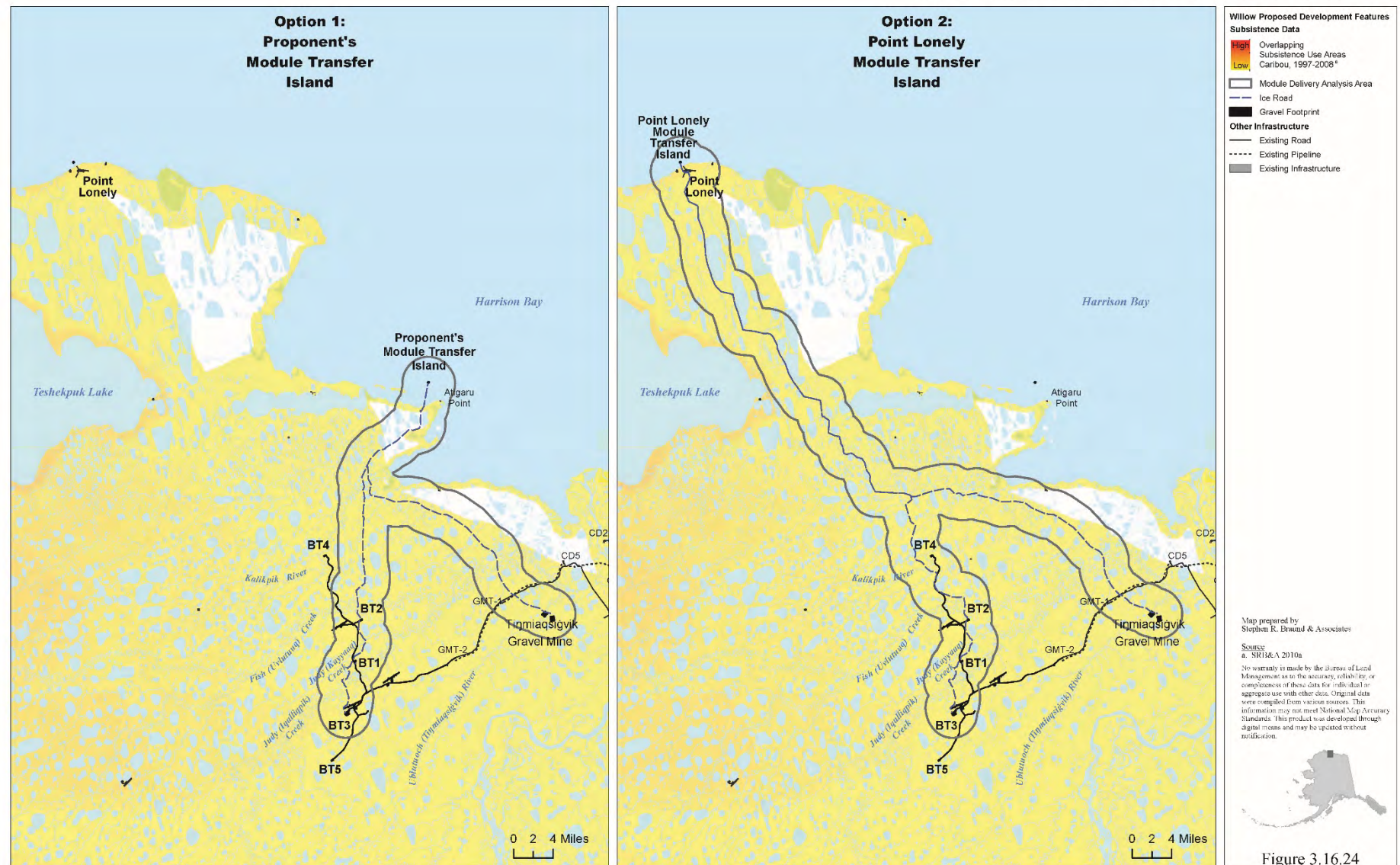


Figure 3.16.24. Caribou Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1997-2008

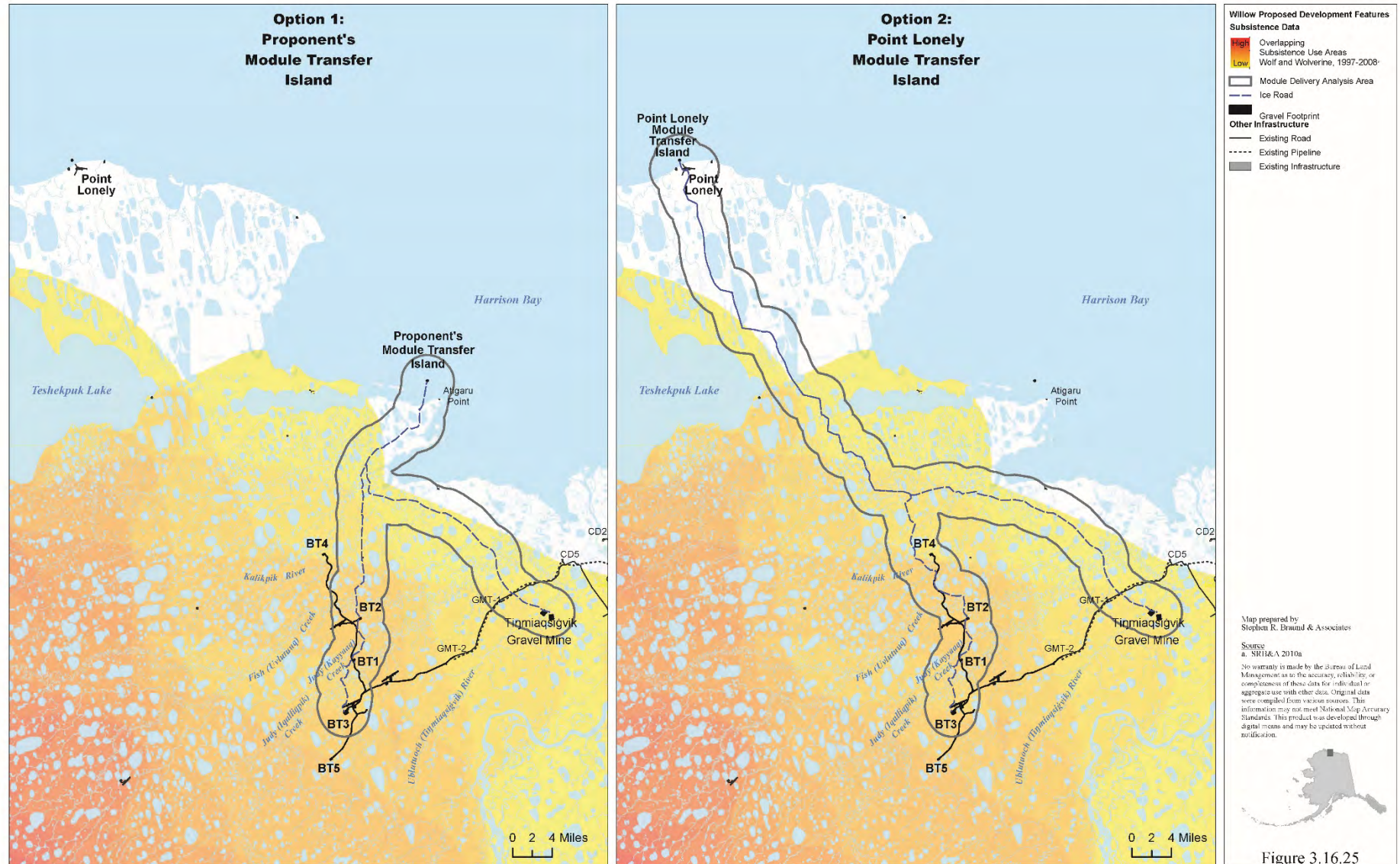


Figure 3.16.25. Wolf and Wolverine Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1997–2008

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Seal Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1997-2008

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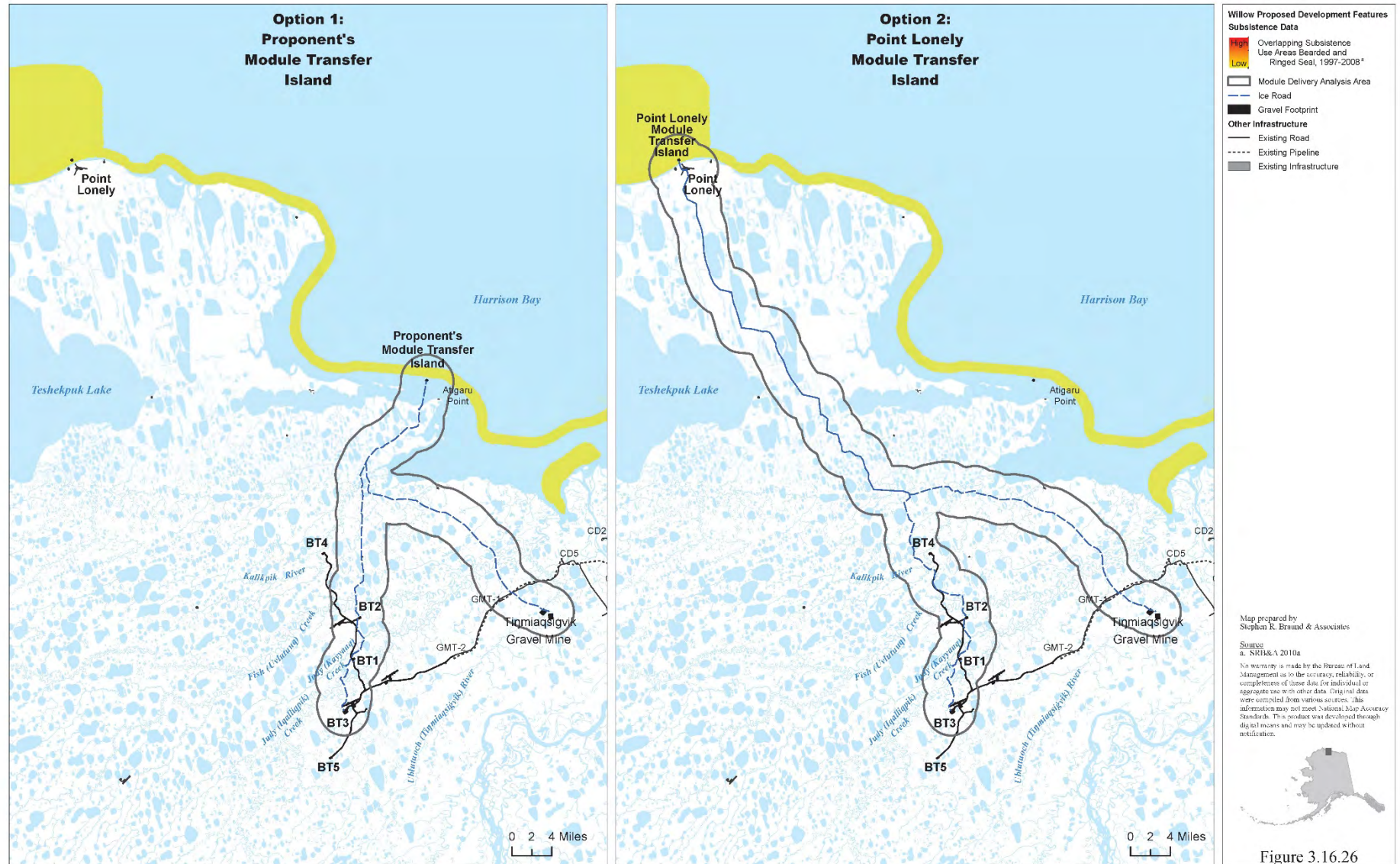


Figure 3.16.26. Seal Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1995-2008

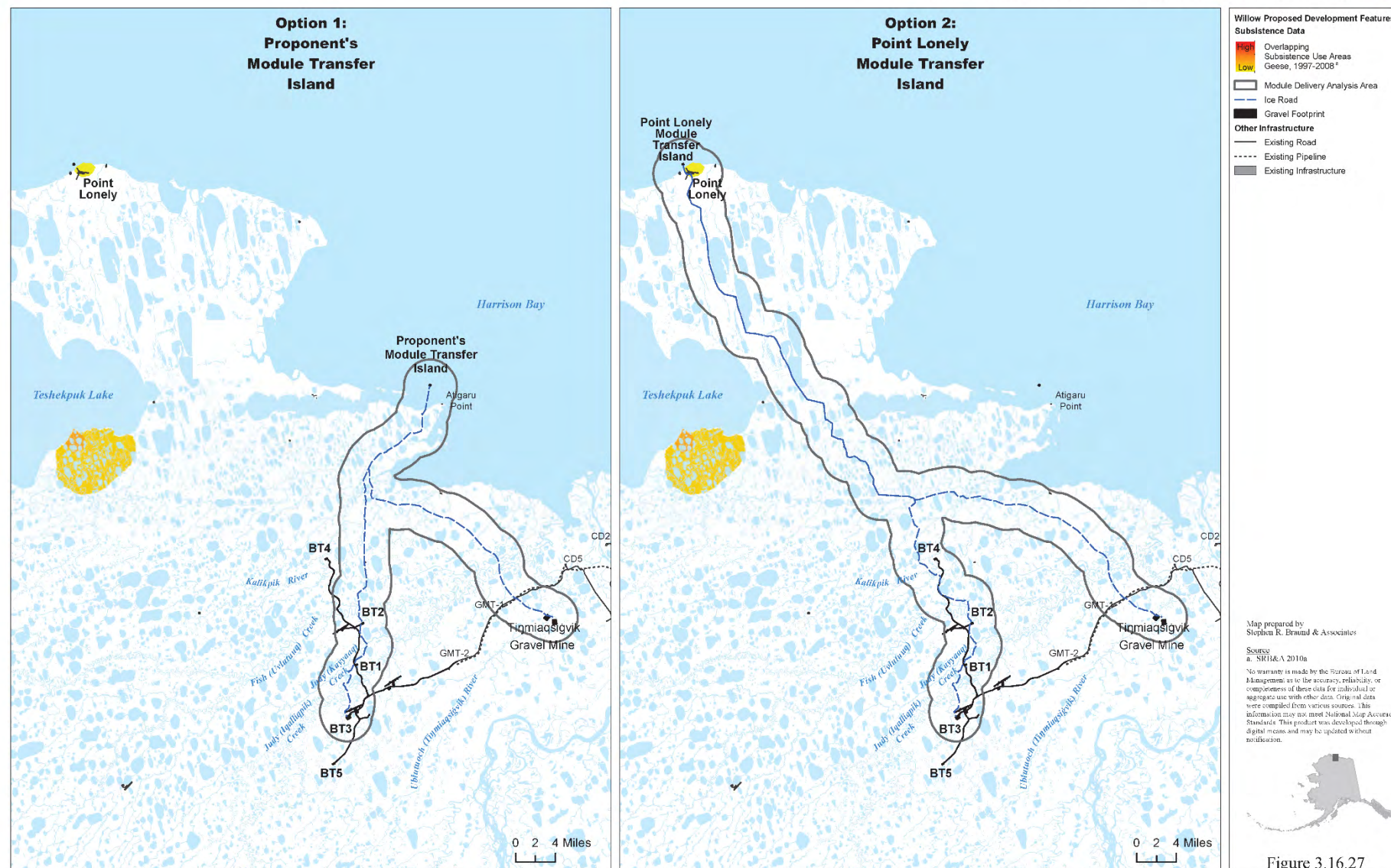


Figure 3.16.27. Goose Subsistence Use Areas by Module Delivery Option, Utqiagvik (Barrow), 1995–2008

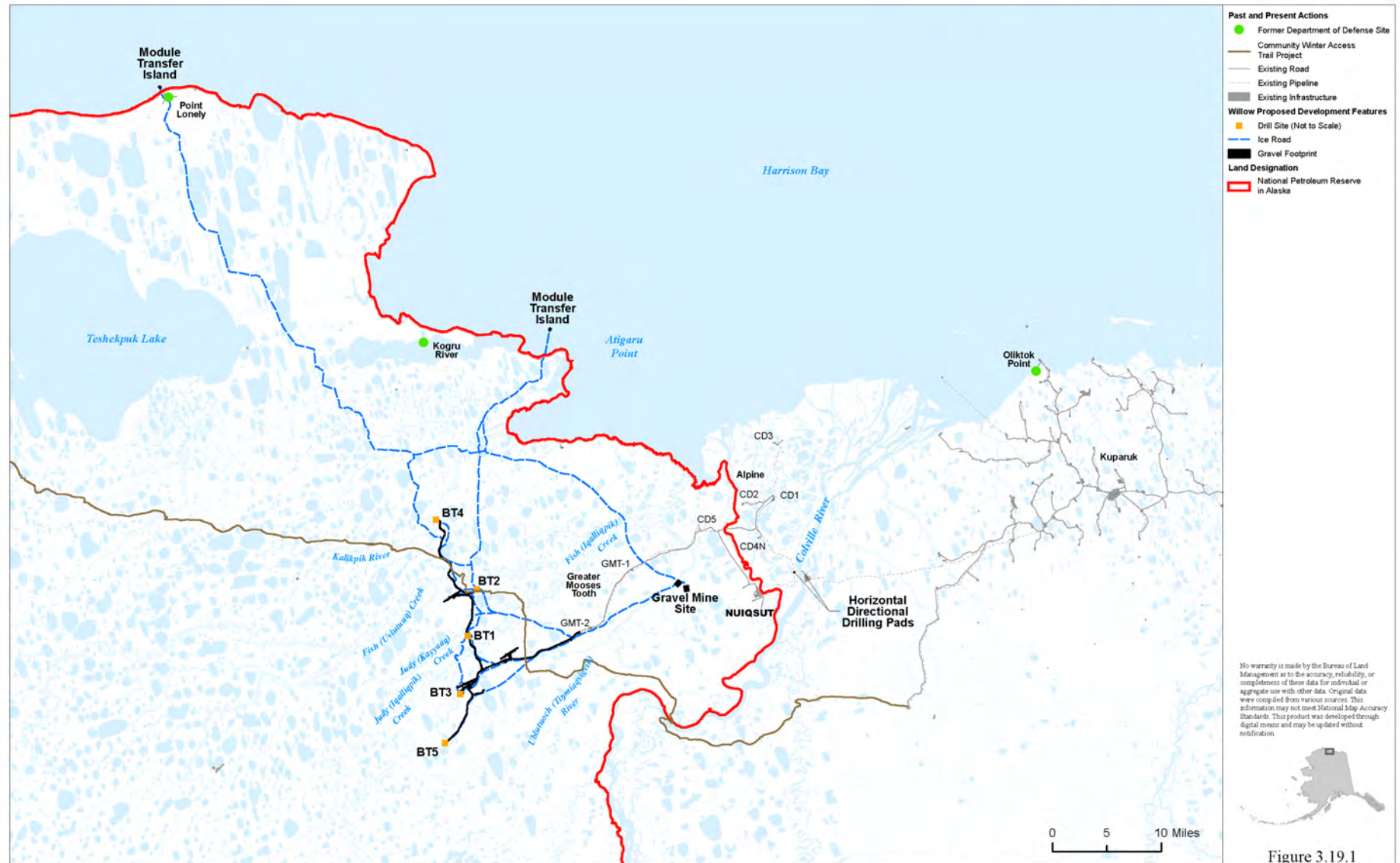


Figure 3.19.1. Past and Present Actions that may Interact with the Willow Project

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Reasonably Foreseeable Future Actions that may Interact with the Willow Project

3.19 - Cumulative Effects

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Figure 3.19.2. Reasonably Foreseeable Future Actions that may Interact with the Willow Project

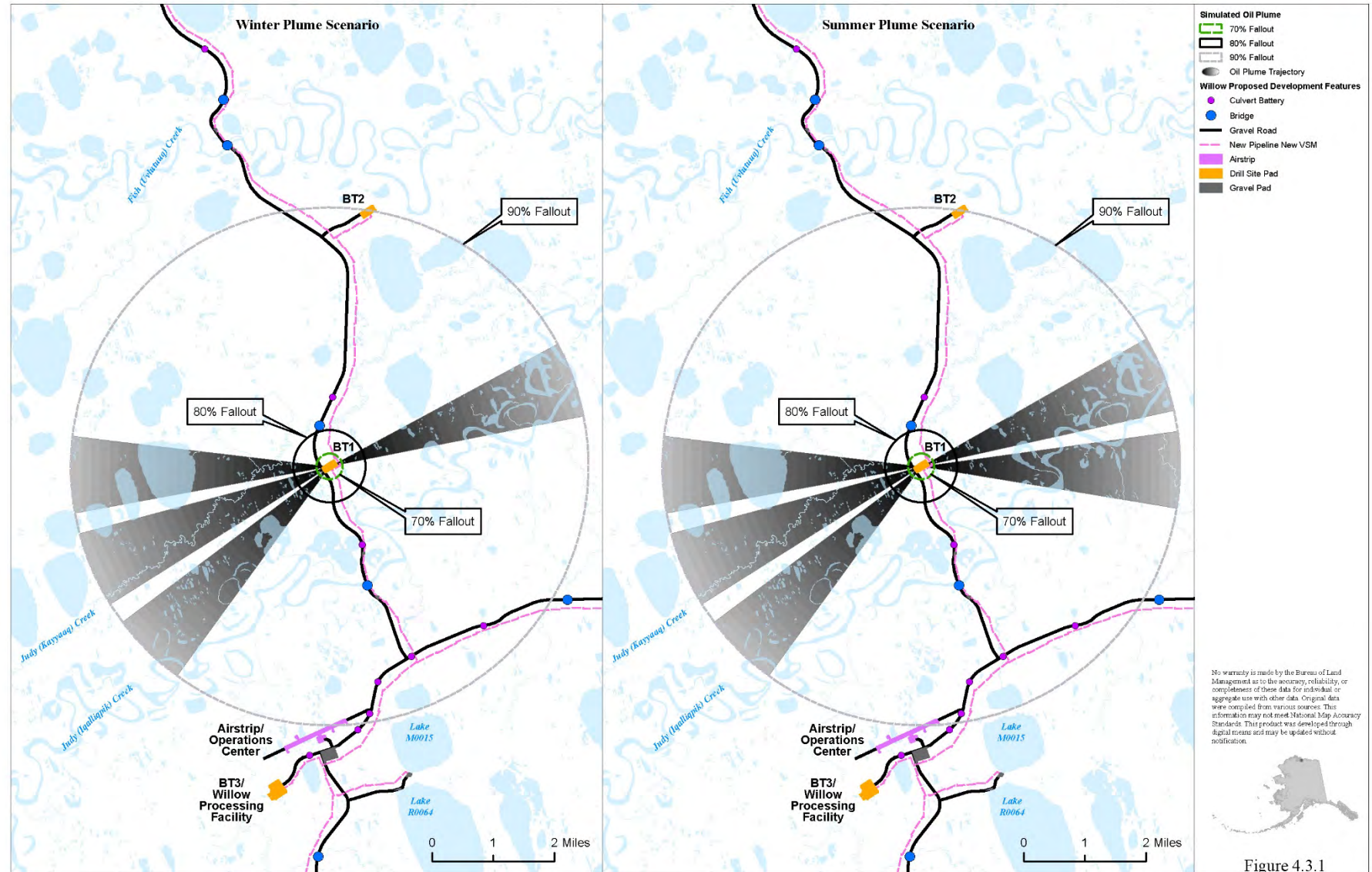


Figure 4.3.1. Drill Site BT1 Reservoir Blowout Oil Fallout

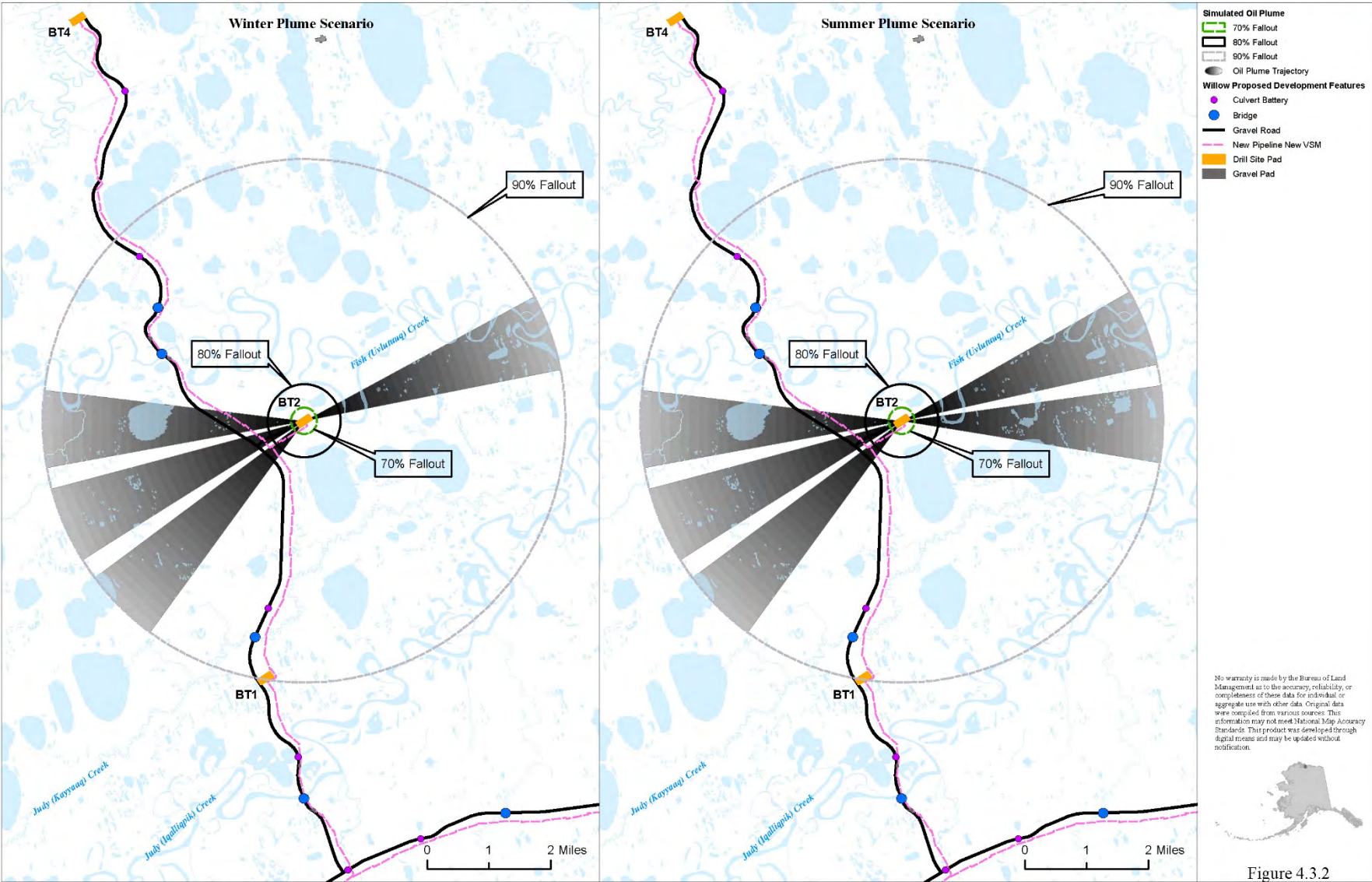


Figure 4.3.2. Drill Site BT2 Reservoir Blowout Oil Fallout

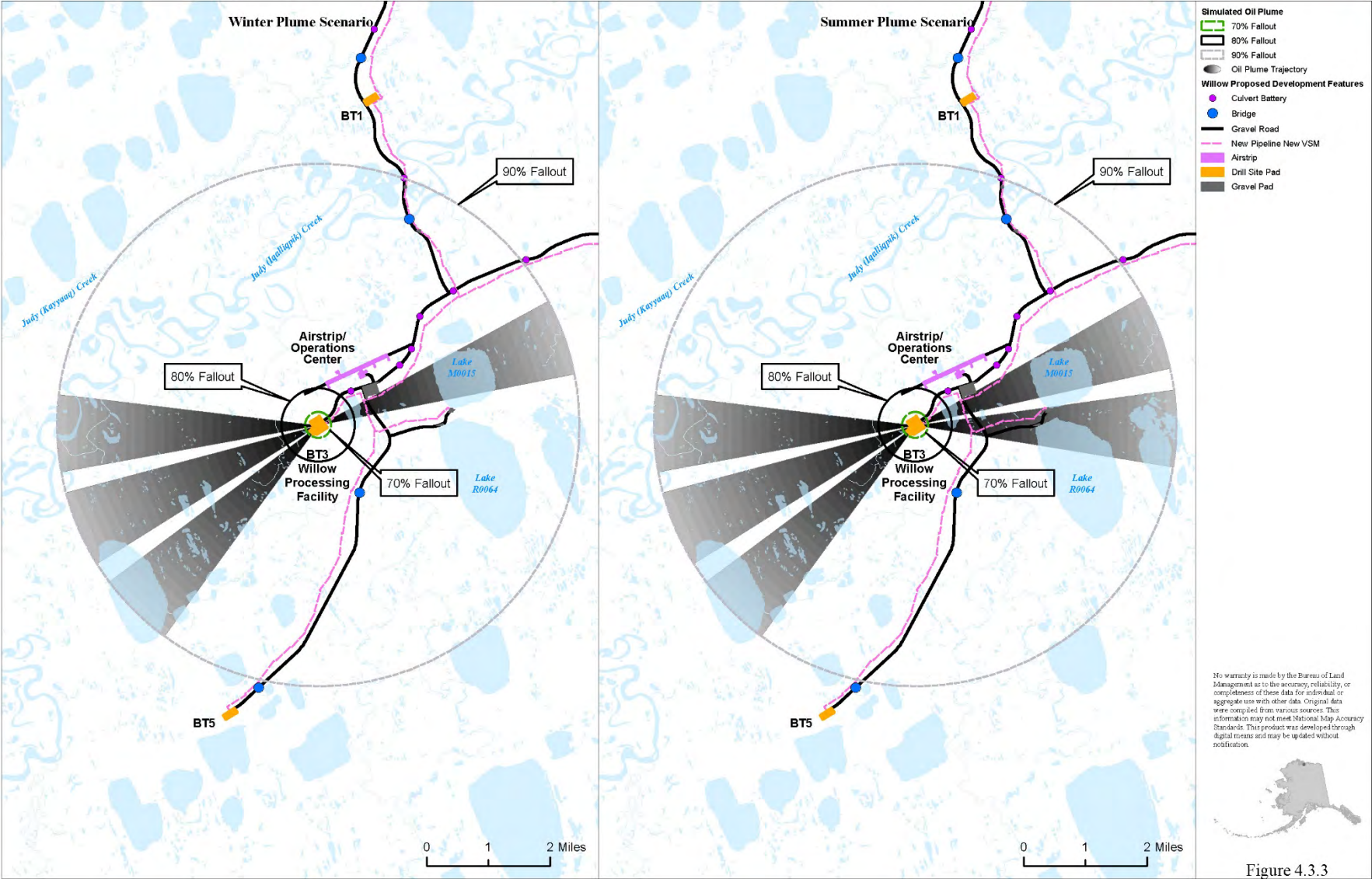


Figure 4.3.3. Drill Site BT3 Reservoir Blowout Oil Fallout

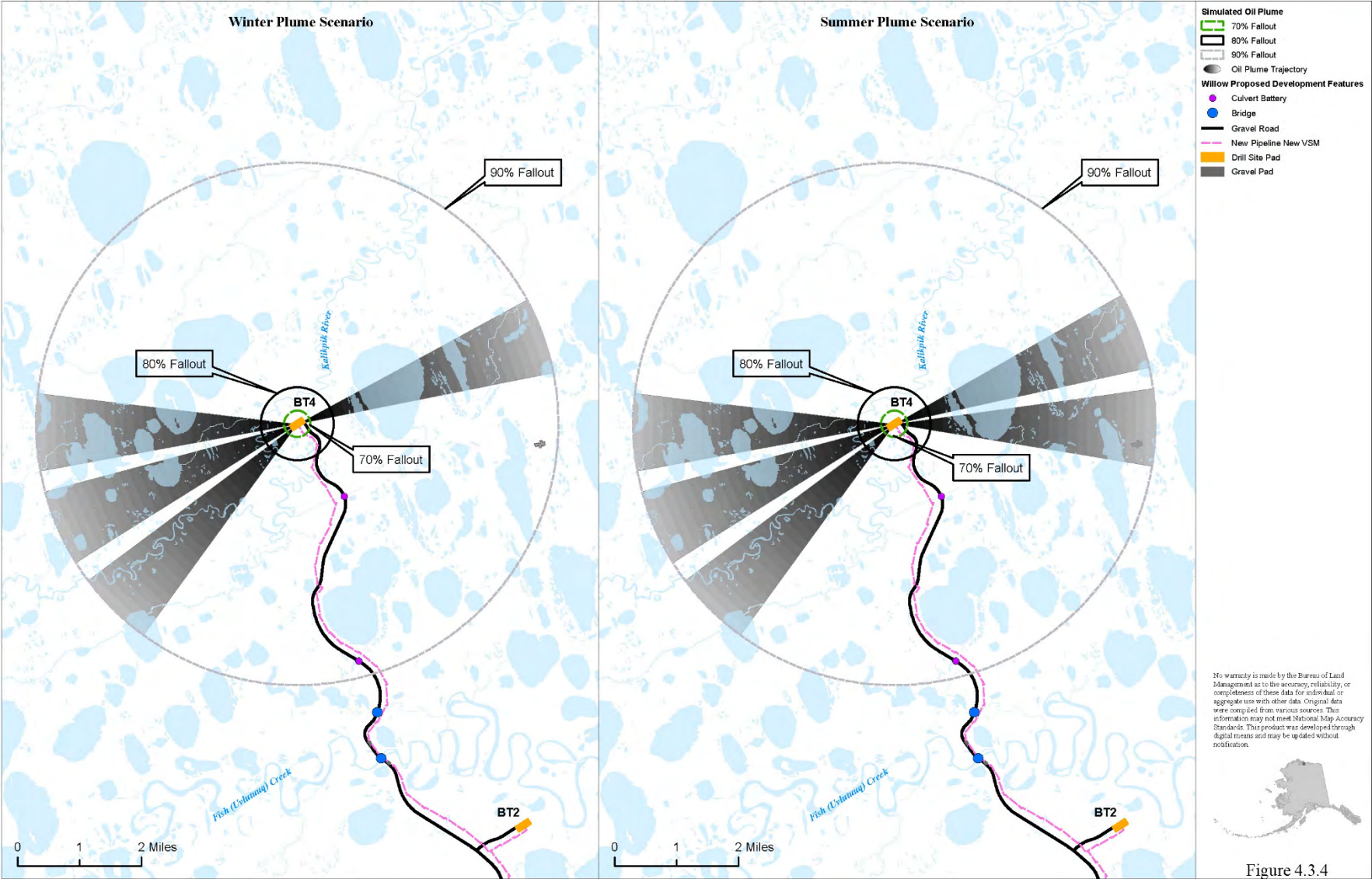


Figure 4.3.4. Drill Site BT4 Reservoir Blowout Oil Fallout

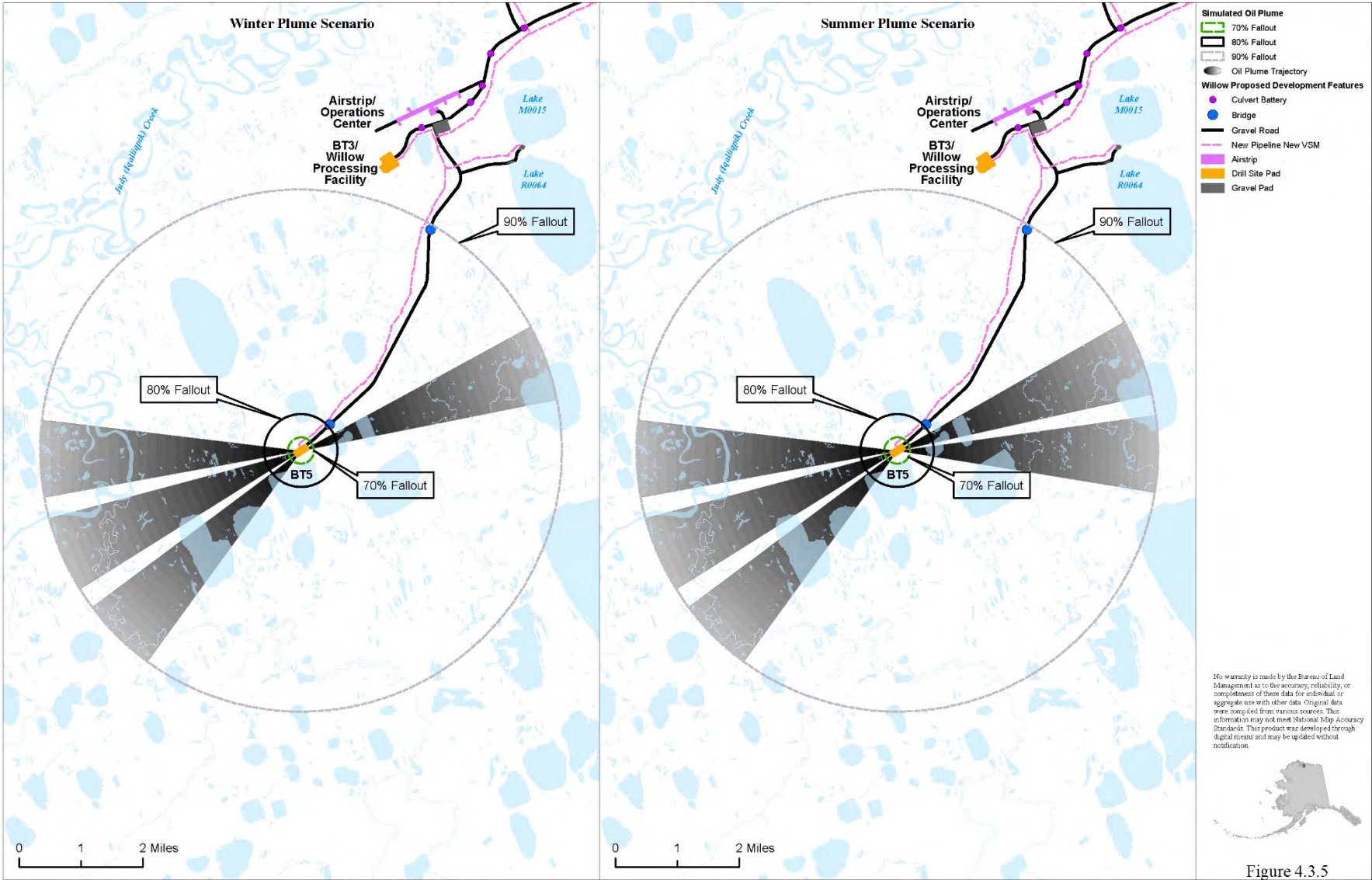


Figure 4.3.5. Drill Site BT5 Reservoir Blowout Oil Fallout