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

Peregrine Exploration Program
Environmental Assessment

DOI-BLM-AK-R000-2022-0004-EA

Emerald House LLC
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FF097644/AA093747

Contents

LIST OF ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ANILCA	Alaska National Interest Land Conservation Act
AOGCC	Alaska Oil and Gas Conservation Commission
APD	Application for Permit to Drill
BLM	Bureau of Land Management
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
CMMA	Charles M. Mobley & Associates, Inc.
COVID-19	Coronavirus pandemic
CWAT	Community Winter Access Trail
DMLW	Division of Mining, Land and Water
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ERT	Emergency Response Technician
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	Finding of No Significant Impacts
FONNSI	Finding of No New Significant Impacts
GHG's	Greenhouse Gases
GIS	Geographic Information System
GMT2	Greater Mooses Tooth Two
IAP	Integrated Activity Plan
LOA	Letter of Authorization
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NPR-A	National Petroleum Reserve in Alaska
NPRPA	Naval Petroleum Reserves Production Act of 1976
NSB	North Slope Borough
NSB SA-10	NSB Deadhorse Service Area 10
OHA	Office of History and Archaeology
ODPCP	Oil Discharge Prevention and Contingency Plan
ROD	Record of Decision
ROPs	Required Operating Procedures
ROW	Right-of-Way
SHPO	State Historic Preservation Office
SPCC	Spill Prevention Control and Countermeasure Plan
TLUI	Traditional Land Use Inventory
TWUA	Temporary Water Use Authorization
USDOI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
VSP	Vertical Seismic Profiles

Chapter 1 Introduction

1.0 Overview

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA) to disclose and analyze the environmental impacts of accessing and drilling an exploratory well on lands managed by the Bureau of Land Management (BLM) in the National Petroleum Reserve in Alaska (NPR-A), amending Right-of-Way (ROW) grant FF097644 to Emerald House, LLC (Emerald House), and approving one Application for Permit to Drill (APD).

Emerald House has applied for permits and/or posted notices for access (ROW FF097644) and to drill on a valid federal oil and gas lease (AA093747) for winter exploration in the NPR-A. Emerald House is proposing to amend its existing ROW to include access to one exploration well. The proposed operations would occur on lands managed by the BLM Arctic District and on oil and gas tracts leased by Emerald House.

The proposed project is a continuation of a multi-year oil and gas exploration program within Emerald House's Peregrine Oil and Gas Lease Block to explore, delineate, and appraise the oil and gas potential in the Merlin Play of the lower Nanushuk formation (a region formed and controlled by the same set of geologic circumstances where hydrocarbon exploration has been predicted to exist in economic quantities). Exploration of the Peregrine Lease Block began in the winter 2020/2021 with the drilling of the Merlin 1 well (USDOI BLM 2021).

For the 2021/2022 winter season, the proposed project would include access to and exploratory drilling and testing at one site (Merlin 2) (Figure 1) to continue exploration and assessment of potential oil and gas resources in the Merlin Play. The BLM inspected the Merlin 2 well location in August 2021. The proposed well is approximately 50 air miles southwest of Nuiqsut, 14 air miles north of Umiat, and 91 air miles south-southwest of Deadhorse.

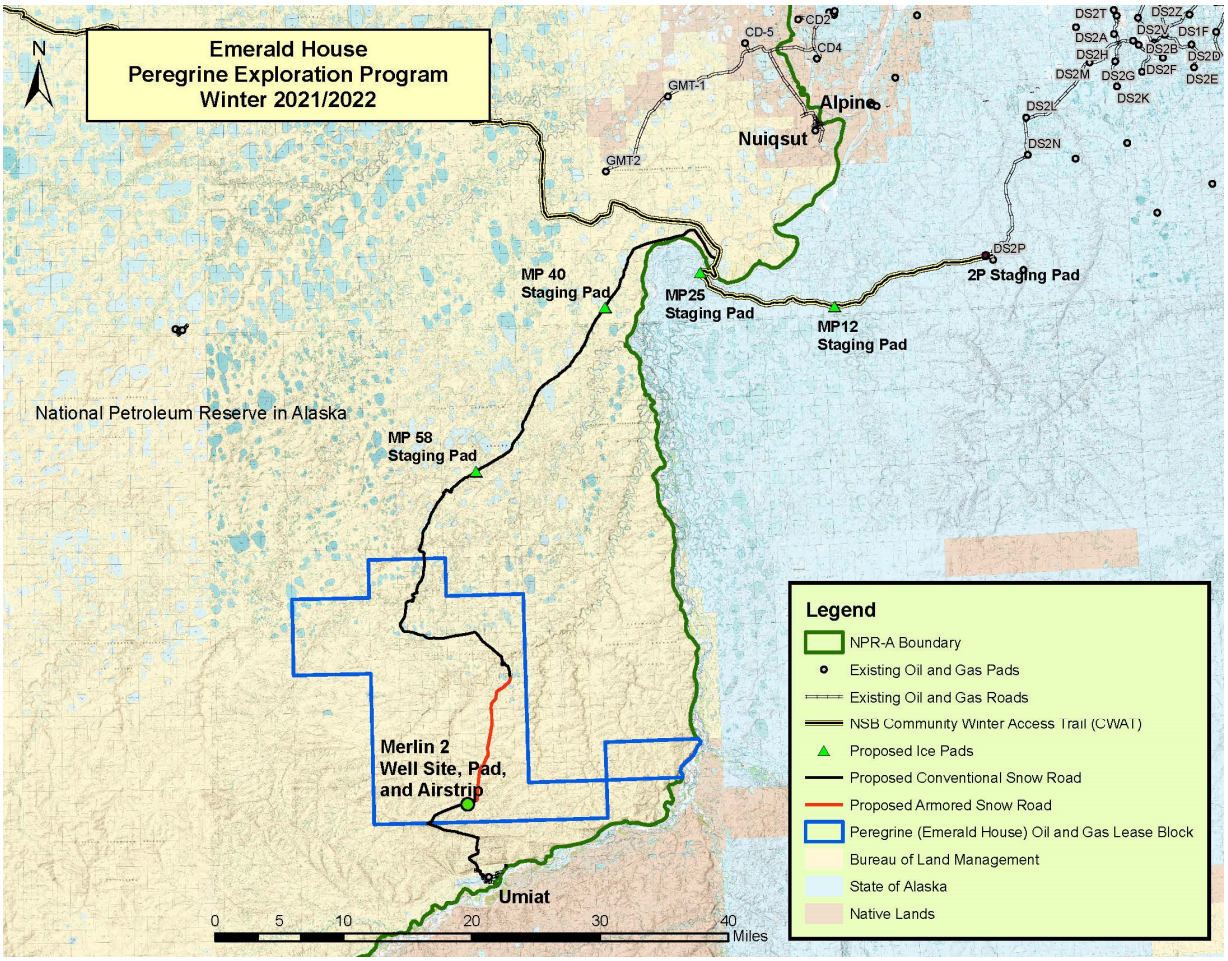

Figure 1. Map of proposed project area.

1.1 Purpose and Need for the Proposed Action

Under the Naval Petroleum Reserves Production Act (NPRPA) of 1976, the BLM is required to conduct oil and gas leasing and development in the NPR-A (42 USC Section 6506a). The Department of the Interior and Related Agencies' Fiscal Year 1981 Appropriations Act, which amended the NPRPA, directs the Secretary to undertake "an expeditious program of competitive leasing of oil and gas" in the Petroleum Reserve. Specifically, the NPRPA, as amended, encourages oil and gas leasing in the NPR-A while requiring protection of important surface resources and uses.

The need for the action is established by the BLM's responsibilities under the NPRPA, the 2020 Integrated Activity Plan Record of Decision, contractual exploration rights Emerald House has for their NPR-A leases, and to respond to Emerald House's request for access to and exploratory drilling of the Merlin 2 well.

The Proposed Action helps meet the purpose of the NPRPA to explore and develop oil and gas resources in the NPR-A. The Peregrine Exploration Project helps satisfy the purpose to develop oil and gas resources in the NPR-A by responding to Emerald House's application for a ROW, drilling permit, and other approvals necessary to carry out oil and gas exploration on Emerald

House's oil and gas leases in the NPR-A. Alternatives to the proposed project would be evaluated on the basis of their effectiveness in meeting these objectives.

1.2 Resource Management Plans, Laws, and Regulations

The 2020 Integrated Activity Plan Environmental Impact Statement (IAP EIS) (USDOI BLM 2020a) and associated Record of Decision (ROD) (USDOI BLM 2020b) were completed to fulfill the BLM's responsibility to manage lands in the NPR-A under the authority of the Naval Petroleum Reserves Production Act of 1976, as amended, Federal Land Policy and Management Act of 1976 (FLPMA), National Environmental Policy Act (NEPA), and the Alaska National Interest Lands Conservation Act (ANILCA). Findings in the 2020 NPR-A IAP EIS and decisions reflected in the associated ROD were based on an open and collaborative public process, as well as experience with multiple exploration programs previously completed in the NPR-A.

Lease stipulations from the 2013 NPR-A IAP ROD (USDOI BLM 2013) were attached to the leases in the proposed project area when these leases were issued to Emerald House. All applicable lease stipulations from the 2013 IAP ROD are required to be followed for the proposed project and would be included on the APDs.

Required Operating Procedures (ROPs) were developed through the BLM planning and NEPA process for the 2020 NPR-A IAP EIS (USDOI BLM 2020a) and are found in Appendix A of the 2020 NPR-A IAP ROD (USDOI BLM 2020b). All applicable ROPs from the 2020 NPR-A IAP EIS ROD (USDOI BLM 2020b) would be followed unless a deviation is analyzed under this EA and found to meet the objectives of the ROP and an exception, waiver or modification is approved by BLM.

In addition to required lease stipulations and 2020 NPR-A IAP ROPs found in Appendix A, project specific ROPs are shown in Section 2.4 (*BLM Project Specific Required Operating Procedures*) of this EA. An applicant proposing to conduct activity on BLM managed lands within the Arctic District must meet the objectives of all ROPs and stipulations in Appendix A and Section 2.4 of this EA.

The Proposed Action must comply with numerous federal laws and Executive Orders (EO) that apply to activities on public lands. Key federal and state controls associated with the Proposed Action were described in the 2020 NPR-A IAP EIS (USDOI BLM 2020a). The Proposed Action is in conformance with the NPR-A IAP ROD (USDOI BLM 2020b), NPRPA, FLPMA, ANILCA, National Historic Preservation Act, Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Sustainable Fisheries Act, and Executive Orders 11988, and 11990.

This EA analyzes the potential environmental impacts of access to and exploration and testing of one oil and gas well on BLM managed lands within the boundaries of the Arctic District in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, and regulations implementing NEPA promulgated by the Council of Environmental Quality (40 CFR Parts 1500-1508; 85 FR 43357, July 16, 2020) and Department of the Interior (43 CFR Part 46; 73 FR 61314, Oct. 15, 2008).

1.3 Required Permits, Licenses, Authorizations, and Approvals

A number of federal, state, and local permits and approvals must be obtained before the applicant could conduct the proposed activity. Primary regulatory authorizations for the proposed project are listed in Appendix B.

1.4 Related Environmental Analyses

An environmental assessment is prepared for a proposed action that is not likely to have significant effects or when the significance of the effects is unknown (Council of Environmental Quality (CEQ) NEPA Regulation 40 Code of Federal Regulation (CFR §1501.5(a)). An environmental assessment shall (1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact (§1501.5(c)(1)) and (2) briefly discuss the purpose and need for the proposed action, alternatives as required by section 102(2)(E) of NEPA, the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted (§1501.5(c)(2)).

The CEQ NEPA regulations encourage agencies to tier their environmental impact statements (EIS) and environmental assessments (EA) where it would eliminate repetitive discussions of the same issues, focus on the actual issues ripe for decision, and exclude from consideration issues already decided or not yet ripe for environmental review. Whenever an agency has prepared an EIS or EA for a program and then prepares a subsequent EIS or EA on an action included within the entire program (such as a project or site-specific action), the subsequent EIS or EA need only summarize the issues discussed in the broader EIS and incorporate discussions from the broader EIS by reference and shall concentrate on the issues specific to the subsequent action.

In accordance with 40 CFR 1501.11, 1501.12, and 43 CFR 46.140, the analysis for this EA is tiered off the 2020 NPR-A IAP EIS (USDOI BLM 2020a) and ROD (USDOI BLM 2020b), which together with the 2018 Supplemental EIS for the Alpine Satellite Development Plan for the Greater Mooses Tooth 2 Development Project (USDOI BLM 2018a) and associated ROD (USDOI BLM 2018b) are incorporated in entirety by reference in accordance with 40 CFR 1501.12. The conditions and environmental effects described in the EISs are still valid. Pursuant to 40 CFR 46.140(c), a finding of no significant impact other than those already disclosed and analyzed in an environmental impact statement to which an environmental assessment is tiered may be called a "finding of no *new* significant impact."

Appendix C provides information related to BLM evaluation of oil and gas related activities, via the NEPA process in the NPR-A from 1998 to 2021.

1.5 Decision to be Made

This EA will assist the BLM in project planning by evaluating potentially significant environmental impacts from the Proposed Action on different resources. As defined by the CEQ, the significance of a federal action is determined by the context of the action in relation to the overall project setting, as well as the intensity of effects resulting from the project. If the BLM determines that the preferred alternative would not result in significant impacts beyond

those already addressed in the 2020 NPR-A IAP EIS (USDOI BLM 2020a) the BLM would prepare a Finding of No New Significant Impacts (FONNSI) and Decision Record approving the selected alternative. If the project is found to result in significant impacts, an Environmental Impact Statement will be prepared.

The decision maker, BLM Authorized Officer, will consider technical, economic, environmental, and social issues (Table 1.1) as well as the purpose and need of the proposed project when making the decision. The decision to authorize Emerald House access to and drilling of an exploratory well on BLM managed lands within the Arctic District will be made based on the analysis in this EA, and, if so, under terms and conditions identified herein and in the FONSSI and Decision Record.

1.6 Scoping and Issues – Public Involvement

Public notification of the Proposed Project and EA development was announced on November 24, 2021, on the BLM NEPA Register website (https://eplanning.blm.gov/eplanning-ui/home) (DOI-BLM-AK-R000-2022-0004-EA).

Development of the NPR-A IAP EIS (USDOI BLM 2020a) involved extensive input from federal agencies, State of Alaska, the North Slope Borough (NSB), individuals, and different interest groups.

Resources potentially impacted by the Proposed Action were considered by BLM specialists in Table 1.1. BLM specialists evaluated each resource and made determinations of potentially impacted, minimally impacted, not present, or not impacted.

A **Potentially Impacted** determination in Table 1.1 means the Proposed Action could result in impacts to a resource that are beyond what could be considered minimal or negligible. Resources identified as potentially impacted are further analyzed in this EA. Five Potentially Impacted resources were identified (Table 1.1) – Environmental Justice, Sociocultural Systems, Subsistence, Fish, and Vegetation. Potential impacts to these resources will be evaluated in this document.

A **Minimally Impacted** determination in Table 1.1 means the Proposed Action would not affect a resource to a degree that would require further analysis because the expected impacts would be minimal, negligible, or are already addressed by standard protections such as Required Operating Procedures from the 2020 NPR-A IAP ROD (USDOI BLM 2020b) or other legal protections. There were 16 resources found to be Minimally Impacted by the Proposed Action (Table 1.1). Minimally impacted resources are not analyzed further in this EA.

A **Not Present** determination in Table 1.1 means that a resource is not expected to be affected by the proposed project because it is not physically located where the project is occurring, or it is not in the project area during a time when the project is being implemented. There were two resources identified as Not Present in the project area (Table 1.1). These resources are not discussed further in this EA.

A **Not Impacted** determination in Table 1.1 means that a resource may be in the project area but would not be impacted by the project. There was one resource identified as Not Impacted in the

project area (Cultural and Paleontological Resources) (Table 1.1). This resource will not be discussed further in this EA.

Table 1.1. Issues Considered in Evaluating Impacts.

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
Air Quality	Minimally Impacted	2020 IAP EIS §3.2.2	Air resources or issues would not be affected to a degree requiring further analysis because the expected impacts from either the proposed action or alternative would be minimal. More discussion on air quality is found in Section 2.2.
Climate Change	Minimally Impacted	2020 IAP EIS §3.2.1	Potential effects from climate change in this region include an increase in the open water period, loss of permafrost (resulting in thermokarst), sea level rise, drying of wetlands, and shrub expansion. Climate change could drive alteration of plant community composition, increasing deciduous shrubs, and sedges and grasses, at the expense of lichens and mosses. This could have a synergistic effect along with alteration due to indirect effects of development. More discussion on climate change is found in Section 2.3.
Cultural and Paleontological Resources	Not Impacted	2020 IAP EIS §3.4.2	The proposed program area has been adequately surveyed in 2020 and 2021 using methods consistent with modern practices for identifying and recording cultural and paleontological resources on the North Slope (Mobley 2020, Mobley & Mobley 2021). No cultural and only one paleontological property are located within 500 ft of the proposed program area, and it is unlikely that any unidentified cultural or paleontological resources (including potential Historic Properties) of the types that would be adversely impacted by the Proposed Action would be located on the surface within the proposed project area. A 500-ft minimum avoidance buffer would be adequate to avoid disturbing cultural resources by vehicles and equipment during snow road, airstrip, and ice pad construction and operations, especially given the temporary, short-term duration of snow/ice infrastructure. The one site within 500 ft of the project area (HAR-00032) is buried deep underground in permafrost and unlikely to be affected even if operations occur directly above. Exploratory drilling and transport are routine activities in the NPR-A and elsewhere throughout Alaska, and the Proposed Action can be considered a routine activity conducted in previously inventoried areas. In addition to no properties having been identified during field survey at the Merlin-2 pad, the proposed disturbance (cellar excavation and well drilling) would occur in tundra bog, a type of area unlikely to yield reasonably identifiable cultural materials and with little potential to adversely affect Historic Properties. The Proposed Action falls within the scope of actions not subject to further Section 106 review in accordance with the Alaska protocol (BLM and Alaska Dept. of Natural Resources Office of History and Archaeology (OHA) 2014: Appendix 2). There would be no anticipated impacts to cultural or paleontological resources by the Proposed Action. The Proposed Action would not be expected to result in any adverse effects to Historic Properties. Protections provided by the National Historic Preservation Act, Archaeological Resources Protection Act, Alaska Historic Preservation Act, Antiquities Act, Native American Graves Protection and Repatriation Act, EO 13007, Paleontological Resources Preservation Act, and 2020 NPR-A IAP ROPs C-2, E-11, and I-1.

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
Economy	Minimally Impacted	2020 IAP EIS, §3.4.11	Minor short-term impacts to the local economy would be expected from the Proposed Action. Impacts to furbearer harvest may reduce the opportunity for local hunters to sell furbearer pelts and there may be some local employment opportunities in the community of Nuiqsut related to snow road construction.
Environmental Justice	Potentially Impacted	2020 IAP EIS §3.4.5	Minor to moderate short-term impacts to subsistence and sociocultural systems would be anticipated to result from the Proposed Action. These impacts would not affect all residents equally, and some residents could benefit from the activity. Adverse impacts to subsistence and sociocultural systems associated with the Proposed Action would present environmental justice issues because they would disproportionately affect a minority population (tribal residents of Nuiqsut). The minority community would likely experience beneficial economic effects from local employment. With applied mitigation, the Proposed Action would not, in and of itself, substantially restrict subsistence uses for the community of Nuiqsut beyond what has been previously analyzed. The Proposed Action would be anticipated to result in temporary and less than significant restrictions primarily associated with limitations on hunter access and reduced availability of subsistence resources (primarily caribou in the summer months and furbearers in the winter) in areas where they are traditionally harvested. Past, present and reasonably foreseeable effects to subsistence and sociocultural systems (and environmental justice) have been previously analyzed. No new significant impacts beyond those previously described and analyzed in the 2020 IAP EIS would be anticipated. Protection provided by NPR-A IAP ROPs A-1-A-6, A-9, B-1, B-2, E-1, F-3, H-1, H-2, H-3, H-4, and I-1 and Executive Order 12898. Environmental Justice is further analyzed in Chapter 3.
Fish	Potentially Impacted	2020 IAP EIS §3.3.3	Potential for impacts on sensitive fish overwintering in water source lakes would be minimized by adhering to liquid water use standards outlined in the NPR-A IAP ROP B-2a. Additional protections would be provided by 2020 NPR-A IAP ROPs A-3, A-4, A-5, B-1, B-2, C-2, C-3, C-4; 2013 NPR-A IAP Lease Stipulation D-1; additional project specific ROPs required by this EA (Section 2.4 15 and 16); and ADFG Fish Habitat Permits. Essential Fish Habitat assessment finding is: *no adverse effect*.
Floodplains and Riparian Zones	Minimally Impacted	2020 IAP EIS §3.3.2	Protections provided by 2020 NPR-A IAP ROPs A-3, A-4, A-5, B-1, C-2, C-3, C-4; 2013 NPR-A IAP Lease Stipulation D-1; Executive Orders 11988 and 11990.
Wetlands	Minimally Impacted	2020 IAP EIS §3.3.2	Protection provided by 2020 NPR-A IAP ROPs A-3, A-4, A-5, A-8, B-1, C-2, C-3, C-4; 2013 NPR-A IAP Lease Stipulation D-1; Executive Orders 11988 and 11990.

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
Invasive, Non-native species	Minimally Impacted	Not Applicable	2020 NPR-A IAP ROP M-2 would greatly reduce the probability that invasive plants become an issue. In addition, Emerald House would follow its Invasive Species Control Plan to prevent the introduction or spread of nonnative, invasive plant species into the NPR-A.
Native American Religious Concerns	Not Present	2020 IAP EIS § 3.4.2, Appendix U	There are no known Native American Religious concerns in the area of the Proposed Action. Protections provided by National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, and 2020 IAP ROPs E-11, and I-1.
Recreation	Minimally Impacted	2020 IAP EIS §3.4.6	Protections provided by the 2020 NPR-A IAP ROPs A-1-A-6, A-9, B-1, B-2, C-1-C-4, F-1, H-3, I-1, M-2, M-3, and lease notice 1 and 3, and additional project specific ROPs required by this EA (Section 2.4) 3, 9 and 13.
Sociocultural Systems	Potentially Impacted	2020 IAP EIS §3.4.4	Sociocultural issues likely to result from the proposed activity could include stress over the pace of exploration, tensions and conflict related to the permitting process, lack of capacity to participate at levels desired, distrust of agencies and industry, lack of local control over the activity, and cultural (and subsistence) concerns associated with the northern portion of the action. The impacts of this project would be expected to be minor to moderate. Past, present and reasonably foreseeable effects to sociocultural systems have been previously analyzed. No new significant impacts beyond what has been described and analyzed in the 2020 IAP EIS would be anticipated. Protections provided by ROPsA-1 through A-5, B-1, B-2, E-1, F-3, H-1, H-3, H-4, and I-1. Sociocultural systems are further analyzed in Chapter 3.
Subsistence	Potentially Impacted	2020 IAP EIS §3.4.3, 3.4.4, 3.4.5, 3.4.11, 3.4.12	Large game (subsistence resources) would likely be deflected from areas of exploration activity. Caribou hunting is lowest during winter, therefore the deflection of furbearers and potential overlap of the project with trapping areas would be the most likely impact. Hunting and trapping activity occurs over a large area within Nuiqsut's broader subsistence use area. Hunters (mainly furbearer hunters) may avoid the area and may have to travel further and longer to harvest. The northern part of the project is in an area of high use for furbearer hunting and trapping. Impacts to subsistence use from the proposed project in and of itself would be expected to be minimal and short term (reduced access and reduced availability of resources, primarily affecting families for whom furbearer harvesting is important). Past, present, and reasonably foreseeable effects to subsistence have been previously analyzed, and analyses have concluded that the cumulative scenario may significantly restrict subsistence access and the availability of resources in areas where they are traditionally harvested. Harvest levels have remained stable to date, and no reduction in the overall abundance of subsistence resources would be anticipated. The proposed activity would occur at the same time and place as other activities (e.g., exploration on nearby state and private lands). No new significant

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
			impacts would be anticipated. Protections provided the 2020 NPR-A IAP ROPs A-1-A-6, A-9, B-1, B-2, C-2, C-3, C-4, E-1, E-8, F-1, F-3, H-1-H-4, I-1, L-1, and M-1, and the 2013 NPR-A IAP lease stipulation D-2. Subsistence is further analyzed in Chapter 3
Threatened & Endangered Species Steller's eider	Minimally Impacted	2020 IAP EIS §3.3.4. Informal consultation between BLM and USFWS concluded November 5, 2020, covering a 5-year period (2020-2025).	Steller's eiders are listed as Threatened under the Endangered Species Act (ESA). No impacts would be expected other than those already analyzed in 2020 NPR-A IAP EIS. Although Steller's eider would be very unlikely to be found in the project area at any time of year, there could be potential to impact nesting habitat for this species due to impacts to vegetation. There is no designated critical habitat for Steller's eider in the project area. Protections provided by section 7 of the ESA and the U.S. Fish and Wildlife Service concurred with the BLM ESA finding of *not likely to adversely affect* for the project. Additional protections would be provided by the 2020 NPR-A IAP ROPs A-2-A-6, C-2, E-8, and LN-2.
Threatened & Endangered Species Spectacled eider	Minimally Impacted	2020 IAP EIS § 3.3.4 Informal consultation between BLM and USFWS concluded November 5, 2020, covering a 5-year period (2020-2025).	Spectacled eiders are listed as Threatened under the ESA. No impacts would be expected other than those already analyzed in the 2020 NPRA IAP EIS. The Proposed Action would not alter the distribution, migration or location of aquatic resources that could impact spectacled eiders feeding from lakes or rivers in the project area. There is no designated critical habitat for Spectacled eider in the project area. Protections would be provided by section 7 of the ESA and the U.S. Fish and Wildlife Service concurred with the BLM ESA finding of *not likely to adversely affect* for the project. Additional protections would be provided by the 2020 NPR-A IAP ROPs A-2-A-6, C-2, E-8, and LN-2.
Threatened & Endangered Species Polar Bear	Minimally Impacted	2020 IAP EIS §3.3.6 Informal consultation between BLM and USFWS concluded November 5, 2020, covering a 5-year	Emerald House consulted with the U.S. Fish and Wildlife Service (USFWS) Marine Mammals Management Office in September 2021. Emerald would take several measures to minimize impacts to polar bear including conducting 3 aerial infrared denning surveys before operations and weekly denning surveys in potential denning habitat along that portion of the snow road within the ITR Geographic Region. The USFWS stated that there would be a low density of denning polar bears in the proposed project area and the likelihood of "take" (harassment) would be low if Emerald House implemented the mitigation measures identified in Section 2.1.19 of this EA. Emerald House would conduct activities without Marine Mammal Protection Act authorization and assume the risk of unauthorized polar bear "take" (harassment of bears).

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
		period (2020-2025).	Emerald House would contact the USFWS immediately if polar bear were encountered during surveys or operations. Informal consultation was completed between the BLM and the USFWS on the 2020-2025 Emerald House Exploration Program (which this project is included in) and USFWS concurred with the BLM ESA finding that the project would "*not likely adversely affect"* polar bear or polar bear critical habitat. Additional protections provided by the 2020 NPR-A IAP ROPs A-1, A-3, A-4, A-5, A-8, C-1, I-1, M-1, and LN-4 and project specific ROPs required by this EA (Section 2.4 2, 3 and 5 - 8).
Non threatened and endangered birds	Minimally Impacted	2020 IAP EIS §3.3.4	Snowy owls, gyrfalcons, ravens, and ptarmigan may inhabit the proposed project area during the operations period. No impacts would be expected other than those already analyzed in 2020 NPRA IAP EIS. The Proposed Action would not alter the distribution, migration or location of aquatic or terrestrial resources that would impact birds feeding in the project area. Protections provided in the 2020 NPR-A IAP ROPs A-1-A-6, C-2, E-8, E-16, and I-1.
Non threatened and endangered mammals	Minimally Impacted	2020 IAP EIS §3.3.5	Caribou, musk ox, grizzly bear, wolf, wolverine, fox, and small mammals (weasel, rodents, and shrews) may inhabit the proposed project area. Only minor impacts would be expected, and these impacts were covered in the 2020 NPRA IAP EIS. The Proposed Action could disturb and displace wildlife from the immediate area of activities but would not reduce population levels or distribution during the winter season. Protections would be provided by the 2020 NPR-A IAP ROPs A-1 through A-9, C-1, C-2, D-1, E-14, F-1 through F-3, H-5, I-1, L-1, and M-1, and Lease Notices 1 and 3. Additional protections would be provided by project specific ROP's required by this EA (Section 2.4 1-3, 6, and 14).
Vegetation/ Soils	Potentially Impacted	2020 IAP EIS §3.3.1 and 3.2.9	Impacts from ice-road and pad construction are expected and are analyzed in the 2020 NPRA IAP/EIS. Mitigations provided by the 2020 IAP ROD ROPs B-2, C-2, D-1, L-1, M-2, and M-3 and Lease Notice 3 would reduce impacts to the extent possible. Additional mitigation provided by ice/snow road building objectives and by project specific ROP's required by this EA (Section 2.4 1-3 and 14).
Visual Resource Management	Minimally Impacted	2020 IAP EIS §3.4.9	Protections would be provided by the 2020 NPR-A IAP ROPs A-1-A-6, A-8, A-9, B-1, B-2, C-1-C-4, F-1, H-3, I-1, M-2, M-3, and lease notice 1and 3.
Water Resources	Minimally Impacted	2020 IAP EIS §3.2.11	Protections would be provided by 2020 NPR-A IAP ROPs A-2, A-3, A-4, A-5, B-1, B-2, C-2, C-3, C-4; 2013 NPR-A IAP Lease Stipulation D-1; and required permits issued by the Environmental Protection Agency, Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, and Alaska Department of Natural Resources.

Resources Considered	Impacts	Location of Tiered Information (2020 IAP/EIS)	Basis of Determination
Waste (Hazardous/ Solid)	Minimally Impacted	2020 IAP EIS §3.2.12	Protections would be provided by Emerald House's Waste Management Plan, Oil Discharge Prevention and Contingency Plan, and Spill Prevention Countermeasures and Control Plan and the 2020 NPR-A IAP ROPs A-1-A-5. Additional discussion on hazardous materials and waste can be found in sections 2.1.14 and 2.1.15.
Wild & Scenic Rivers	Not Present	2020 IAP EIS §3.4.7	Not Applicable
Wilderness Characteristics	Minimally Impacted	2020 IAP EIS §3.4.8	Protections would be provided by 2020 NPR-A IAP ROPs A-1-A-6, A-9, B-1, B-2, C-1-C-4, F-1, F-2, H-3, I-1, M-2, M-3, and lease notice 1and 3, and additional project specific ROPs required by this EA (3, 9 and 14) (Section 2.4).

1.7 Issues Identified for Evaluating Impacts

Issue 1 – *How would winter exploration and associated activities (including summer inspections and cleanup activities) impact subsistence users and local communities?*

Issue 2 - *How would winter exploration and use of snow roads and pads impact vegetation?*

Issue 3 – *How would winter exploration and water withdrawal from source lakes to construct snow roads and pads impact fish?*

Chapter 2 Alternatives

2.0 Alternative A – No Action

Under the No Action Alternative, there would be no exploratory drilling or testing in the Peregrine Exploration Area. Permit applications to the BLM would be denied, and there would be no construction of 89 miles of snow trail or six ice pads. No water would be required to be withdrawn from 29 lakes along the snow road. The Merlin 2 well would not be drilled and there would be no testing of the oil and gas potential of the Merlin Play. While this alternative is contrary to the Naval Petroleum Reserves Production Act of 1976 and the applicant's lease rights, the no action analysis is required by NEPA to provide a baseline against which action alternatives are measured.

2.1 Alternative B - Proposed Action

Alternative B (Proposed Action) would include snow road access, exploration drilling and testing at one site (Merlin 2), and a temporary camp. The applicant proposes to take vertical seismic profiles at the well. The location of the proposed exploratory well is shown in Figure 1 and Table 2.1.

Emerald House has an existing 5-year ROW (2020-2025) for access to its federal oil and gas leases (USDOI BLM 2021). Emerald House, however, has requested an amendment to its ROW for access to its leases along a modified route from the one analyzed and used in 2021. This EA will consider the impacts of drilling one exploratory well (Merlin 2), the modified access route, and all related actions. Additional NEPA would be completed for any future proposed exploratory wells (requested through an Application for Permit to Drill) and/or any changes in the previously analyzed access routes.

Table 2.1. Location of the Merlin 2 well.

Well Name	Lease Case file Number	Township	Range	Section	Latitude	Longitude	Air miles to Nuiqsut
Merlin 2	AA093747	1 North	1 West	8	69.459062	152.16912	59.5

The proposed project would be similar to exploration programs completed in the NPR-A during previous winter seasons (Appendix C), including Emerald House's 2021 exploration program. A summary of the proposed activities is shown in Table 2.2. In addition to submitting a Plan of Operations to the BLM, Emerald House has also provided their Plan to multiple agencies including the Alaska Department of Natural Resources (ADNR) and the North Slope Borough (NSB).

Table 2.2. Summary of the 2021/2022 Proposed Project.

Project Component	**Program Specifics**
Drilling/testing location	Merlin 2
Merlin 2 ice pad	500 feet by 500 feet (6 Acres)
Staging (support) ice pads	5 ice pads (each pad would be 500 feet by 500 feet and 6 acres in size).
Construction/drilling support camps	2 camps
Crew numbers	Total number working onsite and offsite: 100 Total number working onsite: up to 75 Total number housed at a camp: 60
Access	Approximately 27.4 miles along North Slope Borough Community Winter Access Trail Approximately 89 miles of snow road
Temporary airstrip	50 feet by 3500 feet (4 acres) adjacent to the Merlin 2 ice pad
Water requirement	Approximately 13 million gallons for the entire project.
Fuel storage capacity/total fuel required for operations	29,940 gallons storage capacity/643,320 gallons for the entire project
Lakes to be used to supply fresh water	19 lakes on BLM managed lands and 10 lakes on State of Alaska managed lands
Summer activities	Inspection and cleanup during July 2022

2.1.1 Schedule

Proposed activities discussed in this EA could take place annually through 2025 and would include ground verification and staking of the access (snow) routes, prepacking snow roads and

ice pads (creating base), construction and winter maintenance of snow roads and ice pads, exploratory oil and gas drilling and testing, and summer inspections and cleanup. Route verification, staking, prepacking, and snow road and ice pad construction would begin each year in November or December. For the 2021/2022 winter season, route verification, prepacking, and snow road and ice pad construction would start in December 2021. Mobilization of equipment and access to the Merlin 2 well would begin in January 2022. Inspections and cleanup of surface debris would extend into the summer. The proposed schedule for the 2021/2022 season is shown in Table 2.3 although the timing of activities would be dependent on field conditions including snow cover, temperature, and logistical issues.

Table 2.3. Schedule for the 2021/2022 Peregrine Exploration Program.

Activity	**Proposed Start Date**	**Proposed End Date**
Stake, prepack, and construct snow roads, ice pads, and airstrip	December 2021	January 25, 2022
Mobilize drill rig and camp to the well site	January 25, 2022	February 15, 2022
Drill Merlin 2 well	February 15, 2022	March 15, 2022
Mobilize equipment and test the Merlin 2 well	March 15, 2022	April 5, 2022
Demobilize drill rig and tangibles	April 5, 2022	April 15, 2022
Demobilize all equipment and camps, and close snow roads and ice pads	April 15, 2022	April 27, 2022
Inspection and cleanup of snow roads, airstrip, pads, well site, and camp locations	July 1, 2022	July 19, 2022

2.1.2 Access

The proposed winter route (snow roads) to the exploration well site is shown in Figure 1. Over the life of the amended Right-of-Way (2025), access within the NPR-A would occur on the route authorized in 2021 (USDOI BLM 2021) or, if approved, along the route described and analyzed in this EA. If a future proposed route falls outside of the legal description of the amended Right-of-Way (FF097644), Emerald House would notify the BLM and apply to amend the Right-of-Way.

Access to the proposed project would start through the Prudhoe Bay oil fields with controlled security checkpoints. Access would be along gravel roads on State of Alaska lands to an existing permanent gravel pad (2P) (Figure 1). At the 2P pad, the access route would continue across the seasonal North Slope Borough (NSB) Community Winter (Snow) Access Trail (CWAT) on state lands for approximately 27 miles before entering the NPR-A at Ocean Point along the Colville River. Once west of the Colville River, Emerald House would construct a snow road to the Merlin 2 drill site and to Umiat (approximately 80 miles). The snow road would be built to accommodate the drill rig, camp move, and associated activities.

2.1.3 Prepacking

A process of "prepacking" snow would occur along the proposed snow roads and at the ice pad locations (well site and 5 staging ice pads). The purpose of prepacking snow is to create a "base" for the road, promote lower tundra soil temperatures, and compress the insulating snow to accelerate freezing of soils before construction of snow roads and pads and is a common practice on the North Slope of Alaska. Frozen ground conditions help protect tundra during snow road and ice pad construction, maintenance, and use. Prepacking would be used to compact snow to hold it in place, remove the snow's insulating properties to drive frost down, mound up snow at stream crossings to protect streambanks and provide ramps and cover willows.

Prepacking would be implemented using snow machines, Tucker SnoCats, Pisten Bully's or similar all terrain smooth-tracked vehicles that are approved for summer off road tundra travel and would result in a minimum of 6 inches of compacted snow for the base of the snow roads and ice pads.

Water may be applied along the prepacked route and pads to form a thin crust and hold dry snow in place. If the tundra opening criteria has not been met when operations are scheduled to begin, Emerald House may request approval from the BLM and the Alaska Department of Natural Resources (ADNR) Division of Mining, Land and Water (DMLW) to use half-loaded water buffaloes (water trucks) to apply water along the prepacked snow road. Once BLM and ADNR DMLW has confirmed that tundra opening criteria have been met along the route, fully loaded water trucks would be used for watering.

2.1.4 Snow Roads

Emerald House would construct both conventional and armored snow roads on the route between Ocean Point and Umiat (Figure 2) (Refer to Sections 2.1.5 and 2.1.6 for more information on conventional and armored snow roads). Some changes in the route shown is Figure 2 may be necessary due to terrain, water sources, wildlife den sites, river crossings, or other field conditions at the time of construction. The final route could be moved up to 1,500 feet in either direction from the route shown in Figure 1 and would be at least 100 feet from the 2020/2021 snow road location.

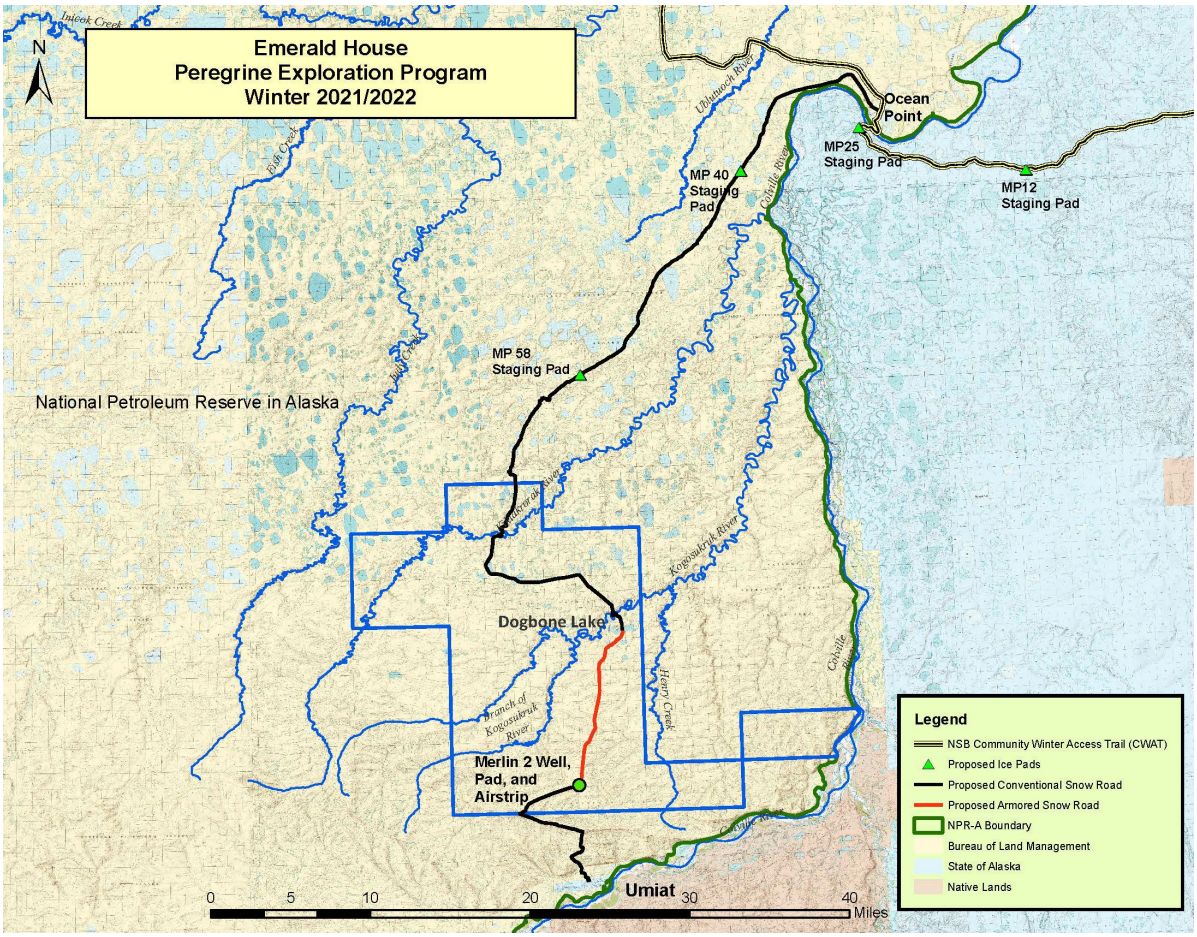

Figure 2. Location of conventional and armored snow roads, ice pads, Merlin 2 well, and airstrip.

Both conventional and armored snow roads could accommodate loads up to 115,000 pounds. Steigers and Pisten Bullys would operate on the conventional snow road but, to prevent potential damage to the road surface or underlying tundra, heavier semi-tractor trailers and heavy equipment would be required to stay on the armored snow road. Semi-tractor trailers and all heavy equipment would be loaded on Steiger trailers at Drill Site 2P, transported over the conventional snow road, and offloaded either at Dogbone Lake or at the Merlin 2 well site. The modular drill rig would be broken down into 27 separate sections (each weighing up to 110,000 pounds) and transported, by Steigers, to the Merlin 2 well site.

Snow roads would be constructed and maintained using generally accepted practices for the North Slope and following BLM NPR-A IAP ROP C-2 (Appendix A) that requires soils to be frozen to a depth of 12 inches with a minimum of 6 inches of snow cover. Four thermistors were installed along the snow road in September 2021. Once operations begin, Emerald House would submit thermistor data to the BLM on a weekly basis.

Where sensitive tundra (tussock tundra, tussock shrub tundra, and willows) can't be avoided, additional snow cover or ice chips would be used to cover and protect tussock tundra and willows during snow road and ice pad construction.

To avoid accidents, the snow road would be built as straight as possible, avoiding sharp curves. Long sweeping curves would be constructed where a change in direction is needed. The maximum speed along both sections of the snow road would be 25 mph.

If bare (not snow covered) tundra is observed along the route, it would be avoided until snow and ice chips from surrounding grounded lakes (less than 4 feet in depth) could be collected and placed on the bare area to provide at least 6 inches of compacted snow cover. Tuckers would smooth the area and a half-loaded water truck would spray water on the site to provide additional armoring and protection of the area with ice.

Emerald House would work with the NSB to construct snow road crossings at established subsistence trails to provide a smooth and safe transition from tundra across the roadbed. In addition, established checkpoints would be avoided to minimize impacts to subsistence hunting and travel.

River and stream crossings could require ice bridges and/or the construction of snow ramps along the banks. Additional ice chip aggregate and/or water could be required at river and stream crossings (Refer to River and Stream Crossing Section 2.2.7). Ice aggregate and water would come from permitted lakes adjacent to the route.

Emerald House would provide the BLM with GIS shapefiles of the final constructed snow roads and ice pads after completion.

At the end of winter operations and after demobilization of all equipment and vehicles, snow berms would also be constructed across the entrance to the snow road to bar further use.

2.1.5 Conventional Snow Road

Approximately 73.5 miles of conventional snow road would be constructed between Ocean Point and Umiat in 2 different sections along the route (58 miles from Ocean Point to Dog Bone Lake, roughly 13 miles between Merlin 2 and Umiat, and 2.5 miles to access water source lakes) (Figure 2). Construction of the conventional snow road would begin when at least 6 inches of snow has accumulated (or been prepacked along the route), and soil temperatures have reached 23 degrees Fahrenheit or lower at a depth of 12 inches. Steigers would be used to compact snow along the route to a minimum of 6 inches deep and up to 35 feet wide. The road would then be groomed to create a flat, compacted surface and maintained throughout the winter season. Liquid water could also be sprayed onto the road to further armor the roadbed. The route would be maintained throughout the winter season by applying additional snow, as needed, and plowing to maintain a flat surface.

Rig mats (portable platforms used to support equipment) or other similar items may be used on or in the construction of snow roads at selected locations depending on field conditions during construction or during equipment moves. Rig mats would be removed prior to the end of the operating season.

2.1.6 Armored Snow Road

Approximately 16 miles of armored snow road would be constructed between Dog Bone Lake and the Merlin 2 drill site (this includes 6 miles of access to water source lakes). The armored snow road would be constructed so conventional (semi) tractor trailers could use the route without damaging the road or underlying tundra as well as to easily access water sources for drilling, testing, and support operations in all weather conditions. To prevent damage to the conventional snow road, semi-tractor trailers and heavy equipment would be transported on trailers to the armored snow road.

The armored snow road would first be constructed as a conventional snow route, but additional water and ice would be spread on one lane of the road to "armor" the route. Repeated passes over watered areas would only be done after the area is fully frozen. The armored lane would have approximately 6 inches of ice that would support the weight of semi-tractor trailers and heavy equipment. Steigers and Pisten Bullys would use the adjacent conventional snow road lane.

The route would be maintained throughout the winter season by applying additional water and ice aggregate, as needed, and plowing.

In the event that a semi-tractor trailer slides off the armored snow road, road maintenance equipment such as graders, loaders or Steigers would be used to pull or winch the tractor trailer back onto the road. If road maintenance equipment is not able to move the tractor trailer, 2 onsite 90-ton cranes would be used to lift the trailers back onto the armored snow road.

2.1.7 River Crossings

The routes would cross lakes, rivers, and streams on grounded ice whenever feasible. A table of major river crossings for the proposed routes are shown in Table 2.4 and Figure 3. Ice thickness at all crossings would be confirmed by hand drilling during route pioneering and verification. There may be areas, however, along the banks of rivers, streams, and lakes where snow or ice ramps would need to be constructed to protect the banks and provide safe travel over these areas. Snow and ice ramps would not exceed 4 percent grade to allow for safe transport of the drill rig components.

Table 2.4. Proposed river crossing locations.

Crossing Number	Umiat MTRS	Coordinates (NAD83)	Description	River	Anadromous Fish	Crossing Width (ft)	Maximum Depth (ft)
Crossing #1	T5NR1W S6	N69.815, W152.241	North Branch	Kikiakrorak River	Not Present/Not Surveyed	178	2
Crossing #2	T5NR2W S35	N69.748, W152.331	Middle Branch	Kikiakrorak River	Not Present/Not Surveyed	32	3
Crossing #3	T4NR2W, S22	N69.689, W152.356	South Branch	Kikiakrorak River	Not Present/Not Surveyed	172	3.1
Crossing #4	T3NR2W, S25	N69.6156, W152.0726	North Branch	Kogosukruk River	Not Present/Not Surveyed	191	1

Rivers and streams would also be crossed at areas with the least amount of willow cover. Snow would be used to protect willows at the crossing.

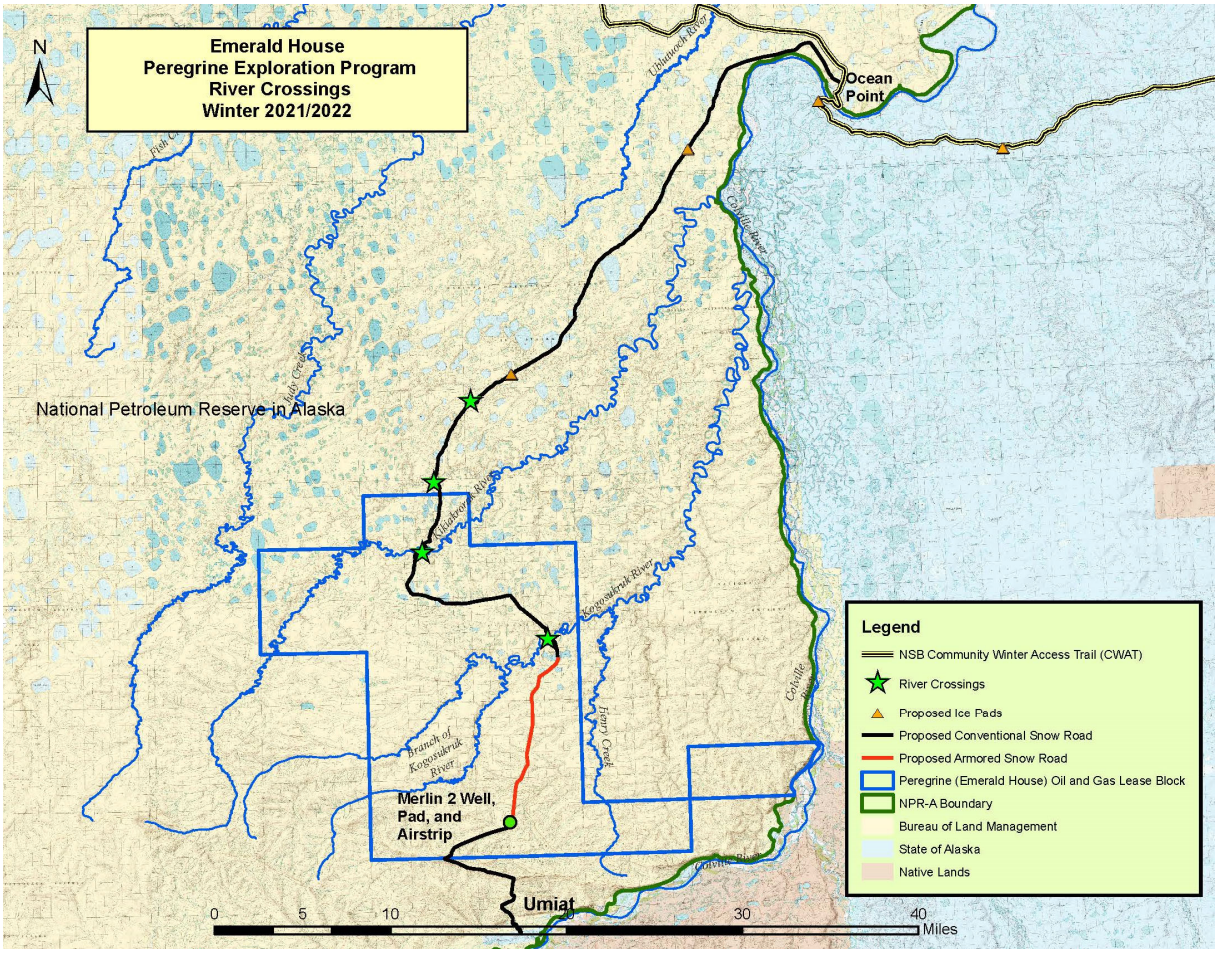

Figure 3. Major river crossings.

Upon completion of operations, the snow road stream crossings would be slotted at a minimum of two locations to facilitate water flow during spring break up, natural hydrological regimes, and reduce potential in-stream barriers to migrating fish during spring break up. Snow berms would also be constructed across the entrance to the snow road to bar further use.

2.1.8 Ice Pads

The Merlin 2 exploratory well would require the construction of a 6-acre ice pad (500 feet by 500 feet) to support oil and gas drilling and testing of the well. Support facilities on the Merlin 2 ice pad would include a safety station, Covid-19 quarantine rooms, satellite office, camp for drill rig operators, and storage of fuel and equipment.

Up to 5 additional 6-acre ice pads would also be required for the camp, equipment and materials, and support facilities. Support facilities on these pads would include housing units for equipment operators and other staff, generators, fuel storage, and light towers.

Each ice pad would be constructed by compacting snow and then adding ice and water to armor the pad. All ice pads would be constructed with no physical changes to surface topography and would meet federal, state and NSB regulatory requirements, industry standards and arctic oil field best practices.

All fuel storage tanks on the pads would be located at least 500 feet from lakes, rivers, and streams. Additionally, Emerald House would consult with Alaska Department of Fish and Game (ADFG) and U.S. Fish and Wildlife Service (USFWS) to help ensure ice pads are greater than one mile from known bear dens.

2.1.9 Cultural Resources and Historic Properties

Emerald House has completed consultation, surveys, and fieldwork to inventory prehistoric and historic archeological resources (sites) on and around the proposed ice pads and snow roads. Charles M. Mobley and Associates, Inc. (CMMA) completed archaeological field surveys in August and September 2020 and August and September 2021 to assess any known cultural resources, and to survey for and identify unknown sites.

As part of the survey, CMMA obtained and reviewed data from Alaska Heritage Resource Survey, the National Register of Historic Places, and NSB Inupiat Heritage and Language Center Traditional Land Use Inventory (TLUI). The BLM Arctic District Archaeologist received copies of the field work and research results, which will also be submitted to the NSB Planning and Community Services Department - Cultural Resources Office, ADNR/OHA State Historic Preservation Office (SHPO), and BLM State Archaeologist.

The surveys indicate that no cultural resources have been identified within 500 feet of the Merlin-2 drill pad and staging pads. One historic archaeological site (Umiat Test Well #9) was identified in 2020 as being within 500 feet of the originally planned snow road, approximately 80 feet south of the original snow road footprint. Therefore, beginning in the winter of 2020-2021, the proposed snow road was moved approximately 600 feet to the east and south to avoid impacts to the site, essentially creating a >500-foot buffer around the site where traffic would be excluded.

Any cultural resources (or suspected resources) that are discovered during project activities would not to be disturbed under any circumstance. This would include providing training to all field personnel on what to do as part of required project orientation.

If archaeological sites are discovered during field activities, the following steps would be taken:

1. Project personnel discovering historical or archaeological (or suspected) resources during operations would not disturb materials at the site of discovery and mark the area with flagging tape.
2. Project personnel would stop all activities and then inform their job supervisor who would contact Emerald House's Field Environmental Coordinator.
3. Emerald House would then report these properties to BLM, State Historic Preservation Office (SHPO), and NSB Inupiat History Language and Culture for identification and assessment.
4. Emerald House would use identification and assessment consultations to guide

further planned activities in the site area.

The proposed drilling location would be entirely within the NPR-A and within the boundaries of the NSB. Known traditional land use sites (e.g., cabins and campsites) would be avoided. The BLM does not authorize use of private property, and access across private lands would require authorization of the landowner.

Permanent surface disturbance resulting from the Peregrine Exploration Program would be limited to the new Merlin 2 well. For each well, disturbance would be limited to the well cellar, which is eight feet in diameter. All other program components would be temporary.

2.1.10 Camp

There would be 3 camps associated with operations (one at the Merlin 2 well pad and camps located on 2 of the staging ice pads). The Merlin 2 ice pad would house the camp for the drill rig operators while the camps on the two supporting ice pads would house equipment operators and other staff. The camps would include housing units, offices, restroom, kitchen, and recreation areas. The camps would also have generators, fuel storage, and waste management facilities.

Generators would provide power to the camps, offices, and other facilities. Satellite phone service and internet would be available at each field camp. Operational radio communications would use fixed base stations and truck-mounted radio equipment. Potable water may be transported to the staging ice pads and the Merlin 2 pad or provided on-site by Potable Water Treatment. Domestic wastewater would be hauled off site for proper disposal or treated with Wastewater Treatment Modules with an Alaska Department of Environmental Conservation certified plant operator.

Vehicle plug-ins for engine warming systems (e.g., block heaters and oil pan heaters) would be available at the camps and all staging pads. These would be available in bull rails in front of camps as well as on mobile heaters or light towers found on the pads.

2.1.11 Aircraft Use

Due to the current Covid-19 pandemic and for safe crew changes, a temporary airstrip would be constructed to accommodate fixed wing aircraft. Fixed wing flights would also be used to inspect the snow road. There would be approximately 2 round trip fixed wing flights per week from December 2021, through April 2022, totaling roughly 70 take offs and 70 landings. The temporary airstrip would be located next to the Merlin 2 drill pad and oriented NE/SW to take advantage of prevalent wind directions.

Since there are few lakes near the Merlin 2 drill pad, the airstrip would be constructed on tundra adjacent to the armored snow road and constructed the same way as the armored snow road. The airstrip would be approximately 50 feet wide, 3,500 feet long and at least 1 foot thick (a minimum 6 inches of compacted snow capped by a minimum 6 inches of ice) to accommodate an Otter and Pilatus N-12 fixed wing aircraft.

Black bags filled with snow would be placed along the sides of the berm to delineate the edge of the airstrip along with lighting and a windsock, as needed.

All aircraft take offs and landings would be recorded in an Aircraft Log that would be filled out electronically and sent to BLM. When use of the airstrip is no longer necessary, Emerald House would inspect the site, record conditions, and provide a report to the BLM (including a GPS file of the site).

2.1.12 Water Use

Approximately 13 million gallons of water and ice would be required for the 2021/2022 Peregrine Exploration Program. Table 2.5 shows the estimated water requirements for the proposed operations. Actual water use would be based on environmental conditions including snow cover, temperature, and maintenance needs, but water use would not exceed the amounts shown in Table 2.5 or permitted thresholds.

Table 2.5. Estimated Required Water Use by Activity.

Activity	**Proposed Water Use (Gallons)**
Ice ramps and snow road armoring	4,000,000
Fresh water and ice chips (combined use) for construction and maintenance of six ice pads	6,000,000
Drilling and testing the Merlin 2 well	2,000,000
Fresh water for the camp and operations	1,000,000
Total	13,000,000

Emerald House has temporary water use authorizations (TWUAs) from the ADNR DMLW for 23 lakes along the snow road. These lakes were permitted for use during the 2020/2021 winter Peregrine Exploration Program for snow road and ice pad construction and maintenance, and drilling and testing operations. For 2021/2022 winter exploration operations, Emerald House has requested TWUA applications to authorize the use of liquid water and ice chips from an additional six lakes located closer to the Merlin 2 well site. All lakes proposed for water withdrawal are shown on Table 2.6 and Figure 4. Water and ice chips from permitted lakes would be used for the construction and maintenance of ice ramps, snow road armoring, drilling operations, testing, and camp use.

For 2021/2022 winter exploration operations, Emerald House has requested a deviation from the 2020 NPR-A IAP ROP B-2 (Appendix A) for four proposed water source lakes. ROP B-2 limits liquid water and ice withdrawal quantities from lakes based on the presence or non-detection of fish species sensitive or non-sensitive to low concentrations of dissolved oxygen. However, fish surveys have not been conducted at these lakes, and these data are necessary to identify applicable thresholds identified in ROP B-2. Emerald House would assume that only non-sensitive fish are present because depths of these lakes are less than 7 feet. This deviation

would not apply to the remaining 25 proposed water source lakes because Emerald House would assume sensitive fish are present, so water and ice removal would be within the 2020 NPR-A IAP ROP B-2 allowable limits (Appendix A) (Table 2.6).

Table 2.6. Water and ice withdrawal requirements and requests by source.

Lake ID	Latitude (N) (NAD83)	Longitude (W) (NAD83)	Max Depth (feet)	Surface Area (acres)	Volume (Million Gallons)	Fish Species Present	15% of Water Under 7 ft of Ice (Million Gallons)	30% of Water Under 5 ft of Ice (Million Gallons)	Liquid Water Volume Request (Million Gallons)	Ice Aggregate Volume Request (Million Gallons)	BLM Lands (Y/N)	Requires BLM Deviation from ROP B-2?
P1	69.653	-152.409	29.7	100.0	348.7	Unknown; Assumed sensitive	22.1	0.0	22.1	0.0	Y	No
P2	69.521	-152.369	20.2	24.0	59.0	Unknown; Assumed sensitive	2.5	0.0	2.5	0.0	Y	No
P3	69.669	-152.375	5.4	82.2	104.2	Unknown; Assumed sensitive	0.0	0.0	0.0	0.4	Y	No
P5	69.766	-152.311	12.2	50.2	51.7	Unknown; Assumed sensitive	0.2	0.0	0.2	0.0	Y	No
P6	70.125	-151.440	5.5	343	323.1	Unknown; assumed Non-Sensitive	0.0	0.472	0.472	2.0	Y	Yes
P7	70.107	-151.576	7.8	217	296.3	Unknown; assumed sensitive	0.378	12.2	0.378	2.0	Y	No
P8	70.072	-151.648	6.6	482.0	482.0	Unknown; assumed Non-Sensitive	0.0	7.0	7.0	2.0	Y	Yes

Lake ID	Latitude (N) (NAD83)	Longitude (W) (NAD83)	Max Depth (feet)	Surface Area (acres)	Volume (Million Gallons)	Fish Species Present	15% of Water Under 7 ft of Ice (Million Gallons)	30% of Water Under 5 ft of Ice (Million Gallons)	Liquid Water Volume Request (Million Gallons)	Ice Aggregate Volume Request (Million Gallons)	BLM Lands (Y/N)	Requires BLM Deviation from ROP B-2?
P10	69.967	-151.834	5.6	332	244.4	Unknown; assumed Non-Sensitive	0.0	0.0	0.0	24	Y	No
P12	69.919	-151.901	7.5	937	1081.9	Unknown; assumed sensitive	0.2	25.9	0.2	16	Y	No
P13	69.863	-152.046	7.8	456	613.0	Unknown; assumed sensitive	0.7	26.2	0.7	1.0	Y	No
P15	69.797	-152.296	9.5	114	208.3	Unknown; assumed sensitive	4.1	19.2	4.1	10	Y	No
P18	69.771	-152.296	9.5	74	116.9	Unknown; assumed sensitive	1.2	8.0	1.2	10	Y	No
P19	69.726	-152.325	7.4	44	54.7	Unknown; assumed sensitive	0.0	1.3	0	1.3	Y	No
P20	69.495	-152.153	28.9	6.7	17.6	Unknown; assumed sensitive	0.8	2.6	0.8	0.0	Y	No

Lake ID	Latitude (N) (NAD83)	Longitude (W) (NAD83)	Max Depth (feet)	Surface Area (acres)	Volume (Million Gallons)	Fish Species Present	15% of Water Under 7 ft of Ice (Million Gallons)	30% of Water Under 5 ft of Ice (Million Gallons)	Liquid Water Volume Request (Million Gallons)	Ice Aggregate Volume Request (Million Gallons)	BLM Lands (Y/N)	Requires BLM Deviation from ROP B-2?
P21	69.604	-152.036	11.8	145.1	224.3	Unknown; assumed sensitive	1.5	12.7	1.5	0.0	Y	No
P22	69.587	-152.087	6.3	41.5	46.4	Unknown; assumed Non-Sensitive	0.0	0.6	0.6	0.0	Y	Yes
P23	69.588	-152.050	8.2	63.4	65.9	Unknown; assumed sensitive	0.0	0.4	0.0	2.8	Y	No
P24	69.601	-152.076	7.22	63.9	91.0	Unknown; assumed sensitive	0.0	4.5	0.0	3.4	Y	No
Dog Bone	69.601	-152.076	6.43	159.0	175.8	Unknown; assumed Non-Sensitive	0.0	1.6	1.6	0.0	Y	Yes
L9006	70.053	-150.637	6.2	299.7	329.2	Non-Sensitive	0.0	0.5	0.5	0.0	N	NA
L9005	70.046	-150.788	6.5	490.3	529.1	None	NA	NA	26.0	4.0	N	NA

Lake ID	Latitude (N) (NAD83)	Longitude (W) (NAD83)	Max Depth (feet)	Surface Area (acres)	Volume (Million Gallons)	Fish Species Present	15% of Water Under 7 ft of Ice (Million Gallons)	30% of Water Under 5 ft of Ice (Million Gallons)	Liquid Water Volume Request (Million Gallons)	Ice Aggregate Volume Request (Million Gallons)	BLM Lands (Y/N)	Requires BLM Deviation from ROP B-2?
M1418	70.011	-150.881	13.2	10.6	84.2	Non-Sensitive	NA	NA	0.5	1.4	N	NA
M1409	70.021	-151.017	6	98.9	110.2	Non-Sensitive	NA	NA	0.5	2.0	N	NA
M1411	70.031	-151.091	7.7	544.2	735.0	None	NA	NA	0.0	5.0	N	NA
M1412	70.010	-151.099	5.4	368.3	311.2	Non-Sensitive	NA	NA	0.0	2.0	N	NA
M1415	70.027	-151.197	6.6	209.6	244.7	Non-Sensitive	NA	NA	1.2	5.0	N	NA
A1947	70.057	-151.409	17.4	19.5	59.3	Sensitive	NA	NA	0.0	0.0	N	NA
A1929	69.995	-150.935	6.1	1,376.1	1,780.6	Non-Sensitive	NA	NA	11.0	4.0	N	NA

Lake ID	Latitude (N) (NAD83)	Longitude (W) (NAD83)	Max Depth (feet)	Surface Area (acres)	Volume (Million Gallons)	Fish Species Present	15% of Water Under 7 ft of Ice (Million Gallons)	30% of Water Under 5 ft of Ice (Million Gallons)	Liquid Water Volume Request (Million Gallons)	Ice Aggregate Volume Request (Million Gallons)	BLM Lands (Y/N)	Requires BLM Deviation from ROP B-2?
A1945	70.022	-151.316	7.8	61.4	96.9	None	NA	NA	7.0	2.0	N	NA

Non-sensitive species are those that are tolerant to low concentrations of dissolved oxygen (such as ninespine stickleback and Alaska blackfish).

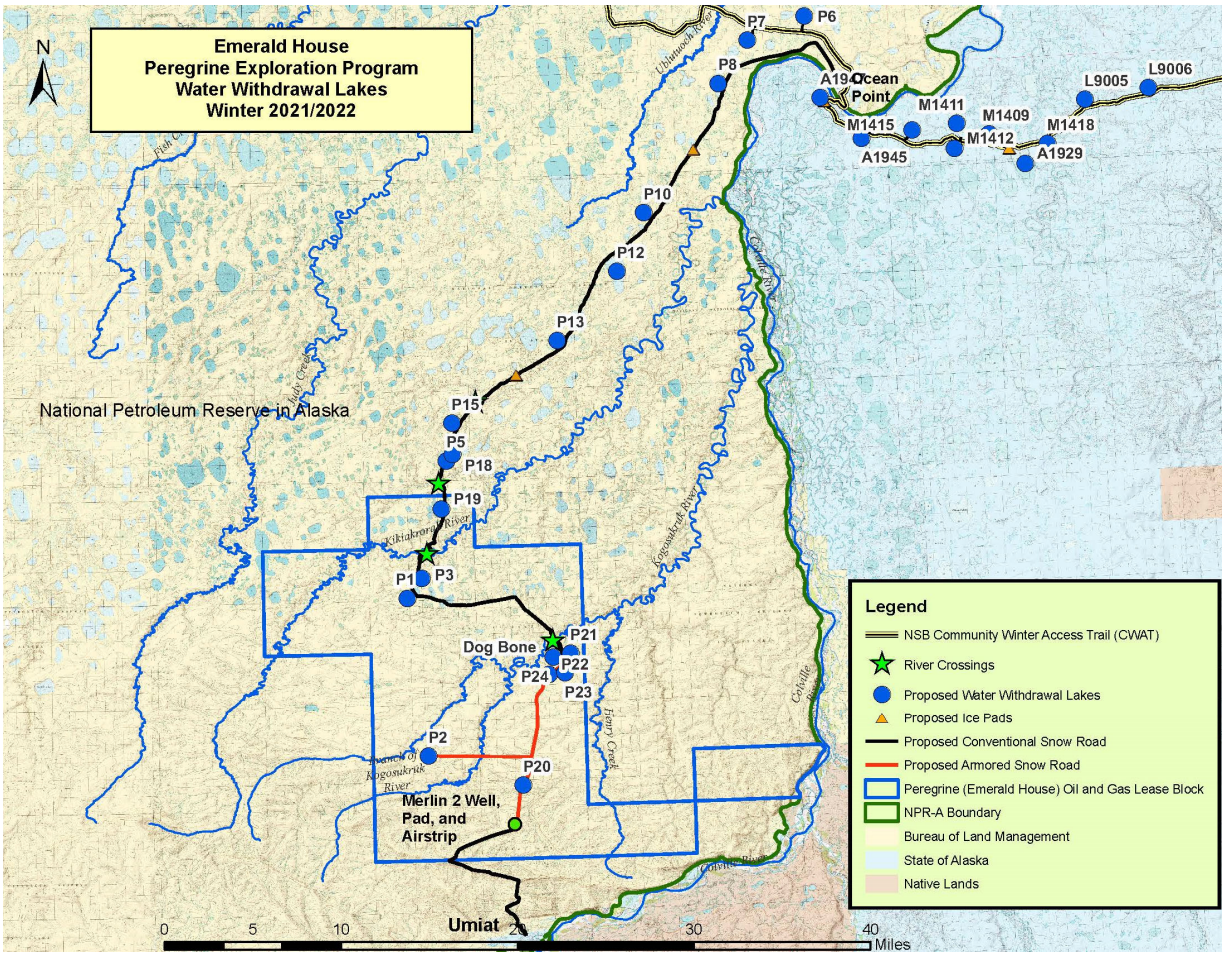

Figure 4. Lakes for potential water withdrawal.

Snow cover would be removed from grounded portions of the lakes that are less than four feet deep to provide room for water pump houses and access by water trucks. Water pumped from these lakes would be hauled in skid-mounted trailer tankers by Steigers, Pisten Bullys and by Volvo A45 Water Buffaloes (articulated water tankers on low ground pressure tires) during snow road construction. Any snow or ice proposed for removal from non-grounded portions of fish-bearing lakes would need to be approved by ADFG and BLM.

Water withdrawal from fish-bearing lakes would also be authorized under Fish Habitat Permits from ADFG. Emerald House is assuming all lakes are fish bearing; therefore, all water intake hoses in all lakes would have ADFG approved screens at the intake points to prevent fish entrapment.

Light plants would be placed next to lake pump houses and road intersections for safety and refueled following the Emerald House Oil Discharge Prevention and Contingency Plan (ODPCP) (approved by ADEC) procedures for fuel transfers. All light plants would have 110 percent fluid self-containment as well as located within additional secondary containment areas. Signs would be placed at lake access points to identify each permitted lake that is being actively used. Wheeled equipment would not be refueled on frozen lake surfaces.

Emerald House would maintain daily records and report weekly to BLM on the amount of water withdrawal. The BLM, ADFG, and ADNR would be notified within 48 hours if water removal exceeds approved volumes at any lake and/or observation of dead or injured fish.

2.1.13 Drilling, Well Testing and Well Plugging and Abandonment

Emerald House has submitted an Application for Permit to Drill (APD) to the Alaska BLM State Office and the Alaska Oil and Gas Conservation Commission to drill a vertical well to test the lower Nanushuk formation. Vertical seismic profiles (VSPs) would be taken at the well. The well bore design would be similar to the Merlin 1 well which evaluated the same formation in winter 2021 (USDOI BLM 2021). Due to the exploratory nature of the wells (and federal regulations), nearly all down-hole information is confidential.

Drilling operations would be conducted using the Arctic Fox modular land drill rig operated by Doyon Drilling Inc. The Arctic Fox is capable of being mobilized by all terrain tractor tundra vehicles such as Pisten Bullys and Steigers. The Arctic Fox drill would be broken down into 27 sections for overland transportation along the snow road. Once at the Merlin 2 drill ice pad, the rig would be placed on rig mats within a lined secondary containment area. Rig operations at the Merlin 2 pad would be self-contained and powered by drill rig generators.

Emerald House intends to gather well data including Measuring While Drilling, Parameters, Logging While Drilling Data, Wireline Logs, Sidewall and/or Conventional cores, VSPs, and check-shot information or Drill Stem Test data. Conventional well development and completion, including hydraulically fracturing specific target zones, may follow.

Production tests could be performed at the well, as needed, after production casing is set/cemented and the well is completed. Following completion, the well could be hydraulically stimulated to facilitate testing. After testing, the oil would either be injected into the same formation or transported offsite for processing and recycling at an approved facility. Produced gas would be flared.

Emerald House has developed and would maintain a well control plan for drilling that includes primary and secondary blowout prevention systems, a well capping program, and a relief well plan designed for arctic conditions.

Upon completion of drilling and extended production testing, data would be integrated into the Emerald House reservoir model. Upon completion of drilling and testing operations, the Merlin 2 well would either be plugged (closed) and abandoned or suspended in accordance with BLM and Alaska Oil and Gas Conservation Commission (AOGCC) regulations, and equipment and structures would be removed from the project area by the end of April 2022. If the well is plugged and abandoned, the well location would be surveyed, and surface and intermediate casing cemented back as directed by BLM and AOGCC. A certified BLM Petroleum Engineer Technician would be present to observe the procedure on BLM managed lands. Surface casing would be cut off 10 feet below ground surface, and a steel cap with the well name and unique identifying number would be welded on to it. The steel, self-sealing well cellar would be removed and the resulting 10-foot by 10-foot by 12-foot open excavation would be backfilled and mounded with gravel to account for soil subsidence and capped with organic-rich silt to

promote revegetation. The original guardrail, cellar, wellhead, and severed casing/tubing would be removed and transported out of the NPR-A. After photographically documenting the condition of the site, a marker plate would be welded to the top of the well.

2.1.14 Fuel and Chemicals

During operations, onsite fuel and hazardous substance storage capacity would total 29,940 gallons and would be stored in double-walled tanks within secondary containment areas. The expected fuel storage in support of the proposed project is provided in Table 2.7. These fluids would be hauled by commercial carrier to ice pads where they would be stored in multiple fuel containers (Table 2.7). All containers would be stored in bermed/lined secondary containment capable of holding 110 percent of the fluids stored, marked with product type, operator name, and affixed with HAZMAT classification labels. The total amount of fuel required for the winter operations would be approximately 643,320 gallons.

Table 2.7. Fuel Storage

Location	Number of Diesel Fuel Tanks	Quantity Per Tank (Gallons)	Total Amount Stored (Gallons)
Drill rig	1	6,400	6,400
Skid-mounted steel tanks	3	9,980	29,940
Totals	4	Not Applicable	36,340

An in-field fuel tanker truck or fuel sleigh would fuel the drill rig, camp, and ancillary equipment such as heaters, light plants, and heavy equipment. Refueling and fluid transfer would be performed by two trained operators and would follow the Emerald House fluid transfer methods in its ODPCP (approved by ADEC), North Slope Environmental Handbook, and Alaska Safety Handbook procedures. Emerald House enforces the use of "duck ponds" (drip pans) for all parked running or plugged-in vehicles and equipment. Spills of fuels, hydrocarbons, or chemicals on ice pads and snow roads would be cleaned up immediately.

Fuel storage of more than 1,320 gallons also requires that a Spill Prevention and Countermeasure Control (SPCC) Plan be developed and maintained on site. Each drilling contractor and well testing company maintains a SPCC Plan for fuel storage associated with its operations, as applicable. Emerald House also has a SPCC Plan Facility Response Plan for exploration activities. Emerald House and contractor personnel conducting fluids transfer would undergo training.

Above ground storage tanks used to store flammable and combustible liquids would comply with the *International Fire Code* and *13 AAC 50.025*. Fuel and hazardous substance storage would comply with all state and federal oil pollution prevention and contingency requirements found in *18 AAC 75*, *40 CFR 112* and *North Slope Borough Municipal Code §19.50* and *§19.70*.

A variety of commonly used water-based mud drilling fluids and additives would also be used to provide and maintain the correct drilling mud formulation for the conditions being drilled. Other drill fluid chemicals, required for testing and well stimulation, may also be used. The various additives would be provided in 5-gallon containers, 55-gallon drums or a variety of different sized (250-400 gallon) iso-containers that are regulated by the U.S. Department of

Transportation and/or Environmental Protection Agency (EPA) and would be stored within secondary containment. All fuel and drill fluid secondary containment areas would be inspected daily. All unused products would be returned to the supplier. All used fluids would be disposed of in accordance with Emerald House's Waste Management Plan and other applicable guidance documents and contract/ballot agreements.

Light plants would be placed next to pump houses and road intersections for safety and refueled daily. On-site generators would be refueled every 24 to 72 hours. All light plants and pump houses would have 110 percent containment for fuel.

2.1.15 Waste Management

Emerald House has prepared and submitted to BLM a project-specific, comprehensive Waste Management Plan and would implement it during operations to provide waste management guidance required by the ADEC pursuant to 18 AAC 60 and the 2020 NPR-A IAP ROPs. Emerald House adopted the latest versions of the Alaska Safety Handbook, the North Slope Environmental Field Handbook, and the Alaska Waste Disposal and Reuse Guide as guidance, reference, and as standard operating procedures for workplace safety and for environmental and waste management practices.

Implementation of the Waste Management Plan would help meet the following objectives:

- Minimize potential impacts on the environment from nonhazardous and hazardous waste generation.
- Encourage environmental improvement, especially recycling.
- Protect the health and safety of oil field workers, local communities, subsistence users, recreationists, and the general public.
- Avoid human-caused changes in wildlife populations while also minimizing the attraction of predators, particularly bears, to human use areas

Drilling wastes would not be discharged into lakes, streams, rivers, or wetlands and would be disposed of prior to completion of winter operations. Drill wastes would be properly stored until removed for disposal. Visual site inspections would be conducted following removal of the drilling waste to ensure all waste has been removed and photographs would be taken for reporting documentation. Emerald House has obtained the necessary agreements to use Class I and Class II waste injection facilities at the Hilcorp Alaska Greater Prudhoe Bay Unit and Hilcorp Alaska Milne Point Unit Waste Disposal Facilities, and at the Kuparuk River Unit Waste Injection Facility for disposal of drilling wastes by grinding and injection into Class I and II underground injection cell disposal wells

Up to 19,000 barrels of drill waste fluids may be generated at a rate of up to 1,000 barrels per day that would require temporary on-site handling and storage and offsite disposal. Drilling fluids (including muds) would either be loaded directly into 168-barrel Arctic Cutting Boxes and hauled by all terrain tundra tractors (Pisten Bullys or Steigers) as soon as possible for disposal (preferred) or would be temporarily stored at the Merlin 2 drill pad in a 288-barrel cuttings bin or 400-barrel steel tank within secondary containment.

Solid, non-burnable waste would be deposited in large dumpsters located at each site. These containers would be backhauled to the NSB landfill at Prudhoe Bay daily. Any food waste that could attract wildlife would be stored in secured wildlife proof containers while waiting transport. Domestic wastewater (including human waste) would average 5,000 gallons per day from envirovacs (restroom facilities) and camps. These wastes would be treated on site and disposed, or hauled offsite, treated, and disposed in the permitted Kuparuk River Unit or NSB Deadhorse Service Area 10 disposal facilities.

2.1.16 Community Relations

As part of the permitting process, Emerald House has published public notices in Utqiagvik, Fairbanks and Anchorage, detailing planned winter drilling operations and has been responding to requests for additional information from individuals and government entities as well as non-government organizations interested in the 2021/2022 Peregrine Exploration Program. Emerald House would continue its partnership with local contractors and businesses through competitive bid contracting opportunities.

Due to Covid-19, Emerald House meetings have been and will continue to be limited to teleconferences and phone calls. Emerald House met with NSB Planning and Kuukpik Subsistence Oversight Panel and will submit its subsistence plan and plan of operations to entities in Nuiqsut. Emerald House has discussed the proposed project with the NSB, local villages, and affected publics to help identify and implement measures to minimize adverse effects on fish and wildlife for commercial and subsistence uses, and to ensure that operations have no negative effect on the quality of life for Alaskans.

Additional project meetings, consultations, and updates would be held, as necessary, with the NSB Planning and Community Services Department and with stakeholders in Nuiqsut. These discussions would help with the development of a plan of cooperation regarding Emerald House operations on the North Slope. Emerald House would work with all concerned stakeholders to maintain efficient and effective communications with the affected communities for the duration of the project.

Subsistence trails are an integral part of travel within the NSB. Travel for subsistence harvest is normally by snow machine and subsistence trails would likely cross the snow road during subsistence harvest and trapping. Emerald House would construct snow road crossings at established subsistence trails to provide a smooth, easy, and safe transition for snow machines from tundra across the roadbed and the subsistence trail crossings would be marked with road signs and delineators. In addition, established checkpoints would be avoided to minimize impacts to subsistence hunting and travel. Emerald House would not restrict traditional and customary subsistence access to and harvesting in the proposed project area, except for a 100-foot safety zone around each ice pad. Public access to the ice pads would be restricted due to safety concerns, however, Emerald House would provide shelter and assistance to subsistence users in emergency situations.

Emerald House understands subsistence is a way of life for Nuiqsut residents and it is important to protect subsistence resources, uses, and access. Emerald House also understands that due to the high costs of goods, fuel, and transportation, subsistence harvests reduce food costs and, more

importantly, provides cultural identity and spirit. Due to concerns regarding subsistence harvests, Emerald House would the start winter operations during the colder and darker part of winter 2022 when limited subsistence activities takes place and is generally limited to trapping and hunting moose and/or caribou further south, past Umiat.

Emerald House would designate a single Point of Contact for monitoring and resolving NPR-A subsistence-related issues. The Emerald House Health, Safety, and Environmental Manager would be the Point of Contact for the 2021/2022 exploration season. This position would be the primary contact for communication and would work to assist in resolution of subsistence/industry conflicts. In addition, the Emerald House Point of Contact would be responsible to provide information to Nuiqsut residents regarding Emerald House winter operational activities, as requested, and act as a focal point for Nuiqsut residents to learn about, comment on, or expresses concerns with Emerald House NPR-A activities.

Emerald House is contacting Umiaq Environmental LLC and Arctic Slope Regional Corporation Energy Services to discuss subsistence representatives during the winter drilling program.

2.1.17 Winter Cleanup and Inspections

Spills of fuels, hydrocarbons, or chemicals on ice pads and snow roads would be cleaned up immediately, and to the satisfaction of the BLM Authorized Officer, ADNR, ADEC, and NSB to prevent damage to the underlying lakes and tundra.

Snowmelt and other run-off from the ice pads would be managed through implementation of Emerald House Best Management Practices pursuant to the Alaska Pollutant Discharge Elimination System Alaska Pollutant Discharge Elimination System general permit for North Slope activities (AKG32000). Emerald House Best Management Practices consist of:

- Positioning the drill rig and camps relative to wind directions to reduce the amount and number of times snow needs to be removed after a storm event.
- Piling snow on the down gradient edge of pads.
- Inspecting and removing foreign objects and debris from the ice pads.
- Inspecting and removing debris from snow piles after each snow removal/loading.
- Immediately cleaning up all spills of drill materials to avoid scraping and loading on to snow piles.

In response to a major blowout, Emerald House would follow response tactics and procedures presented in the Emerald House ODPCP. Alaska Clean Seas would supply a Senior Emergency Response Technician (ERT) to manage spill response and cleanup. The Alaska Clean Seas Senior ERT would be supported by a dedicated Emerald House Field Environmental Coordinator.

At the end of the winter operations season and after demobilization of all equipment and facilities, each ice pad would be bladed by a grader to remove dark-colored drips that had been missed. The ice spoils (ice bladed/scrapped/removed from the top ½ inch surface of the ice pad)

would be thawed and the resulting oily water disposed of at a permitted disposal facility. Trash and debris would be removed and transported for disposal at the NSB service area in Deadhorse.

Additionally, Emerald House would inspect and remove any trash and debris from the snow roads and ice pads.

If tundra damage is discovered, Emerald House would notify the BLM Authorized Officer within 72 hours, and then consult with the BLM, State of Alaska, and the NSB to determine the appropriate methods for restoration and incorporate them into a Tundra Damage Rehabilitation/Remediation Plan that meets requirements found in North Slope Borough Municipal Code § 19.30, 19.500 and § 19.60, BLM lease conditions, and specific state requirements. The Tundra Damage Rehabilitation/Remediation Plan would address the area, type, and extent of damage and would, at a minimum, be developed in accordance with the Alaska Coastal Revegetation and Erosion Control Guide (developed by the ADNR Plant Materials Center), the Streambank Revegetation and Protection Guide (developed by the Alaska Department of Fish and Game), and other relevant BLM guidance documents.

2.1.18 Summer Activities

All snow roads, ice pads, work areas, drill site, and camp locations would be inspected during the summer (July 2022) to ensure no debris or materials had been left on the landscape after winter exploration activities. The snow roads, pads, and work areas would be flown with a helicopter at low elevation (<15 feet) at approximately 40 knots to survey for debris. If debris is located, the helicopter would land, and all materials would be removed from the site. The helicopter would also be used to access ice pads, drill site, work areas, and camp locations for ground inspections and to remove any remaining debris from these areas. Approximately 70 takeoffs and 70 landings would be expected for the 2022 summer activities.

All sites would also be inspected for tundra damage. If damage to the tundra is observed, Emerald House would notify the BLM within 72 hours and consult with the BLM and NSB to determine the appropriate methods for restorations.

Human waste may be generated during cleanup activities when personnel are away from lavatory facilities. The deposition of materials would be infrequent and widely distributed geographically. Any paper or sanitary waste would be bagged, removed from site, and disposed of at Alpine Central Facilities. Care would be taken to avoid negative impacts to waterbodies or plants.

2.1.19 Polar Bear Mitigation

Approximately 3 miles of the snow road would be constructed within polar bear denning habitat that occurs within the Geographic Region of the U.S. Fish and Wildlife Service (USFWS) Incidental Take Regulations for polar bears. For this reason, Emerald House consulted with the USFWS, and several mitigation measures were identified to minimize potential impacts to polar bear. Emerald House would conduct aerial infrared (AIR) and weekly handheld Forward Looking Infrared (FLIR) polar bear den detection surveys. Three aerial infrared surveys would be conducted between December 2021 and January 2022. On the ground field surveys would be conducted to identify potential denning habitat within the project area by using a handheld

thermal camera on a weekly basis around drifted snow adjacent to certain topographical features (i.e., bluffs, riverbanks, and lake edges) which are conducive to habitat selected by polar bears for denning.

Imagery from AIR and thermal imagery cameras would be used to detect the presence of heat signatures, resulting from escaping animal body heat, and identify the location of maternal polar bear dens. Other measures Emerald House would implement include:

- Reroute traffic to create a 1-mile exclusion zone around any dens found and cessation of nearby activities.
- Continuous monitoring of any bear dens found and limiting travel.
- Provide U.S. Geologic Survey denning habitat maps to field crews for awareness prior to field activities.
- Store food inside buildings or containers that minimize odors.
- Store hazardous materials in drums or other secure containers.
- Position structures to maximize visibility and minimize potential areas that a bear could crawl into or otherwise be hidden from view.
- Instruct project personnel not to feed wildlife of any type.

2.1.20 Required Plans

The 2020 NPR-A IAP ROD requires a company conducting oil and gas activities in the NPR-A to have certain plans, including some that are required to be approved by the BLM authorized officer. Emerald House has submitted the following plans as part of its Plan of Operations.

Waste Management Plan
Invasive Species Prevention Plan
Bloodborne Pathogens Plan
Hazardous Waste Prevention Plan
Wildlife Avoidance and Interaction Plan
Subsistence Plan
Oil Discharge Prevention and Contingency Plan
Orientation Plan
Aircraft Use Plan
Polar Bear Avoidance and Interaction Plan and Polar Bear Consultation with USFWS
Medical Emergency Response Plan

2.2 Air Emissions

Emissions sources for the construction, drilling, and operations would be similar to other exploration drilling projects on the North Slope. Sources of air emissions would include rig engines, camp generators, mobile non-road engines, construction equipment, oil burners, hot-air heaters, light plants, boilers, and potentially well test flaring equipment. Therefore, Emerald House has applied for ADEC authorization for the exploration location under the *Minor General Permit #1 for Oil and Gas Drilling Rigs (18 AAC 50.390*).

Vehicle plug-ins for engine warming systems (e.g., block heaters and oil pan heaters) would be available at the camps and all staging pads. These would be available in bull rails in front of camps as well as on mobile heaters or light towers found on the pads. When the ambient temperature is warmer than –40 degrees Fahrenheit, Emerald House requires vehicles that would not be used for extended periods be turned off and plugged in. These standard practices would help reduce air emissions and protect human health.

In accordance with 40 CFR 1502.20 and 43 CFR 46.140, the air quality analysis for this EA is tiered off the NPR-A Integrated Activity Plan Environmental Impact Statement (USDOI BLM 2020a). This analysis looked at direct, indirect, and cumulative impacts of the air emissions considered in this EA, together with other past, present, and reasonably foreseeable future actions. The near-field impact assessment was conducted using the EPA regulatory air dispersion model AERMOD, the far-field (regional) impact assessment was conducted using the Comprehensive Air Quality Model with Extensions, and Hazardous Air Pollutants emission impacts were all below the respective Reference Exposure Level and Reference Concentrations. The impacts of Greenhouse Gas emissions from future oil and gas development in the NPR-A on climate change was also analyzed. The conditions and environmental effects described in the NPR-A IAP EIS are still valid.

2.3 Climate Change

Climate change is a global process that is affected by greenhouse gases (GHGs) in the earth's atmosphere. Climate change is expected to be most dramatic in the Arctic, with rates of warming nearly twice that experienced globally (ACIA 2005, Wendler et al. 2014). The effects of these global trends are complicated, but forecasts point to dramatic declines in the extent and thickness of sea-ice cover in the Arctic. Increased air and sea temperatures, longer periods of open water with an earlier onset of melting and later onset of freeze-up, increased rain-on-snow events, warm water intrusion, and changing atmospheric wind patterns are contributing to overall reduction and changes in sea ice (Kovacs et al. 2011, Chapin et al. 2014, Stroeve et al. 2014, Joint Secretariat 2015).

There is also a potential for climate-induced changes on the availability of wetlands and an increase in coastal erosion rates (Mars and Houseknecht 2007; Walsh et al. 2005), changing precipitation patterns, longer growing seasons, drying of tundra (Martin et al. 2009, Post et al. 2009), shrinking lakes (Hinzman et al. 2005), and increasing shrubs (Sturm et al. 2001).

The Proposed Action would lead to emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), the three most common greenhouse gases associated with oil and gas development. For the purposes of this discussion, the BLM has evaluated the potential effects of the Proposed Action on climate change by estimating and analyzing potential GHG emissions based on past oil and gas development and available information from existing development within the state.

Additional discussion of climate change science and predicted impacts as well as the reasonably foreseeable and cumulative GHG emissions associated with BLM's oil and gas leasing actions are included in the *BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends (2020)* (Annual GHG Report) (USDOI BLM 2020c). This report presents the estimated

emissions of greenhouse gases attributable to fossil fuels produced on lands and mineral estate managed by the BLM. The Annual GHG Report is incorporated by reference as an integral part of the analysis for the Proposed Action and is available at https://www.blm.gov/content/ghg/.

The incremental contribution to global GHGs from a single proposed land management action cannot be accurately translated into its potential effect on global climate change or any localized effects in the area specific to the action. Currently, global climate models are unable to forecast local or regional effects on resources. However, there are general projections regarding potential impacts on natural resources and plant and animal species that may be attributed to climate change from GHG emissions over time. GHGs influence the global climate by increasing the amount of solar energy retained by land, waterbodies, and the atmosphere. GHGs can have long atmospheric lifetimes, which allows them to become well mixed and uniformly distributed over the entirety of the earth's surface no matter their point of origin. Therefore, potential emissions from the Proposed Action can be compared to state, national, and global GHG emission totals to provide context of their significance and potential contribution to climate change impacts.

Table 2.8 shows the total estimated GHG emissions from fossil fuels at the global and national scales over a five-year period (2015-2019). Emissions are shown in megatonnes (Mt) per year of carbon dioxide equivalent (CO_{2e}). Chapter 3 of the Annual GHG Report contains additional information on greenhouse gases and an explanation of CO_{2e}. Table 2.9 shows GHG emissions data from the largest greenhouse gas emitting facilities as reported to the U.S. Environmental Protection Agency (EPA) through its Greenhouse Gas Reporting Program (GHGRP) for Alaska. Table 2.9 also shows energy-related CO_2 emissions reported by the U.S. Energy Information Administration (EIA) in its annual State Energy-Related Carbon Dioxide Emissions Tables (USEIA 2021). State energy-related CO_2 emissions include emissions from fossil fuel use across all sectors (residential, commercial, industrial, transportation, and electricity generation) and are released at the location where the fossil fuels are consumed.

Additional information on current state, national, and global GHG emissions as well as the methodology and parameters for estimating emissions from BLM fossil fuel authorizations and cumulative GHG emissions is included in the Annual GHG Report (Chapters 4, 5, and 6) (USDOI BLM 2020c).

Table 2.8. Global and U.S. GHG Emissions 2015 - 2019 Megatonnes (Mt) CO_{2e}/year

Scale	2015 (Mt)	2016 (Mt)	2017 (Mt)	2018 (Mt)	2019 (Mt)
Global	52,700	52,800	53,500	55,300	59,100
U.S.	5,249	5,153	5,083	5,244	5,107

Source: Annual GHG Report, Chap. 6, Table 6-1. Mt (megatonne) = 1 million metric tons.

Table 2.9. EPA Large GHG Emissions

State	**Total Reported (**Mt CO_2/yr)	**Power Plants** (Mt CO_2/yr)	**Petroleum and Natural Gas Systems** (Mt CO_2/yr)	**EIA Energy-related CO_2 Emissions (Mt/yr)**
Alaska	14.4	3.1	8.5	35.2

Sources: Annual GHG Report (2020), Chap. 6, Table 6-3; Energy Information Administration

The continued increase of anthropogenic GHG emissions over the past 60 years has contributed to global climate change impacts. A discussion of past, current, and projected future climate change impacts is described in Chapters 8 and 9 of the Annual GHG Report (USDOI BLM 2020c). These chapters describe currently observed climate impacts globally, nationally, and in each state, and present a range of projected impact scenarios depending on future GHG emission levels. These chapters are incorporated by reference in this analysis.

Utilizing the BLM Lease Sale Emissions Tool, we can estimate the amount of GHGs (CO_2) that would be produced from the construction of a single well in Alaska. This tool uses emissions factors developed by incorporating historical development and production plans and activities throughout the state. Using the BLM Lease Sale Emissions Tool, the estimated GHG emissions associated with the Proposed Action would be approximately 438.3 metric tons of CO_{2e}.

Potential emissions from the proposed oil and gas exploration were compared to past exploration activities that generate GHG emissions as well as to emissions at the state and national scales. The EPA GHG equivalency calculator was used (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator) to express the potential average yearly GHG emissions on a scale relatable to everyday life. The projected GHG emissions from the proposed exploration activities would be equivalent to 95.3 gasoline-fueled passenger vehicles driven for one year, or the emissions that could be avoided by operating 0.091 wind turbines as an alternative energy source or offset by the carbon sequestration of 537 acres of forest land.

Compared to emissions from other existing and foreseeable federal oil and gas development, the emissions for the Proposed Action would be 0.000008 percent of the energy related emissions nationally and 0.0012 percent of energy related emission in the state.

In summary, potential GHG emissions from the Proposed Action could result in GHG emissions of 438.3 metric tons over the life of the Proposed Action.

Monetized Impacts from GHG Emissions

The "social cost of carbon", "social cost of nitrous oxide", and "social cost of methane" are considered the "social cost of greenhouse gases" (SC-GHG) and are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year.

On January 20, 2021, President Biden issued EO 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. Section 1 of EO 13990

establishes an Administration policy to, among other things, listen to the science; improve public health and protect our environment; ensure access to clean air and water; reduce greenhouse gas emissions; and bolster resilience to the impacts of climate change. Section 2 of the EO calls for federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the EO and to take appropriate action.

Consistent with EO 13990, the CEQ rescinded its 2019 "Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions" and has begun to review its "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews" issued on August 5, 2016 (2016 GHG Guidance). While CEQ works on updated guidance, it has instructed agencies to consider and use all tools and resources available to them in assessing GHG emissions and climate change effects including the 2016 GHG Guidance.

Regarding the use of "*Social Cost of Carbon*" or other monetized costs and benefits of GHGs, the 2016 GHG Guidance (https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf) noted that NEPA does not require monetizing costs and benefits. It also noted that "the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations."

Section 5 of EO 13990 emphasized how important it is for federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and established an Interagency Working Group on the Social Cost of Greenhouse Gases. In February 2021, the IWG published the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under Executive Order 13990* (IWG 2021). This is an interim report that updated previous guidance from 2016. The final report is expected in January 2022.

For federal agencies, the best currently available information of the SC-GHG are the interim estimates of the social cost of carbon dioxide (SC-CO2), methane (SC-CH4), and nitrous oxide (SC-N2O) developed by the Interagency Working Group (IWG). Select estimates are published in the Technical Support Document (IWG 2021) and the complete set of annual estimates are available on the Office of Management and Budget's website (https://www.whitehouse.gov/omb/information-regulatory-affairs/regulatory-matters/#scghgs)

The IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021).

As expected with such a complex model, there are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3 percent annual discount rate for future economic effects. This is a low probability, but high damage scenario, represents an upper bound of damages within the 3 percent discount rate model.

In accordance with the IWG direction and recommendations, the monetary value of changes in GHG emissions were estimated for the Proposed Action. The analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with the Proposed Action. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this EA. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.

The SC-GHGs associated with estimated emissions from the Proposed Action are shown in Table 2.10. These estimates represent the present value (from the perspective of 2021) of future market and nonmarket costs associated with CO2, CH4, and N2O emissions. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and BLM's estimates of emissions in each year. They are rounded to the nearest $1,000. The estimates assume development would start in 2021 and end-use emissions complete in 2022.

Table 2.10. Social Cost of Greenhouse Gases Associated with Future Potential Development (from 2021).

Activity	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Development and Operations	$6,000	$23,000	$34,000	$68,000

2.4 BLM Project Specific Required Operating Procedures

In addition to the description of the Proposed Action, relevant 2013 Lease Stipulations and Required Operating Procedures (ROPs) from the 2020 Integrated Activity Plan Record of Decision (USDOI BLM 2020b) found in Appendix A, the following project specific required operating procedures would also be required to provide additional protections to social and environmental resources. These project specific ROPs would only apply to federal lands within the project area.

1. Emerald House will provide the BLM Arctic District Office with a weekly activities' summary report. This report shall include all required information identified below. The report shall be delivered in digital format every Monday to blm_ak_arctic_permitting@blm.gov through the applicable season(s) for the life of this project.
2. Emerald House will provide BLM with a map, GPS tracks of flights, and the takeoff/landing locations at the conclusion of the activity (by November 1, each year).
3. Emerald House will maintain an aircraft log of the following information for each take-off and landing (which shall be turned in to BLM in electronic format in an excel spreadsheet with each item below listed in a separate column No Later Than 30 days after field activity is completed):

   Type of Aircraft
   Aircraft N number
   Date
   Time
   Decimal Degree Format – latitude of takeoff location
   Decimal Degree Format – longitude of takeoff location
   Date
   Time
   Decimal Degree Format – latitude of landing location
   Decimal Degree Format – longitude of landing location
4. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds and humans. Such markings shall be developed through consultation with the BLM.
5. Emerald House and its designees will cooperate with the U.S. Fish and Wildlife Service (USFWS) and other federal, state, or local agencies designated to represent the USFWS to monitor impacts of project activities on polar bears. For example, Emerald House and its designees will allow USFWS personnel access to the activity site upon request.
6. All field crews will follow the Emerald House Wildlife Interaction Plan detailing how crews will manage wildlife attractants (food and non-food materials) and respond to human-polar bear interactions. This interaction plan will include all guidelines for safely and non-lethally deterring polar bears from damaging

property and endangering the public as found in the Final Rule of the Marine Mammal Protection Act (MMPA) Deterrence Guidelines. Other methods of deterring polar bears require authorization by the USFWS Marine Mammals Management (MMM) office.

7. If a polar bear interaction escalates into a life-threatening situation, section 101(c) of the MMPA allows, without specific authorization, persons to take (including lethal take) a polar bear. Any injury or lethal take of a polar bear must be reported to the USFWS (907-786-3844) and BLM within 48 hours.
8. A polar bear den detection survey must be conducted each year prior to activities occurring in polar bear denning habitat during the maternal denning period (November to mid-April). All personnel must use caution when operating near polar bear denning habitat during the denning period.
9. Each year, at least 90 days prior to the start of each year's winter activity, Emerald House will notify the BLM of its plans for the season on BLM managed lands. After the requested information is received, BLM will determine if consultation with the USFWS is required.
10. Due to expected increase in use of the Ocean Point crossing in the winter 2024/25, Emerald House will be required to submit a letter of non-objection, from the North Slope Borough and ConocoPhillips to overlap and use part of their existing ROWs in connection with this project.
11. Immediately cease pumping and contact the BLM and ADFG if water removal exceeds the volume approved at any lake.
12. As part of the weekly reports, Emerald House will provide photos of all stream crossings and include name/identifier and geographic coordinates (latitude/longitude) as well as how the crossing was constructed.
13. Any structures left above ground at the conclusion of the exploration project shall be covered in plastic to discourage use by ravens and other birds in accordance with applicable BLM and Alaska Oil and Gas Conservation Commission regulations.
14. Emerald House will submit information to BLM about any summer activities prior to April 6 each year in order to have its activities covered under BLM's ESA summer programmatic consultation.
15. After the completion of 2021/2022 winter operations, Emerald House will conduct fish surveys in lakes P6, P8, P22, and Dog Bone Lake to determine if sensitive fish species are present. Fish sampling methods will include short duration and closely attended gill nets, minnow traps, seines, and visual surveys. Fish survey data and any associated habitat or water quality data will be submitted to the BLM by October 31, 2022.
16. If Emerald House requests liquid water to be withdrawn from lakes with maximum depths between 5 and 7 feet for the remainder of the authorization and Right-of-Way, proposed water source lakes will be surveyed for fish presence using the same methodologies as identified in #15 above. Fish survey data and any associated habitat or water quality data will be submitted in conjunction with proposed Plan of Operations to

evaluate whether the objective and requirements identified by the 2020 NPR-A Record of Decision Required Operating Procedure B-2 will be met.

2.5 Possible Future Action

Exploration drilling is necessary to verify the presence of oil, but drilling may not result in discovery of potentially producible oil or gas resources. If a discovery is made, it may take years to conduct required studies and to develop design proposals before the project is ready to submit for development approval to the BLM and other agencies. Each phase of the decision-making process would require additional, site-specific environmental review and potential mitigation, as well as additional environmental protection measures.

2.6 Alternatives

The 2020 NPR-A IAP ROPs, 2013 NPR-A IAP stipulations, and project specific ROPs for the proposed project provide substantial control over the Proposed Action. The 2020 NPR-A IAP EIS evaluated various exploration and development related alternatives. As a result, the 2020 NPR-A IAP ROD includes decisions and ROPs that limit the potential range of exploration program alternatives. This EA is tiered to the broader alternatives analyzed in the NPR-A IAP EIS and more specific alternatives evaluated in subsequent EAs, which are incorporated by reference (Appendix C). Since the potential exploration well must be located where geophysical data would most likely delineate the oil and gas reservoir, variations or alternatives to the exploratory well site location would not be practicable or economically feasible.

A BLM oil and gas lease allows a lease holder the exclusive right to drill for, extract, remove, and dispose of all the oil and gas from the location described on the lease. Restricting environmentally compliant exploration on existing valid leases in the NPR-A is counter to recommendations of the National Energy Policy and the Naval Petroleum Reserve Production Act, as amended of 1976. The 2001 National Energy Policy specifically addresses the need to promote exploration and development of domestic resources, including the NPR-A and recommended that the President direct the Secretary of the Interior to examine impediments to leasing and consider additional development (2001 National Energy Policy).

2.6.1 Previously proposed alternative actions

As shown in Appendix C, the BLM has analyzed many years of winter exploration projects. Within the analyses, various alternatives have been discussed and eliminated from detail. In the 2000 winter exploration EA, alternatives considered but eliminated included: airlifting equipment (rejected due to cost and community concerns with aircraft) and an alternative Colville River crossing (rejected due to the need to avoid potential impacts to fish, habitat, and lease requirements). In the 2001 winter exploration EA, an alternative considered but eliminated included authorizing the applicant to drill at fewer sites or drill fewer wells than applied for, or fewer wells per year over a more extended time period. This alternative was rejected as the extent of any commercial oil and gas prospects on the leases cannot be determined if the applicant is not allowed to drill the minimum number of wells needed to define prospective oil and gas deposits. Additionally, the enormous costs of exploration dictate

that a reasonable operator would not drill unnecessary wells to meet the needs of its exploration program.

In the 2007 winter exploration EA, an alternative considered constructing a water supply system to eliminate water withdrawal from multiple fish-bearing lakes. This alternative was eliminated because it did not meet the purpose and need and was technically infeasible or unreliable.

2.7 Conformance

The Proposed Action is in conformance with the 2020 NPR-A IAP EIS (USDOI BLM 2020a) and associated ROD (USDOI BLM 2020b), the Naval Petroleum Reserves Production Act of 1976, as amended, Federal Land Policy Management Act, Alaska National Interest Lands Conservation Act, Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), Executive Orders 11988, and 11990.

In the 2020 NPR-A IAP EIS (USDOI BLM 2020a), the BLM evaluated intensity of impacts including reasonably foreseeable impacts of winter exploration and access in the NPR-A. This analysis concluded that the stipulations and ROPs provided adequate protection for surface resources and subsistence activities in the planning area.

The BLM considered site-specific evaluations of winter exploration programs in and around the proposed project area over previous years, all of which received a Finding of No Significant Impact or a Finding of No New Significant Impact by the BLM. Findings for these winter programs included analysis of Threatened and Endangered Species, Essential Fish Habitat, and Subsistence under ANILCA 810, as well as coordination with the State Historic Preservation Office. In addition to BLM permits, other required federal, state, and local authorizations were issued.

Chapter 3 Affected Environment and Environmental Consequences

3.0 Introduction

This chapter provides an overview of the resources that could be potentially affected by the activities described in Chapter 2 and identified in Table 1.1. Five resources were identified as Potentially Impacted (environmental justice, sociocultural systems, subsistence, fish, and vegetation) resulting 3 Issue Statements:

Issue 1 – *How would winter exploration and associated activities (including summer inspections and cleanup activities) impact subsistence users and local communities?*

Issue 2 - *How would winter exploration and use of snow roads and pads impact vegetation?*

Issue 3 - *How would winter exploration and water withdrawal from source lakes to construct snow roads and pads impact fish?*

The affected environment and environmental consequences for each Issue Statement will be described and analyzed in this Chapter.

Chapter 3 also takes into consideration the No Action Alternative. The No Action Alternative would reject the Proposed Action and deny authorization of access and exploratory drilling. The existing condition (baseline conditions) would be the same for the No Action Alternative as the Proposed Action.

3.1 Past, Present, and Reasonably Foreseeable Activities

Table 3.1 identifies past, present, and reasonably foreseeable projects that will be considered when analyzing how these activities, along with the Proposed Action, could impact resources in the project area. Reasonably foreseeable activities are those actions for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trend. The 2020 NPR-A IAP EIS (USDOI BLM 2020a), which this EA is tiered to, discusses, and analyzes reasonably foreseeable development scenarios in the NPR-A.

The projects and activities shown in Table 3.1 will be taken into consideration as part of the existing condition as well as the environmental impacts described throughout the rest of this chapter. These projects are also shown in Figure 5.

Table 3.1. Winter 2021/2022 North Slope Projects.

Project	**Location**
BLM Legacy Well Closures	Plugging and abandonment activities at up to 5 legacy wells: Oumalik 1, Oumalik Core 2, Oumalik Core 11, Oumalik Core 12, and East Oumalik 1.
Olgoonik Oilfield Services	Winter travel across the NPR-A
Alaska West Express Inc. (Lynden Oilfield Services)	Travel on the North Slope Community Winter Access Trail
North Slope Community Winter Access Trail	Snow trail between villages in the NPR-A
ConocoPhillips Greater Mooses Tooth One (GMT1) Operations	There are currently 7 wells operating on the GMT1 pad. Operations of the pad and wells would continue during the same time as the Proposed Action.
ConocoPhillips Greater Mooses Tooth Two (GMT2) continued construction	The GMT2 gravel pad (14 acres) is connected by an 8-mile gravel road to GMT1. A total of 36 wells and planned to be located on the pad. The first oil production began in December 2021. Activity would continue on the pad during the same time of the Proposed Action.
Subsistence	Subsistence activities occur throughout the Project Area.
ConocoPhillips Well Closures	Three wells will be closed, plugged, and abandoned (Scout 1, Cassin 1 and Cassin 6) in the GMT area during the winter 2022. The project would include 31 miles of ice road, three 6-acre ice pads at each well site, up to 33.7 million gallons of water withdrawn from up to 12 lakes, and a 50-person support camp.

Project	Location
SAExploration Seismic Exploration	Winter seismic exploration on 36,350 acres around the community of Nuiqsut. Proposed to start in January 2022.
Summer Studies	Ongoing summer studies for bathymetry, fish, vegetation, and summer cleanup activities.

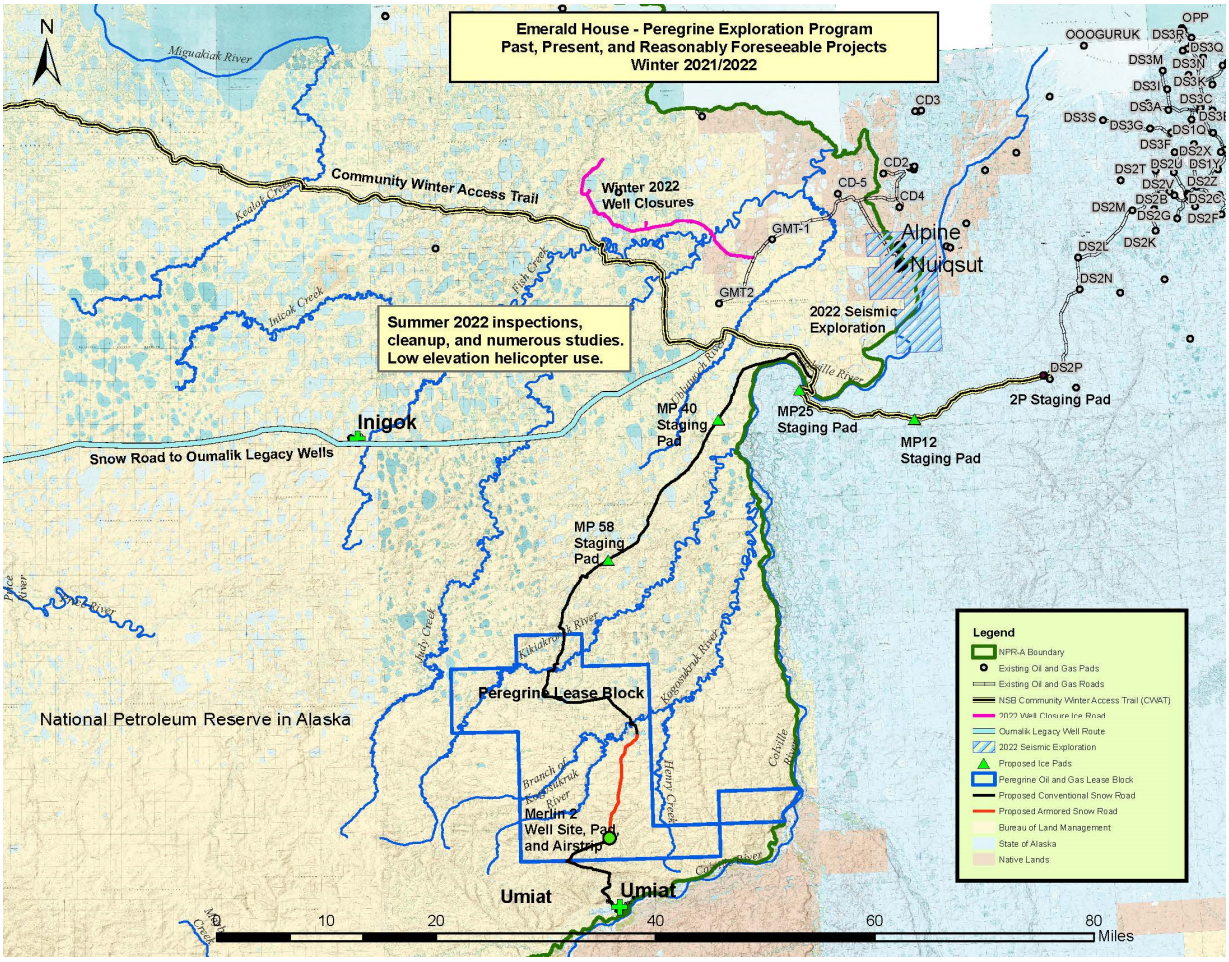

Figure 5. Past, present, and reasonably foreseeable projects in the proposed project area.

Environmental characteristics of the general project area have been extensively described in the 2020 NPR-A IAP EIS (USDOI BLM 2020a, Vol. 1, Chapter 3), to which this analysis is tiered, with site-specific features described below.

3.2 Issue 1: *How would exploratory drilling and associated activities (including summer inspections and cleanup activities) impact subsistence users and local communities?*

Affected Environment

Section 3.4.3, 3.4.4 and 3.4.5 of the 2020 NPR-A IAP EIS (USDOI BLM 2020a) provide a recent description of the affected environment for subsistence, sociocultural systems, and environmental justice for the community of Nuiqsut. Appendix F of the Greater Mooses Tooth 2 (GMT2) Supplemental Environmental Impact Statement (SEIS) (USDOI BLM 2018) provides an overview of Nuiqsut subsistence uses.

The proposed project involves winter activity in an area with important subsistence value, utilized by residents of both Nuiqsut and Utqiagvik. The winter months are not primary to subsistence harvesting pursuits; however, it is the principal time for harvesting furbearers. Additionally, other subsistence activities that occur in the winter months include caribou hunting, small land mammal harvesting, hunting for non-migratory bird species, and fishing (Brown et al. 2016). Based on the most recent spatial harvest and use data, hunting areas for non-migratory birds have not been closely tied to the project area. Additionally, some recorded fishing areas are in the periphery of the project area along the Colville River. However, most fish harvests occur from May to November, with the exception of burbot harvests which can occur throughout the winter and spring (Brown et al. 2016, SRB&A 2010). Thus, this analysis will focus primarily on subsistence pursuits of caribou and furbearers.

The Teshekpuk Herd (TCH) and the Central Arctic Herd (CAH) are the two caribou herds that most commonly occur in the Colville River drainage (Prichard at al. 2018). Winter hunting for caribou is primarily focused on the TCH, which generally overwinter on the coastal plain to the west and southwest of Nuiqsut. In the summer months, caribou from the TCH and the CAH can be found in coastal areas on both sides of Nuiqsut during mosquito season and later during the peak harvest season (July and early August) along the Colville River. The CAH was at its peak in 2010 with an estimated 68,000 animals but declined to 23,000 caribou by 2016 (ADFG 2020); in recent photocensus data the herd has experienced modest increases, growing to an estimated 28,000 animals in 2017 and 30,000 caribou in 2019. Currently, the CAH is considered to be stable and slightly increasing. The most recent photocensus for the TCH occurred in 2017, and the current size of the herd is unknown. Recent indicators are varied, but recent survival rates point to a continued increase since 2017; despite this, other indices (parturition rate, short yearling weights and recruitment show some demographic strain (Lincoln Parrett, personal communication 2021).

As mentioned previously, winter is not the primary season for caribou harvest. Most winter hunting of caribou is focused to the west and southwest of Nuiqsut, however some residents choose to travel along the Colville River by snowmachine to the area of Ocean Point (SRB&A 2010). Since the mid-1990s, no winter months were identified as periods of high or moderate activity and harvest (in the 1990s, March was considered a month of moderate activity) (SRB&A 2021a). Hunting characteristics over the last decade have been similar in terms of trip frequency, duration, and travel method, however the timing of hunting and hunting success within use areas can vary from year to year (SRB&A 2018, SRB&A 2019, SRB&A 2021a, SRB&A 2021b). Recent caribou harvests over the last four years for which data are available

have remained largely stable. Nuiqsut estimated caribou harvests in 2016-2019 ranged from a low harvest of 481 in 2016 to a high harvest of 636 caribou in 2019, and, with the exception of 2016, are all within the mean harvest of 508 caribou from all available study years from 1985 to 2019 (SRB&A 2021b); controlling for community population, a similar pattern emerges for per capita harvests, which range from a low harvest of 132 pounds to a high harvest of 157 pounds in comparison with the 1985-2019 average harvest of 149 pounds of caribou per person. Hunting areas have varied over time, but 2015 to 2019 data indicated use of gravel roads and ice roads connected to development; despite increased use of these areas, some residents indicated that they choose to avoid areas of development entirely. Although direct habitat loss would be relatively small and temporary for the Proposed Action, there are concerns about indirect habitat loss from caribou avoidance behavior and temporary displacement of caribou. While minor deflection and avoidance behavior of caribou would be anticipated due to traffic and drilling activities during the winter, these impacts would likely be temporary and would likely impact fewer hunters given the timing of winter operations.

For summer activities, helicopter activity during summer inspections and cleanup operations has the potential to disturb caribou and hunters during the peak harvesting months of July and August. Because inspections and cleanup efforts require helicopters to fly at low altitudes in order to observe debris on and adjacent to the snow road, ice pads, and work areas, this air traffic may be of particular concern. However, these operations would be limited in duration.

The most likely direct impact would be experienced by those subsistence users involved in furbearer hunting and trapping, which takes place during the winter months during the highest level of activity for the proposed project. Furbearer harvest is largely more specialized than many other subsistence pursuits, and fewer residents engage in these activities (Brown et al. 2016). However, furbearer resources hold a cultural value above the economic value of the skins as they are used to produce native handicrafts and warm winter clothing. As the Kuukpik Native Corporation stated in its 2019 comment letter on the Draft Willow Master Development Plan EIS (USDOI BLM 2019) “trapping is not as critical from a food security standpoint as whaling and caribou hunting, but it has immense cultural significance and is an important inter-generational activity. In fact, trapping has had something of a resurgence in recent years as several community members have increasingly focused on trapping and on passing this information along to the younger generation.”

Environmental Impacts

Alternative A – No Action

Under the no action alternative, Emerald House would not conduct winter exploration activities on BLM managed lands and no snow road, drilling or testing, or other associated activities would occur. As a result, there would be no impacts to subsistence users and local communities because no activity would take place.

Alternative B – Proposed Action

While the Proposed Action would be anticipated to deflect caribou and furbearers from the immediate area and associated snow roads, the potential of the Proposed Action to affect the

abundance of subsistence resources in the project area would be low. Impacts could include subsistence users avoiding the area of project activity and cause hunters/trappers to travel further in order to pursue these resources. Traveling further could cause a greater expenditure of time, cost, and, potentially, risk due to very cold and dark winter travel conditions.

Considering the timing of the Proposed Action, relative densities and distribution of caribou, stable harvest rates, and the historically low winter harvest of caribou, the direct and indirect effects of the Proposed Action would not significantly restrict subsistence uses for this species. Some subsistence users may benefit from access by snow roads, and a minority of residents may benefit from job opportunities brought into the community from the Proposed Action. For summer activity, impacts from helicopter traffic may have the potential to deflect caribou and disturb hunters, however, the activities would be limited in duration. The Proposed Action would be anticipated to result in minor to moderate, short-term impacts to subsistence users in both the winter and summer seasons, primarily associated with altered distribution/reduced availability of subsistence resources in areas where they are traditionally harvested (mainly furbearers).

Wolf and wolverine avoidance of infrastructure is well documented (SRB&A 2010). Hunters targeting furbearers in the northern portion of the project area may need to relocate trap lines due to reduced availability of these resources near the start of the snow road, which branches off of the CWAT Trail. Displacement in the southern half of the project area would be less likely, as this area tends to be less frequently used by subsistence hunters (Figure F-5 of the GMT2 SEIS (USDOI BLM 2018)). Additionally, the Peregrine Lease Block, which encompasses all of the more intensive proposed project activities, including all exploratory drilling and ice pad construction, is planned in the southern portion of the project area where displacement of trap lines would be less likely. While the Proposed Action would be anticipated to deflect furbearers from the immediate area and associated snow roads, the potential of the Proposed Action to affect the abundance of subsistence resources in the project area would be low.

Development activities like the Proposed Action can cause other sociocultural issues including stress over the pace of exploration, tension and conflict related to the permitting process, lack of capacity to participate at the levels desired, distrust of agencies and industry, and lack of local control over the activity. Additionally, activities like the Proposed Action can cause short-term benefits to a minority of local residents in terms of employment opportunities. These factors and the subsistence related concerns identified above would not impact all residents equally.

Considering the timing of the Proposed Action, relatively stable harvest rates, and the historically low winter use of the area for subsistence activities, the direct and indirect effects of the Proposed Action would not significantly restrict subsistence uses beyond what has been described and analyzed in the 2020 NPR-A IAP EIS (USDOI BLM 2020a). Some subsistence users may benefit from access on ice roads. The Proposed Action would be anticipated to result in minor to moderate, short-term impacts to subsistence uses, primarily reduced availability of subsistence resources in areas where they are traditionally harvested (mainly furbearers). There would be no new significant impacts expected from the Proposed Action.

Cumulative Effects from Past, Present, and Reasonably Foreseeable Impacts

The Alaska Native mixed subsistence and cash economy and cultural way of life depend on the continued ability to hunt, fish, and gather adequate wild resources in traditional areas of use. For many non-Native rural residents of Alaska (federally recognized subsistence hunters under ANILCA Title VIII), hunting and gathering is also of critical economic and cultural importance. Subsistence can be understood as a wide range of distinct and localized traditions established by communities that reflect local ecological, economic, and cultural contexts (Wolfe 2004). Subsistence harvests are also important for the food security of rural communities and are a sizeable contribution to the diet; based on comprehensive data from 2014, the Arctic region (which included the North Slope) had an estimated per capita subsistence harvest of approximately 400 pounds per person, the highest of any region in Alaska (Fall and Kostick 2018). This analysis of impacts to subsistence resources is tiered to the 2020 NPR-A IAP EIS (USDOI BLM 2020a). This analysis considers impacts to access, availability, and abundance of subsistence resources that would be anticipated to result from disturbances related to the construction of snow roads and ice pads, as well as the drilling of one oil and gas well in concert with other activities taking place in the project area.

Winter activities in the Project Area are found in Table 3.1 and have the potential to cumulatively impact subsistence and sociocultural systems in the region in combination with the Proposed Action. BLM Legacy well closures, Olgoonik Oilfield Services, Alaska West Express, Inc, and the North Slope Community Winter Access Trail (CWAT) would all bring in traffic to the project area along ice and snow roads. Current operations at Greater Mooses Tooth 1 include 7 wells operating on the pad that would occur during the same time as the Proposed Action, as would construction of an additional ice pad connected to the GMT2 gravel pad. ConocoPhillips will be conducting plugging, closing, and abandonment activities in the vicinity of GMT1 and GMT2. SAExploration may be conducting seismic exploration in the vicinity of Nuiqsut. Taken together, winter activities in the Project Area have the potential to deflect caribou and furbearers in the vicinity of these developments, which could cause some residents to have to travel further for these resources and avoid traditional hunting areas. Conversely, some residents may make use of gravel, ice, and snow roads in the project areas to access resources. Summer activities outside of the Proposed Action area include studies on bathymetry, fish, and vegetation, as well as inspections and cleanup activities from other development projects. Much of this work would be conducted using helicopters, which have the potential to deflect caribou and disturb hunters.

Other impacts to the community from all activity in the project area would be similar to what was discussed above. Development and research activities can cause stress over the pace of all activities, tension and conflict related to the permitting process, lack of capacity to participate at the levels desired, distrust of agencies and industry, and lack of local control over the activity. Some economic benefit may be realized by a minority of Nuiqsut residents from all of these activities in terms of employment opportunities. These factors and the subsistence related concerns identified above would not impact all residents equally.

Direct effects from the current Proposed Action alone would be expected to last throughout the life of the Emerald House Peregrine Exploration Program (2025), and additional exploration and drilling activities may be applied for throughout the life of the Program. Overall impacts to

access, abundance, and availability of subsistence resources (primarily furbearers and caribou) related to past, present, and reasonably foreseeable energy development projects would likely be long-term and would persist as long as oil and gas development and operations continue on the North Slope. Activities from the Proposed Action, considered within the context of energy development in the project area, would not be expected to add any new significant impacts within broader trends and what have been analyzed in the 2020 NPR-A IAP EIS (USDOI BLM 2020a).

The effects of a warming climate in the Arctic have the potential to substantially affect subsistence harvest and use practices if the warming trend continues as predicted (Arctic Climate Impact Assessment 2004). Reductions and loss of subsistence resources or access restrictions at times of peak harvest would have severe impacts to the subsistence way of life for residents of Arctic communities (Brinkman et al. 2016). Increased loss of permafrost is predicted, which could cause collective impacts on infrastructure, travel across the landscape, landforms, sea ice, rivers, habitats, fresh water sources, and availability of wild resources (National Research Council 2003; Arctic Climate Impact Assessment 2004). The short-term impacts of the Proposed Action on subsistence would not be expected to add any significant impacts to the broader trend of climate impacts and what have been analyzed in the 2020 NPR-A IAP EIS (USDOI BLM 2020a).

3.3 Issue 2 - *How would winter exploration and use of snow roads and pads impact vegetation?*

Affected Environment

Vegetation in the NPR-A is influenced by physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The NPR-A can be roughly divided into three latitudinal bands from north to south including the Arctic Coastal Plain, the Arctic Foothills, and the Brooks Range. The vegetation of the NPR-A consists primarily of dwarf shrubs, herbaceous plants (especially graminoids), lichen, and mosses. Most species of vegetation within NPR-A can be found in all three latitudinal bands, however the relative frequency of occurrence of each species varies across bands, due in large part to differences in moisture levels (USDOI BLM 2002). The Arctic Coastal Plain is characterized by many small lakes and very poorly drained soils, while the Brooks Range has relatively few lakes, improved drainage, and increased topography. The Arctic Foothills are intermediate between the two in both characteristics and geography.

The Arctic Coastal Plain ecoregion is a smooth treeless plain rising gradually from the Arctic Ocean to the foothills of the Brooks Range. This ecoregion is mainly undulating plains and vast floodplains. The dominant vegetation along the coast and within the Arctic Coastal Plain is moist sedge-willow or moist sedge-Dryas tundra; however, salt marshes are found in coastal depressions along the coast while wet graminoid occupy basins on the Arctic Coastal Plain. On the southern end of the Arctic Coastal Plain, the Arctic Foothills ecoregion has rolling hills and plateaus, with better defined drainages and fewer lakes than in the Arctic Coastal Plain. Vegetation in the foothills is mainly moist tussock tundra due to the high prevalence of ice-rich permafrost. Mineral-rich granite and limestone bedrock and glaciers of the Brooks Range mountains to the south feed its numerous rivers and floodplains and have carved the landscape into deep ravines and channels. The steep topographic gradients are reflected in the diverse

geology, soils, snow regimes, hydrology, and vegetation, which form a complex mosaic of habitats supporting the high biological diversity of the region. There are few known non-native or invasive species within the NPR-A.

Approximately 60 miles of the conventional snow road falls within the Arctic Coastal Plain while 13 miles of the conventional snow road and the entire length of armored snow road (16 miles) would be within the Arctic Foothills.

A more detailed description of vegetation in the NPR-A, including discussion of vegetation mapping methods, can be found in section 3.3.1 of the 2020 NPR-A IAP EIS (USDOI BLM 2020a).

Wet vegetation types and soils usually freeze more rapidly and solidly than drier areas and generally can endure a higher vehicle load-bearing capacity. In general, wetter areas are less affected by disturbance than moist and dry areas (Walker 1996). Due to topographic variation within the project area, however, some wetter sites could be more highly susceptible to disturbance than their moisture status would suggest.

Tussock tundra whose tussocks project above the surrounding land surface, and sedge-dryas tundra, notable for a hummocky surface topography, are both vulnerable to disturbance by winter tundra travel (Yokel and Ver Hoef 2014). Along with sensitive willow habitats, these cover classes are recognized as some of the most susceptible to long-term disturbance from vehicle use due to shearing of tussocks. For the purpose of this EA, "long-term disturbance" is defined as disturbance lasting more than 10 years with a 25->50 percent decrease in vegetation or shrub cover, 5->15 percent exposed organic or mineral soil, and obvious compression of mosses and standing litter in wet graminoid and moist sedge-shrub tundra. In addition, areas with long-term disturbance usually appear wetter or have more standing water compared to the surrounding vegetation and tussocks or hummocks are sheared or crushed (Felix et al 1992).

To determine impacts to vegetation, the proposed project area was defined as the area potentially impacted by snow roads, ice pads (including the pad for the well), and airstrip. The snow roads (35 feet wide by 89 miles, 377.2 acres), ice pads (36 acres) and airstrip (4 acres) total approximately 417 acres. In addition, the amount of vegetation within a 1,500-foot buffer on each side of the snow roads was also calculated to account for route realignment and provide context for impacts to vegetation from the snow roads, ice pads and airstrip. Coarse vegetation land cover classes for the proposed project area and larger buffered corridor, based on descriptions found in the Alaska Vegetation and Wetland Composite User Guide (Alaska Center for Conservation Science 2017), are found in Table 3.2. Vegetation land cover class descriptions are grouped according to susceptibility to long-term disturbance. Characteristics and features specific to each vegetation land cover class determine the susceptibility to long-term disturbance.

Table 3.2. Coarse vegetation land cover classes on federally managed lands in the larger buffered corridor and proposed project area.

Coarse Land Cover Class	Acreage within Buffered Corridor (1,500 feet on either side of road) (acres)	Total Acreage within Proposed Roads, Pads, and Airstrip (acres)	Total Percent Vegetation Cover within Proposed Route (%)	Percent Vegetation Cover under Conventional Snow Roads (%)	Percent Vegetation Cover under Armored Snow Roads (%)	Susceptibility to Long-Term Disturbance
Herbaceous (Wet)	2,440	33	8	10	1	High
Herbaceous (Mesic)	2,438	33	8	8	4	High
Dwarf Shrub	991	13	3	4	2	High
Sparse Vegetation	113	1	< 1	< 1	< 1	High
Bare Ground	143	< 1	< 1	< 1	Not Present	High
Tussock Tundra	17,727	246	59	53	86	Intermediate
Low Shrub	2,721	33	8	8	5	Intermediate
Tall Shrub	344	4	1	1	< 1	Intermediate
Herbaceous (Marsh)	3,740	50	12	15	< 1	Low
Freshwater or Saltwater	1,743	4	1	1	< 1	Low
Fire Scar	1	Not Present	Not Present	Not Present	Not Present	Intermediate
Total	32,402	417	100% of Proposed Route	82% of Proposed Route	18% of Proposed Route	

Vegetation Cover Classes with High Susceptibly to Long-Term Disturbance

The Herbaceous (Wet) land cover class (8 percent of both the proposed project area and buffered corridor area) (Table 3.2) is characterized by more than 20 percent herbaceous cover, 5-25 percent water or more than 20 percent *Carex aquatilis*. This class represents sites which are wet or seasonally flooded by freshwater. These sites are typically dominated by *Carex aquatilis* and *Eriophoru mangustifolium*. Dwarf shrubs (less than 0.2 m tall) such as *Salix fuscescens, S. polifolia, Betula nana*, and *Vaccinium uliginosum* may also be present but make up less than 25 percent cover. Moss species are typically dominated by *Sphagnum spp*. The Herbaceous Wet cover class includes both non-patterned ground and low-centered-polygonal ground. Despite their relatively high-water content, polygonal ground and associated vegetation are at a high risk of disturbance from snow and ice road building and use due to the microtopography along ice-wedge margins and an increase in sensitive shrub species on these microhabitats. The seasonally flooded ground at the center of polygons is less susceptible to long-term disturbance from tundra travel than the margins of ice-wedges. Because it is difficult to map out individual polygonal ground features at a useful scale and nearly impossible to reroute to avoid ice-wedge polygons, this vegetation type is assigned a "high susceptibility" rating to long-term disturbance. If disturbed, the low centers of polygons would show increased green up for several years, and rapidly show full to nearly full recovery. The higher microtopography along ice-wedge margins, however, could be easily damaged by vehicles resulting in ruts, bare ground, crushed or sheared tussocks, and broken stems on woody vegetation, if not sufficiently protected. These features, similar to tussocks or shrubs, project above the surrounding land surface and are susceptible to scuffing or partial removal (Yokel and Ver Hoef 2014).

The Herbaceous (Mesic) land cover class (8 percent of both the proposed project area and buffered corridor area) (Table 3.2) is defined by its occurrence on mesic to dry sites with more than 25 percent cover of herbaceous species. Dominant and codominant species include sedges, grasses and forbs. These sites are commonly dominated by *Carex bigelowii*, *Luzula confusa* and lichens. Dwarf shrubs (≤ 0.2 m tall) such as *Arctostaphylos alpina*, *Empetrum nigrum*, *Salix pulchra* and *Betula nana* may be present but contribute less than 25 percent to the canopy cover. The high occurrence of sensitive dwarf shrubs and ground willow present in the Herbaceous Mesic cover class lead to a high susceptibility rating for long-term disturbance. The Herbaceous Mesic land cover class includes sites higher and drier than the vast majority of NPR-A. The low moisture content and better drainage of soils in this cover class cause soils to be less solidly frozen with lower load bearing capacities due to reduced ice bonding between soil particles.

The Dwarf Shrub land cover class (3 percent of both the proposed project area and buffered corridor area) (Table 3.2) is defined when more than 25 percent of the cover is shrub and either 25 percent of the site consists of shrubs less than 0.2 m in height or shrubs less than 0.2 m tall are the most common shrubs. Lichen cover is less than 20 percent. *Dryas integrifolia* and/or *Dryas octopetala* dominate the shrub layer with more than 20 percent cover. Other dwarf shrubs include *Cassiope tetragona*, *Salix arctica*, *S. phlebophylla*, *Vaccinium uliginosum*, *Empetrum nigrum*, *Rhododendron tomentosum*, *Diapensia lapponica* and *Arctostaphylos rubra*. Common herbaceous species may include *Senecio lugens*, *Anemone parviflora*, *Hierochloe alpina*, *Carexscirpoidea*, *C. microchaeta*, *Festuca altaica*, *Lupinus arcticus*, *Artemisia*

globularia and *Equisetum spp*. Common mosses include *Hylocomium splendens*, *Racomitrium spp.* and *Tortula ruralis*. Dwarf shrubs, dryas and lichens occurring in this land cover class are sensitive to disturbance. These sites contain high percentages of dwarf shrubs, dryas and lichen, are typically better drained than surrounding tussock tundra or emergent vegetation habitats and freeze less solidly during the winter. The combination of improved drainage and sensitive plant species result in a highly susceptible to long term disturbance rating. Dwarf Shrub classified sites occupy 3 percent of the project area and should be avoided whenever possible. Ground willows, dwarf shrubs, dryas, and lichens in this cover class are susceptible to disturbance with inadequate protective cover, and vegetational succession to a low shrub cover class over time would be possible.

The Sparse Vegetation land cover class (<1 percent of both the proposed project area and buffered corridor area) (Table 3.2) is defined by at least 50 percent cover of unvegetated ground and vascular vegetation with more than 10 percent cover. The canopy is sparse due to extreme exposure, exposed bedrock or unstable substrates. Soils are typically thin, stony, and well-drained. Common dwarf shrubs include *Dryas octopetala*, *D. integrifolia*, *Saxifraga oppositifolia*, *Rhododendron lapponicum*, *Salix arctica*, *S. reticulata*, *Cassiope tetragona* and *Arctostaphylos rubra*. Herbaceous species may include *Lupinus arcticus*, *Hedysarum boreale ssp. mackenziei*, *Carex scirpoidea*, *C. rupestris*, *Oxytropis nigrescens*, *Potentilla uniflora*, *Artemisia senjavinensis*, *A. globularia*, *A. furcata*, *Saxifraga oppositifolia* and *Equisetum spp.* Lichens such as *Thamnolia spp.* and *Cetraria islandica* also commonly occur. Lichens are very slow growing, resulting in longer recovery times. Sparse Vegetation sites should be avoided, when possible, for similar reasons to bare ground (see below) and are also classified as highly susceptible to long term disturbance.

The Bare Ground land cover class (<1 percent of both the proposed project area and buffered corridor area) (Table 3.2) is defined by vegetation cover less than 10 percent. This class includes sand along the major rivers, high-elevation rock/gravel areas and unvegetated sand dunes. While high-elevation rock and gravel areas are not highly susceptible to long-term vegetation disturbance, this cover class includes sensitive sand dune features located in NPR-A. Since sand dunes and all bare ground occupies less than 1 percent of the project area, avoidance of this sensitive habitat type is the best option. Soils in these relatively well drained sites are poor locations for ice road routing due to the same reasons as detailed in the Mesic site above. If disturbed with inadequate protection, this vegetation type easily shows vehicle tracks and rutting, and the low percent of vegetation present may not recover before soils erode or hydrology is permanently altered.

Vegetation Cover Classes with Intermediate Susceptibly to Long-Term Disturbance

The Tussock Tundra (Low Shrub or Herbaceous) land cover class (59 percent of proposed project area and 55 percent of the buffered corridor area) (Table 3.2) is defined by more than 35 percent cover of tussocks and trees have less than 10 percent cover. These sites may have more than 25 percent cover of low shrubs 0.2-1.3 m tall, or a combination of low and dwarf shrubs. These sites are typically cold, poorly drained, and underlain by mesic, silty mineral soils with a shallow surface organic layer surrounding the tussocks (Viereck et al. 1992). Permafrost is present. *Eriophorum vaginatum* is the primary tussock-former in most stands, but *Carex bigelowii* may dominate some sites. Common shrubs include *Betula nana*,

Salix pulchra, *Rhododendron tomentosum*, *Vaccinium vitis-idaea*, *Vaccinium uliginosum* and *Empetrum nigrum*. The Tussock Tundra land cover class covers a range of tussock sizes and represents a major fraction of land cover in NPR-A. Wetter tussock tundra with seasonal flooding has a lower disturbance susceptibility than higher and drier tussock tundra with increased topography. Tussocks that project above the surrounding land surface are susceptible to scuffing or partial removal by snow and ice road vehicles (Yokel and Ver Hoef 2014). With insufficient protective cover, tussock scuffing, crushing and vehicle ruts are likely to occur. With sufficient snow cover and ice road building standards, some lesser tussock or hummock scuffing may occur but rapidly recovers and would likely be the highest observed disturbance level of this land cover class.

The Low Shrub land cover class (8 percent of proposed project area and 6 percent of the buffered corridor area) (Table 3.2) is defined by 25-100 percent cover of shrubs, where shrubs taller than 1.3 m make up less than 25 percent of the site, and either more than 25 percent of the site consists of shrubs 0.2-1.3 m in height or shrubs 0.2-1.3 m are the most common shrubs. Lichen cover is less than 20 percent. Common shrubs include *Salix spp.*, *Alnus viridis ssp*., *Betula nana*, *Vaccinium uliginosum* and *Rhododendron tomentosum*. Other species include *Calamagrostis canadensis, Carex aquatilis*, *Comarum palustre*, *Empetrum nigrum*, *Chamaedaphne calyculata* and *Sphagnum spp.* (Jorgenson and Heiner 2003). Initial disturbance on low shrubs would be more visible than other vegetation classes due to shrubs projecting far above the ground surface, facilitating greater damage from vehicles than for most other vegetation classes. Despite low shrubs suffering initial disturbance, they recover more quickly than dwarf shrubs (Yokel and Ver Hoef 2014). Part of recovery for low shrubs includes replacement by grasses, a natural, intermediate stage in succession that occurs when shrubs are killed (Jorgenson and Heiner 2003). In other cases, low shrubs may recover more quickly than dwarf shrubs because they tend to capture deep enough snow (Emers et al. 1995) such that the underlying soils are protected and stems either bend over or break off well above ground level. In the latter case, these stems can then sprout new branches and the shrub canopy appears no different than surrounding shrubs after several years.

The Tall Shrub land cover class (1 percent of both the proposed project area and the buffered corridor area) (Table 3.2) is defined by 25-100 percent cover of shrubs and either more than 25 percent of the site consists of shrubs taller than 1.3 m in height or shrubs taller than 1.3 m are the most common shrubs. This class is widespread adjacent to streams and rivers. Patch size is small to large and often linear, and soils are mesic to wet. Common tall shrubs include *Salix alaxensis, S. pulchra, S. glauca, S. richardsonii, Alnus incana ssp. tenuifolia, A. viridis ssp. crispa*, and *A. viridis ssp. Sinuata*. Vegetation in the Tall Shrub land cover class tends to show relatively quick and complete recovery after disturbance, even when initial damage is extreme (Jorgenson et al. 2010). The ice-poor gravel substrate does not subside when thawed and conditions for plant growth therefore remain unchanged. Taller willows also tend to collect wind-blown snow which helps to protect the ground cover. Additionally, although willows may be badly broken, they tend to grow back vigorously after disturbance as a physiological adaptation to herbivory. Studies suggest that mechanical cutting during snow road pioneering and construction is preferable to crushing during vehicular disturbance.

The Fire Scar land cover class (not present in proposed project area and 1 percent of buffered corridor area) (Table 3.2) is defined as burned areas dominated by snags or burned vegetation. These areas are typically too difficult to label spectrally; had poor field data (as it is difficult and dangerous to access remote areas with numerous snags by helicopter); or had changed significantly between the time of burn, the image acquisition date, and/or the date of field work. The lack of data for fire scar cover class type makes it difficult to categorize for long-term disturbance susceptibility. Areas with severe burns could be at increased risk for long-term disturbance due to already exposed soils and sparse vegetation, whereas those areas that are insufficiently evaluated have indeterminant susceptibility to long term disturbance.

Vegetation Cover Classes with Low Susceptibility to Long-Term Disturbance

The Herbaceous (Marsh) land cover class (12 percent of both the proposed project area and buffered corridor area) (Table 3.2) is defined by sites which are periodically wet or continually flooded and dominated by emergent herbaceous plants such as sedges. Soils are muck or mineral, and water can be nutrient-rich. Vegetation is typically dominated by monocultures of *Arctophila fulva*, *Carex aquatilis* or *Eriophorum angustifolium*. The higher moisture content found in the Herbaceous (Marsh) land cover class allows vegetation and soils to freeze more rapidly and solidly, protectively freezing vegetation in place and providing a higher load-bearing capacity for vehicle traffic.

The Freshwater or Saltwater land cover class (1 percent of proposed project area and 5 percent of buffered corridor area) (Table 3.2) is defined by aquatic sites where the cover of vegetation is less than 10 percent. As with the Herbaceous (Marsh) land cover class above, the higher moisture content found in the Freshwater or Saltwater land cover class allows vegetation and soils to freeze more rapidly and solidly, protectively freezing what little vegetation may be present in place and providing a higher load-bearing capacity for vehicle traffic.

Environmental Impacts Alternative A – No Action

Under the No Action Alternative, Emerald House would not conduct winter exploration activities on BLM managed lands and no snow roads, ice pads, drilling and testing, or other associated activities would occur. As a result, there would be no impacts to vegetation.

Alternative B – Proposed Action

The total length of the proposed snow road (up to 35 feet wide) would be approximately 80.5 miles, with an additional 8.4 miles of access roads to the lakes, potentially impacting an overall area of approximately 377.2 acres. Additionally, the proposed ice pads would occupy 36 acres (six 6-acre ice pads), and a 4-acre temporary airstrip would also be constructed. The Proposed Action would be expected to potentially impact an estimated 417 acres in total.

To optimize snow road placement and help minimize impacts, Emerald House would have the flexibility to move the proposed snow road up to 1,500 feet to either side of the planned route, an area encompassing approximately 32,402 acres. Within this 32,402-acre buffered corridor area, the 417-acre proposed route would potentially impact approximately 1 percent of the total vegetative cover.

As shown on Table 3.2 and Figure 6, 19 percent (81 acres) of the 417-acre area (proposed roads, pads, and airstrip) has vegetation classified as "High Susceptibility to Long-Term Disturbance" (if disturbed with insufficient protective measures). This is compared to 6,125 acres of vegetation identified with High Susceptibility to Long-Term Disturbance in the larger buffered road corridor (1,500 feet on either side of the proposed snow roads). The roads, pads, and airstrip represent approximately 1 percent of vegetation that is Highly Susceptible to Long-Term Disturbance in the buffered corridor.

An additional 68 percent (283 acres) of the proposed project area (roads, pads, and airstrip) is classified as vegetation with an "Intermediate Susceptibility to Long-Term Disturbance" rating (Table 3.2 and Figure 6). This is compared to 20,792 acres of vegetation identified with Intermediate Susceptibility to Long-Term Disturbance in the larger buffered road corridor (1,500 feet on either side of the road). The roads, pads, and airstrip represent approximately 1 percent of vegetation that is Intermediately Susceptible to Long-Term Disturbance in the buffered corridor.

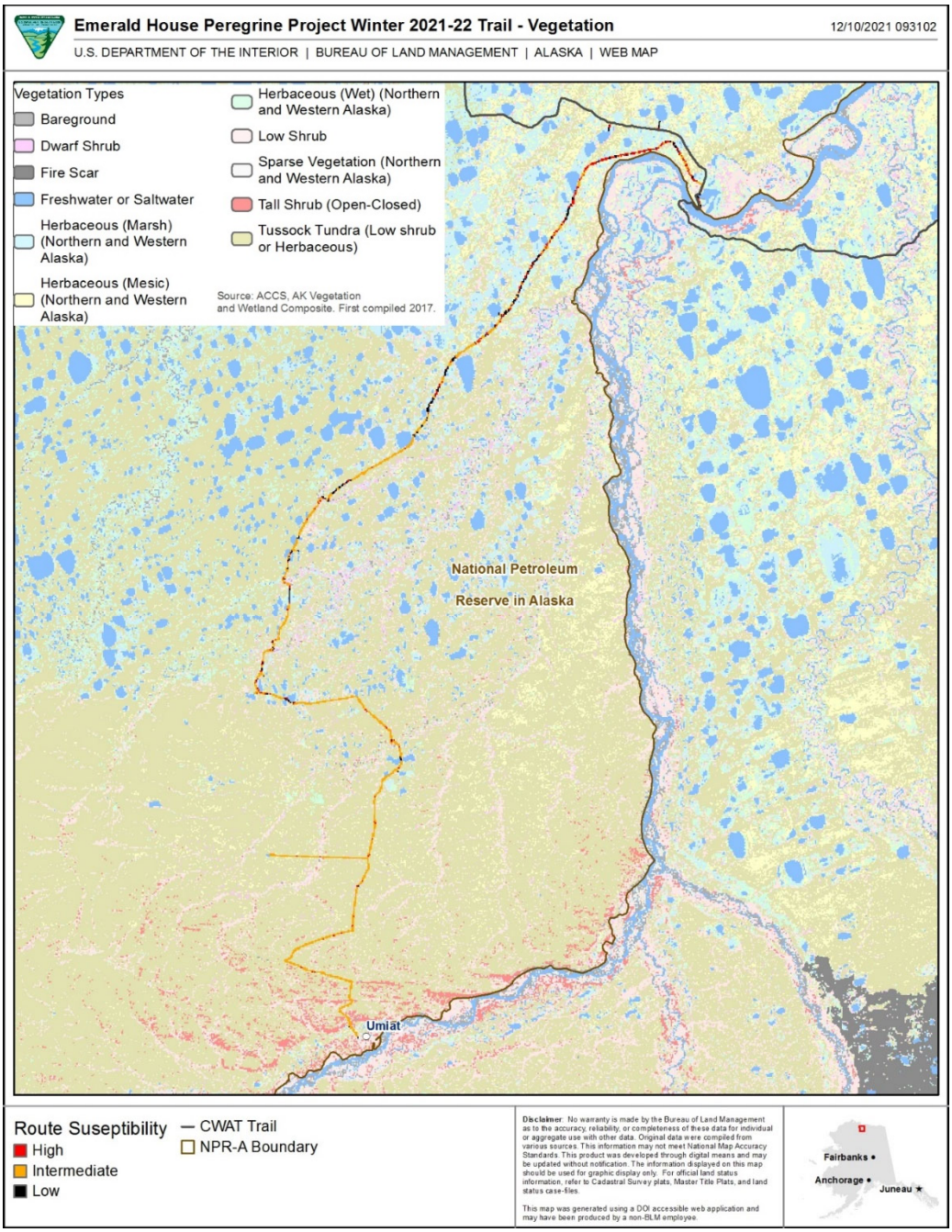

Figure 6. Vegetation within the proposed project area and areas of High, Intermediate, and Low susceptibility to disturbance along the proposed ice road.

Magnitude of disturbance would vary along the route, due in part to differences in snow road construction and number of passes. Approximately 10.5 miles of the proposed 89-mile snow road would be constructed as an armored snow road. Armored snow roads have higher ice content and persist longer in the summer than conventional snow roads. The ice pads, airstrip, and approximately 6 miles of lake access road would also be constructed similarly to armored snow roads. In total, an estimated 110 acres would be expected to potentially be impacted by armored snow roads.

Vehicle and road design variables that could lead to vegetative damage have been considered in the project design. Vehicles to be used for the Proposed Action have been specially designed or modified for snow and ice road travel and to reduce environmental damage. This includes lowering PSI by use of appropriate tires or tracks, as well as careful monitoring of speed and turning radius. Road building specifications include minimizing sharp turns and ensuring proper snow and ice thickness and quality. Use of these practices would help reduce vegetative impacts to the extent possible.

Vegetative damage could include plant crushing, shearing, uprooting, and possible spread of noxious weeds. This type of damage to vegetation in arid ecosystems could lead to land degradation and desertification (Belnap, 1995, Mouat et al., 1997). In wetter tundra areas, impacts would usually be limited to "green-up" of trails caused by compression of snow and dead plant material, where standing dead vegetation has been laid down, leaving only newer, greener vegetation standing during the following growing season.

The extent and magnitude of impacts to vegetation from disturbance can vary from site to site. Snow cover is variable across the North Slope due to redistribution of snow by winds, resulting in sparse cover on hillcrests and deep accumulations in water courses and low areas (Jorgenson et al. 2010). The high level of natural variability in snowfall timing, distribution, and depth within NPR-A results in a wide range of dates when vegetation would be sufficiently protected from tundra travel. Topography and landforms within hilly regions of NPR-A make routing and avoidance of sensitive vegetation, such as dryas, difficult. Vehicle tracks (with insufficient protection) could impact vegetation, soil chemistry, soil invertebrates, soil thermal properties, and cause localized irreversible hydrologic changes (Kevan et al. 1995). Sufficient snow depth, density, and hardness along travel routes and at staging pads, however, would act as a buffer against these impacts. Adhering to minimum snow depth criteria would be expected to minimize impacts in most instances.

Impacts to vegetation associated with winter activities depend on the type of vehicle, number of passes, vegetation type, soil physical properties, ground ice content, and snow conditions (NRC 2003; Jorgenson et al. 2010). Construction and use of snow and ice roads and ice pads would occur solely during winter months once conditions have been determined to be sufficiently protective to begin prepacking activities. Because vegetation, soils, ground ice, and snow conditions can vary, careful site-specific monitoring to meet standards would need to occur in order to minimize impacts. Resource specialists from BLM would monitor applicable environmental conditions before and during construction to ensure snow depths, soil temperatures, and other critical variables have been met, as well as conduct summer inspections along the route to help ensure damage to vegetation had been minimized. Protective measures to mitigate potential impacts would include delaying prepacking until snow depth reaches an average of six inches, use tundra approved vehicles for prepacking, avoiding areas with low snow cover, starting snow road construction once soil temperatures reach 23-degree Fahrenheit (or below) at a depth of 12 inches, and minimizing sharp turns. Use of these protective measures for previous ice road construction has resulted in little to no environmental damage. Additionally, ROP M-2 from the 2020 IAP ROD would help ensure that invasive species would not become established in the proposed project area (Appendix A).

Cumulative Effects from Past, Present, and Reasonably Foreseeable Impacts

Climate change may eventually lead to far larger shifts in the composition of Arctic tundra toward increased shrub height and cover extent, tree encroachment north of the Brooks Range and increased grass and sedge species (Chapin et al. 1995; Naito and Cairns 2011; Sturm et al. 2001; and Walker et al. 2006). These increases would likely be at the expense of lichen and moss cover (Chapin et al. 1995, Epstein et al. 2004, Walker et al. 2006, Jandt et al. 2008). In addition, warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic, and wet tundra vegetation types and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004). Such impacts of climate change could accumulate with changes in soil thermal regimes that might occur as a result of past and future activities in and near the Coastal Plain, potentially leading to synergistic impacts to vegetation.

3.4 Issue 3 – *How would winter exploration and water withdrawal from source lakes to construct snow roads and pads impact fish?*

Affected Environment

Condensed information on fish species and their habitats in this region can be found in Section 3.3.3 of the 2020 NPR-A IAP EIS (USDOI BLM 2020a). However, the prime focus of this section is to consider results from more recent field studies that furthered understanding of fish and aquatic habitats in the NPR-A. For more detailed background information on fish species, including general distributions and life histories, refer to Section 3.3.4 of the 2012 NPR-A IAP EIS (USDOI BLM 2012). Together, information presented in these two EISs provides a comprehensive, informed summary of fish and aquatic habitats in the NPR-A.

As summarized in the 2012 NPR-A IAP EIS (USDOI BLM 2012), the NPR-A is divided into three geographic regions: (1) the Arctic Coastal Plain (ACP), (2) Arctic Foothills, and (3) the Arctic Mountains. The proposed project is primarily located within the Arctic Foothills region but also utilizes the ACP for access to the proposed project area. While the ACP has a complex hydrological landscape consisting of lakes, beaded streams, and large alluvial rivers that cover approximately 20 percent of the landscape, the Arctic Foothills consist of hillscape topography with less than 1 percent of the surface covered by waterbodies (Hinkel et al. 2012; Wang et al. 2012; USDOI BLM 2012).

Suitable overwintering habitat is a limiting factor for fish species in the NPR-A. For example, it has been estimated that available summer habitats are reduced by up to 95 percent during winter (Craig 1989), highlighting the importance of these refugia to maintain fish populations. Although the extent of overwintering habitats in the NPR-A are not fully understood (USDOI BLM 2020a), radio telemetry studies have illustrated sensitive fish species generally overwinter in deep pools of alluvial river channels and a few deep lakes with strong connections to river systems (Morris 2003). Generally, lakes with depths greater than 13 feet are categorized as high-value overwintering habitat capable of supporting large numbers of sensitive species (USDOI BLM 2020a). Moulton (MJM Research 1998) developed a widely applicable lake-type classification for the Arctic based on the potential for access by fish. A summary for each lake-type classification is described in detail in the 2020 NPR-A IAP EIS (USDOI BLM 2020a). In

addition, recently developed lake-centric geospatial databases provide detailed information on over 4,000 lakes in northern Alaska (i.e., lake morphometry, hydrologic connectivity, winter liquid water availability, etc.; Grunblatt and Atwood 2014; Jones and Zuck 2016) to help guide research and aid in the management of aquatic resources (Jones et al. 2017).

For the purposes of determining water withdrawal thresholds identified in ROP B-2 (Appendix A), fish are broadly classified as either 'sensitive' or 'non-sensitive' to low levels of dissolved oxygen. More specifically, Alaska blackfish (*Dallia pectoralis)* and ninespine stickleback (*Pungitius pungitius)* are considered 'non-sensitive' because these species have been routinely documented surviving in aquatic environments characterized by extremely low concentrations of dissolved oxygen (Lewis et al. 1972; Crawford 1974; MJM Research 2002; Haynes et al. 2014). All other species in the region are considered 'sensitive' in that acute or prolonged exposure to hypoxic conditions could have lethal or sublethal effects (USDOI BLM 2020a). For lakes that support sensitive fish species, permitted water withdrawal thresholds are limited to 15 percent of the calculated volume deeper than 7 feet to minimize potential impacts to overwintering habitat. Permitted thresholds are higher for lakes that support only non-sensitive fish species (i.e., 30 percent of the calculated volume deeper than 5 feet) because of their ability to tolerate low dissolved oxygen conditions. These thresholds have been identified as being broadly protective of fish and aquatic habitats in the NPR-A (USDOI BLM 2020a).

Research efforts focused on lake basins within the NPR-A have illustrated the presence (or non-detection) of Arctic fish species is primarily driven by lake depth and perennial connections to other waterbodies (Hayes et al. 2014; Laske et al. 2016; Heim et al. 2018; Murdoch et al. 2021). This is because waterbodies within the ACP typically freeze up to 6 feet in depth during winter (Childers et al. 1979; Zhang and Jeffries 2000; Hinzman et al. 2006), so water depths of approximately 7 feet are considered the minimum for supporting overwintering fish sensitive to low concentrations of dissolved oxygen (USDOI BLM 2020a). It is recognized that some lakes shallower than 7 feet do not freeze entirely to the bottom (Arp et al. 2015). These lakes provide limited overwintering habitat for fish that can tolerate more extreme conditions (i.e., Alaska blackfish and ninespine stickleback; USDOI BLM 2020a). Further, fish surveys have demonstrated lakes that are isolated or exhibit only ephemeral connections to other water bodies are often fishless or contain only rapidly dispersing species (i.e., ninespine stickleback; MJM Research 2006; Haynes et al. 2014; Owl Ridge 2019). As a result, these attributes can be used to make reasonable determinations as to the value of proposed water source lakes as critical overwintering habitat for sensitive fish species (Arp et al. 2019).

Environmental Impacts

Alternative A – No Action

Under the No Action alternative, Emerald House would not conduct winter exploration activities on BLM managed lands and no snow road or other associated exploration activities would occur. As a result, there would be no impacts to sensitive fish species overwintering in lakes because no water would be withdrawn.

Alternative B – Proposed Action

Potential impacts to fish from winter lake-water use include effects on overwintering habitat and summer hydrology, as lowered water levels can affect habitat space and connectivity (Cott et al. 2008a). More specific to the Proposed Action, the primary concern is potential impacts to overwintering sensitive fish. Potential impacts to natural hydrological processes would be minimized because proposed volumes for all water source lakes would be within thresholds that have been demonstrated to naturally replenish during spring break up (i.e., 20 percent of total lake volume; Baker 2002, 2011, 2014, 2015).

As identified in Table 1.1, the potential for impacts on sensitive fish overwintering in water source lakes would be increased if liquid water withdrawal exceeds 15 percent of the available water (ROP B-2a). The primary concern in regard to removing liquid water from lakes during winter is that dissolved oxygen might be reduced. Depletion of dissolved oxygen, caused by overcrowding or over-demand by biological and chemical processes, can result in fish mortality (Schreier et al. 1980; Schmidt et al. 1989; Reynolds 1997) as well as non-lethal effects (Kramer 1987; Evans 2007). Water withdrawal lakes were monitored during a variety of research efforts between 2003 and 2011 to help determine if liquid water use guidelines were protective of North Slope fish and aquatic habitats (Hinzman et al. 2006; Hilton et al. 2009). In addition, a study in the Canadian Arctic that used an experimental approach found that removing 10 percent of total lake volume did not have an effect on total volume-weighted dissolved oxygen, while removing 20 percent had a substantial impact and effectively reduced fish overwintering habitat by about 25 percent (Cott et al. 2008b). While this indicates that winter liquid water withdrawals can reach a threshold that effects fish, dissolved oxygen changes have not been apparent at current levels of withdrawal on the North Slope (Hinzman et al. 2006; Chambers et al. 2008).

Emerald House has requested to withdraw liquid water from up to 29 lakes on BLM managed and State of Alaska lands to support the 2021/2022 winter exploration program in the NPR-A. Of the 19 lakes on BLM managed lands, 4 have maximum depths between 5 and 7 feet. It is unknown if volume requests for these lakes fit the guidelines outlined in ROP B-2b because fish surveys have not been conducted to determine the presence (or non-detection) of sensitive fish species. Generally, if fish surveys cannot be completed prior to the start of winter operations, operators may assume that water source lakes contain sensitive fish species, thereby restricting water withdrawal quantities to 15 percent of the calculated volume of liquid water deeper than 7 feet (ROP B-2a). This assumption provides the greatest level of protection, should overwintering fish sensitive to low concentrations of dissolved oxygen be present. However, this assumption limits liquid water withdrawals to lakes with depths greater than 7 feet. Due to the limited number of lakes in close proximity to the area of Proposed Action, Emerald House has requested a ‘deviation’ from ROP B-2 in the absence of fish survey data for four lakes. Emerald House would assume the four lakes support non-sensitive fish species because they are under 7 feet in depth. Because the remaining 15 proposed water source lakes on BLM managed lands have maximum depths greater than 7 feet, Emerald House would assume sensitive fish species are present.

The BLM has closely examined each of the four lakes (i.e., P6, P8, P22, and Dog Bone Lake) regarding a decision for water use. In each case liquid water would be utilized, increasing the

possibility for potential impacts to overwintering fish sensitive to low concentrations of dissolved oxygen.

To first evaluate the extent of potential overwintering habitat, each lake was examined using a spatial dataset that mapped winter liquid water availability within lakes on the ACP using Synthetic Aperture Radar (SAR; Grunblatt and Atwood 2014). This GIS-based analysis showed that, assuming a maximum ice thickness of 5.2 feet, all 4 lakes potentially provide overwintering habitat. Estimates of unfrozen liquid water ranged from 65.0 to 83.0 percent (Table 3.3) among the 4 lakes. These estimated volumes were then compared to liquid water withdrawal quantities proposed by Emerald House. This comparison illustrated that Emerald House has proposed to remove a maximum of 2 percent of the total estimated volume of unfrozen water (Table 3.3). Based on this information, it is unlikely that liquid water requests of this magnitude would greatly impact overwintering fish. This is because it falls within the most restrictive guideline (ROP B-2a) that specifies 15 percent of total volume under ice can be withdrawn—a guideline that conservatively estimates maximum ice thickness annually reaches 7 feet. It is recognized that uncertainty remains in that unfrozen liquid water proportions for these lakes were generated from high-resolution imagery collected during a single year. As such, actual unfrozen volumes are expected to change based on annual weather conditions (e.g., snow cover, winter winds, etc.) that influence depth of freeze down (Zhang and Jeffries 2000; Arp et al. 2018; Engram et al. 2018). However, this information can be combined with known lake basin characteristics to further asses the probability that sensitive fish species use these lakes as overwintering habitat.

Table 3.3. Lake basin characteristics and winter water availability estimates.

Lake Identifier	Maximum Depth (feet)	Total Volume (Million gallons)	Unfrozen Percentage of Total Lake Volume* (Equivalent in million gallons) (Percent)	Percentage of Unfrozen Volume Requested by Operator (Equivalent in million gallons) (Percent)
P6	5.5	323.1	73.4% (237.2)	0.2% (0.5)
P8	6.6	482.0	75.3% (362.9)	2.0% (7)
P22	6.3	46.4	65.0% (38.5)	1.5% (0.6)
Dog Bone	6.4	175.9	83.0% (114.3)	1.4% (1.6)

*As determined by Grunblatt and Atwood (2014) using SAR; MG = millions of gallons.

As discussed in Section 3.5 of this EA, the primary considerations regarding the suitability of water source lakes as overwintering habitat for sensitive fish species are: (1) lake depth and (2) hydrological connectivity to other fish bearing waterbodies (Haynes et al. 2014; Laske et al. 2016; Murdoch et al. 2021). Lakes P6 and P8 have depths of 5.5 and 6.6 feet, respectively (Table 3.3). Both lakes are categorized by a lake classification system for the Fish Creek Watershed as having floating ice with no deep central pool and exhibit only ephemeral connections to surrounding waterbodies (Jones and Zuck 2016). As indicated above, while lakes P6 and P8 may provide overwintering habitat, the morphological and hydrological characteristics of both lake basins (i.e., shallow depths and limited hydrological connectivity)

suggests the quality of this habitat for overwintering would be suboptimal for sensitive fish species. As such, it is unlikely large numbers of sensitive fish species utilize these lakes as overwintering habitats. While it is possible that fish may disperse into these lakes during spring break up flooding, many of these ephemeral connections are temporary and shallow, making them potentially difficult to navigate for larger-bodied, sensitive species (Haynes et al. 2014). If sensitive fish did manage to disperse to these lakes during short periods of hydrological connectivity, individual fish would naturally become stranded in these suboptimal overwintering habitats when spring floodwaters receded. Independent of water use, this would result in an increased probability of a local extinction event that would ultimately be dependent on local environmental conditions and maximum ice thickness during the subsequent winter.

The remaining two lakes, Dog Bone Lake and Lake P22, are located south of the Fish Creek Watershed and are not a part of the lake classification system developed by Jones and Zuck (2016). However, similar information can be inferred using high-resolution imagery and the USGS National Hydrography Dataset (NHD). This GIS-based information indicated Dog Bone Lake is isolated but likely exhibits an ephemeral connection to surrounding waterbodies. In contrast, Lake P22 exhibits a perennial connection (primarily outflow) to a branch of the Kogosukruk River. Similar to other shallow Arctic rivers (Childers et al. 1979; Craig and McCart 1975; Sloan 1985; Craig 1989), the headwaters of the Kogosukruk River stop flowing during the winter months reducing potential overwintering habitat. This was further supported by a recent telemetry study that tracked seasonal movements of Arctic grayling (*Thymallus arcticus*) within the Colville River and its tributaries. Over the course of two years, no tagged fish were reported to overwinter within the Kogosukruk River (Andrew Gryska, ADFG, personal communication 2021). As a final aspect for consideration, Dog Bone Lake has a maximum depth of 6.4 feet and Lake P22 has a maximum depth of 6.3 feet. Similar to above, this combination of factors suggests the probability that Dog Bone Lake and Lake P22 support high numbers, if any, overwintering sensitive fish species is low.

Ultimately, winter water use may impact sensitive fish species should they be overwintering in the four lakes associated with the Proposed Action. Because these effects would most likely be local and impact only individual fish that occupy those lakes during winter, potential impacts would not be expected to be reflected at the population level for sensitive fish species. Further, best available information indicates the probability of sensitive fish overwintering in these suboptimal lake habitats would be low, increasingly the likelihood that potential impacts to sensitive fish would be minimal. The stipulations and ROPs associated with the Proposed Action would further reduce the likelihood of impacting sensitive fish overwintering in lakes on BLM lands and(or) contribute to additional knowledge that would assist with future management decisions. Project-specific ROPs 15 and 16 (Section 2.4) would require Emerald House to conduct fish surveys at proposed water source lakes between 5 and 7 feet of depth to inform appropriate thresholds outlined in ROP B-2.

Cumulative Effects from Past, Present, and Reasonably Foreseeable Impacts

Cumulative effects from past, present, and reasonably foreseeable development activities within the area of Proposed Action would not be anticipated to substantially impact fisheries resources. As discussed in detail above, a small number of individual fish overwintering in 4 lakes between 5 and 7 feet could experience sublethal or lethal effects due to reductions in dissolved oxygen

from proposed winter liquid water withdrawals. Impacts occurring to overwintering sensitive fish species would be very localized (i.e., lake-specific) and short-lived, but the Proposed Action could result in repeated local impacts for the duration of the Peregrine Exploration Program (through 2025) if: (1) water withdrawals occurred each winter at all four lakes, and (2) overwintering sensitive fish species occupied all four lakes each year. However, the magnitude of these impacts would still not be expected to effect fish at population or regional levels.

To date, archived permitting information indicate the four lakes identified in the Proposed Action would only be used by Emerald House. As such, impacts from Emerald House winter exploration activities would not be expected to be additive or synergistic to impacts associated with co-occurring winter activities identified in Table 3.1. Similarly, no other activity in the region (e.g., transportation, subsistence, scientific research, and community development) would be anticipated to impact fish in a manner that would persist and contribute to regional effects. While it is recognized that climate change will likely alter current distributions and assemblages of fish species in the Arctic (Comte et al. 2013; Bilous and Dunmall 2020; Campana et al. 2020), the type and magnitude of impacts associated with the Proposed Action on fish would not be expected to add substantial impacts to broader trends associated with large-scale climatic processes.

Chapter 4 Consultation and Coordination

Public notification of the Environmental Analysis will be on file at the Arctic District Office and available on the Arctic District Office Environmental Assessment web site.

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