U.S. Department of Energy

ALASKA LNG PROJECT

Draft
Supplemental Environmental Impact Statement

July 2022

Summary

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COVER SHEET

Responsible Federal Agency: U.S. Department of Energy (DOE)

Cooperating Agencies: None

Title: Draft Supplemental Environmental Impact Statement for the Alaska LNG Project (DOE/EIS-0512-S1)

Location: North Slope, Alaska

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Abstract:

The U.S. Department of Energy (DOE) prepared this Draft Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts associated with natural gas production on the North Slope of Alaska (North Slope) and life cycle greenhouse gas emissions associated with authorizing Alaska LNG Project LLC (Alaska LNG) to export liquefied natural gas (LNG) as part of the Alaska Gasline Development Corporation's proposed Alaska LNG Project (Project). DOE is in the process of rehearing DOE/Office of Fossil Energy Order No. 3643-A issued in August 2020 (Alaska LNG Order), which authorized export of LNG to non-Free Trade Agreement (FTA) countries. This Draft SEIS supplements the Final Environmental Impact Statement published by the Federal Energy Regulatory Commission, as adopted by DOE (DOE/EIS-0512) on March 16, 2020, and will support DOE's decision-making process. Following completion of the National Environmental Policy Act (NEPA) process, DOE intends to issue an order under Section 3(a) of the Natural Gas Act in which DOE may exercise its authority to reaffirm, modify, or set aside the Alaska LNG Order.

DOE prepared this Draft SEIS in accordance with the National Environmental Policy Act of 1969 (42 United States Code 4321 *et seq*.) and in compliance with the Council on Environmental Quality implementing regulations (Title 40 *Code of Federal Regulations* [CFR] Parts 1500 to 1508) and DOE NEPA procedures (10 CFR 1021). This Draft SEIS evaluates the potential environmental impacts associated with natural gas production in the North Slope and includes a life cycle analysis calculating the greenhouse gas emissions for LNG exported from the proposed Alaska LNG Project.

Comment Period:

DOE encourages public participation in the NEPA process. Comments postmarked by August 15, 2022, will be addressed in the Final SEIS.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AGDC	Alaska Gasline Development Corporation
Alaska LNG	Alaska LNG Project LLC
CO_2	carbon dioxide
DOE	Department of Energy
EIS	Environmental Impact Statement
E.O.	Executive Order
EOR	enhanced oil recovery
FERC	Federal Energy Regulatory Commission
FTA	free trade agreement
GHG	greenhouse gas
KRU	Kuparuk River Unit
LCA	Life Cycle Analysis
LNG	liquefied natural gas
NEPA	National Environmental Policy Act
NGA	Natural Gas Act
PBU	Prudhoe Bay Unit
Project	Alaska LNG Project
PTU	Point Thomson Unit
ROW	right-of-way
SEIS	Supplemental Environmental Impact Statement
U.S.	United States
USACE	U.S. Army Corps of Engineers

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SUMMARY

S.1 INTRODUCTION

S.1.1 Background

The U.S. Department of Energy (DOE) has prepared this Draft Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts associated with natural gas production on the North Slope of Alaska (North Slope) and a life cycle analysis (LCA) calculating the greenhouse gas (GHG) emissions for liquefied natural gas (LNG) exported from the proposed Alaska LNG Project (Project).

The Federal Energy Regulatory Commission (FERC) published a Final Environmental Impact Statement (EIS) in March 2020 to evaluate the Alaska LNG Project proposed by the Alaska Gasline Development Corporation (AGDC). FERC's 2020 EIS assessed the potential environmental effects of the Project's construction and operation activities in accordance with the requirements of the National Environmental Policy Act (NEPA). The 2020 EIS concluded that approval of the proposed Project would result in a number of significant environmental impacts. Implementation of the impact avoidance, minimization, and mitigation measures proposed by AGDC, AGDC's commitments to additional measures, and mitigation measures recommended by FERC in the 2020 EIS would reduce the majority of impacts to less-than-significant levels. Based on findings of the 2020 EIS, FERC issued an Order on May 21, 2020 (FERC Order), granting AGDC authorization under Section 3(a) of the Natural Gas Act (NGA) to site, construct, and operate the proposed Alaska LNG Project.

DOE participated as a cooperating agency in FERC's review of the proposed Alaska LNG Project. Following FERC's completion of the NEPA process, on August 20, 2020, DOE issued DOE/FE Order No. 3643-A (the Alaska LNG Order) to Alaska LNG Project LLC (Alaska LNG) under Section 3(a) of the NGA. Concurrently with its issuance of the Alaska LNG Order, DOE issued a Record of Decision under NEPA (DOE Docket No. 14–96–LNG). DOE/FE authorized Alaska LNG to export LNG produced from Alaskan sources to non-free trade agreement (FTA) countries. DOE's Alaska LNG Order included the condition that Alaska LNG comply with the 165 environmental conditions adopted in the FERC Order.

Subsequently, on September 21, 2020, Sierra Club filed a Request for Rehearing of the Alaska LNG Order. Sierra Club argued that DOE violated NEPA by relying on an EIS that did not examine all of the reasonably foreseeable impacts of the proposed Alaska LNG Project. On April 15, 2021, DOE issued an Order on Rehearing[1]. In that Rehearing Order, DOE granted Sierra Club's Request for Rehearing for the purpose of conducting Alaska-specific environmental studies and related public process. DOE noted that, since the issuance of the Alaska LNG Order, the President had issued two Executive Orders (E.O.s) relevant to the Alaska LNG proceeding: E.O. 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, and E.O. 14008, *Tackling the Climate Crisis at Home and Abroad*.

Consistent with these E.O.s and considering the arguments on rehearing, DOE stated that it was appropriate to further evaluate the environmental impacts of exporting LNG from the proposed Project to non-FTA countries. On July 2, 2021, DOE published its Notice of Intent in the *Federal Register* to prepare a SEIS for the Alaska LNG Project (DOE/EIS-0512-S1).

[1] On December 16, 2020, after DOE had issued a tolling order but before DOE had issued any subsequent order addressing Sierra Club's Rehearing Request, Sierra Club filed a petition for review of the Alaska LNG Order in the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit). See Sierra Club v. U.S. Dep't of Energy, Petition for Review, Case No. 20-1503 (D.C. Cir. Dec. 16, 2020). That case is currently being held in abeyance in light of DOE's ongoing rehearing proceeding involving this SEIS.

S.1.2 Purpose and Need

S.1.2.1 DOE's Purpose and Need

Section 3(a) of the NGA requires DOE to conduct a public interest review and grant authority to export LNG to non-FTA countries unless DOE finds that the proposed exports would not be consistent with the public interest. Additionally, NEPA requires DOE to consider the potential environmental effects of its decisions regarding applications to export natural gas to non-FTA countries. DOE is preparing this Draft SEIS in furtherance of its Rehearing Order and to more fully evaluate the potential environmental impacts associated with natural gas production on the North Slope and considering a LCA for GHG emissions of exporting LNG from the proposed Project to non-FTA countries. This also includes evaluation consistent with the two recent E.O.s regarding the climate crisis. Following completion of this SEIS, DOE intends to issue an order under Section 3(a) of the NGA in which DOE may exercise its authority to reaffirm, modify, or set aside the Alaska LNG Order.

S.1.2.2 AGDC's and Alaska LNG's Purpose and Need

Alaska LNG's purpose and need for the Project was defined in their application to DOE. The proposed Project's purpose is to commercialize the natural gas resources of Alaska's North Slope, primarily by converting the existing natural gas supply to LNG for export by Alaska LNG and providing gas to users within Alaska. Specifically, the stated purpose and need for the proposed Project are to:

- commercialize natural gas resources on the North Slope during the economic life of the Prudhoe Bay Unit (PBU) and the Point Thomson Unit (PTU) and achieve efficiencies through the use of existing common oil and gas infrastructure and economies of scale;
- bring cost-competitive LNG from Alaska to foreign markets in a timely manner; and
- provide interconnections along the pipeline to allow for in-state gas deliveries, benefiting Alaskan gas users and supporting long-term economic development.

S.1.3 Scope of the Draft SEIS

This Draft SEIS supplements the 2020 EIS[2] to consider additional potential Project impacts associated with LNG exported from Alaska over DOE's term of authorization. This Draft SEIS also re-evaluates North Slope "non-jurisdictional" activities[3] discussed in the 2020 EIS related to upstream development that would support the proposed Project. This Draft SEIS does not include projects that were analyzed in detail in the 2020 EIS as part of AGDC's proposed Project, such as the proposed 62.5-mile-long, 32-inch-diameter Point Thomson Unit Gas Transmission Line, which would be located in the North Slope. This Draft SEIS incorporates by reference information and analysis contained in the 2020 EIS and examines the potential environmental effects of natural gas production on the North Slope and the global nature of GHG emissions associated with exports of LNG from Alaska from a life cycle perspective.

[2] The 2020 EIS is available for review and download from FERC's website: https://www.ferc.gov/industries-data/natural-gas/final-environmental-impact-statement-0.

[3] FERC considered facilities to be "non-jurisdictional" in the 2020 EIS that do not fall under the jurisdiction of the Commission. Non-jurisdictional facilities may be integral to the project need or they may be associated as minor components that would be built as a result of the jurisdictional facilities.

S.1.4 Public, Agency, and Tribal Involvement

As part of FERC's NEPA process, FERC conducted extensive public involvement activities for its EIS, including 12 public scoping meetings in the Fall of 2015 and a 90-day public review/comment period for the Draft EIS starting in June 2019. As part of this SEIS process, DOE published a Notice of Intent in the *Federal Register* on July 2, 2021, announcing its intent to prepare an SEIS. DOE did not conduct public scoping as a public scoping process is not required for a DOE-issued SEIS (10 *Code of Federal Regulations* 1021.311(f)). DOE is providing opportunities for public review and comments, including a public hearing, on this Draft SEIS.

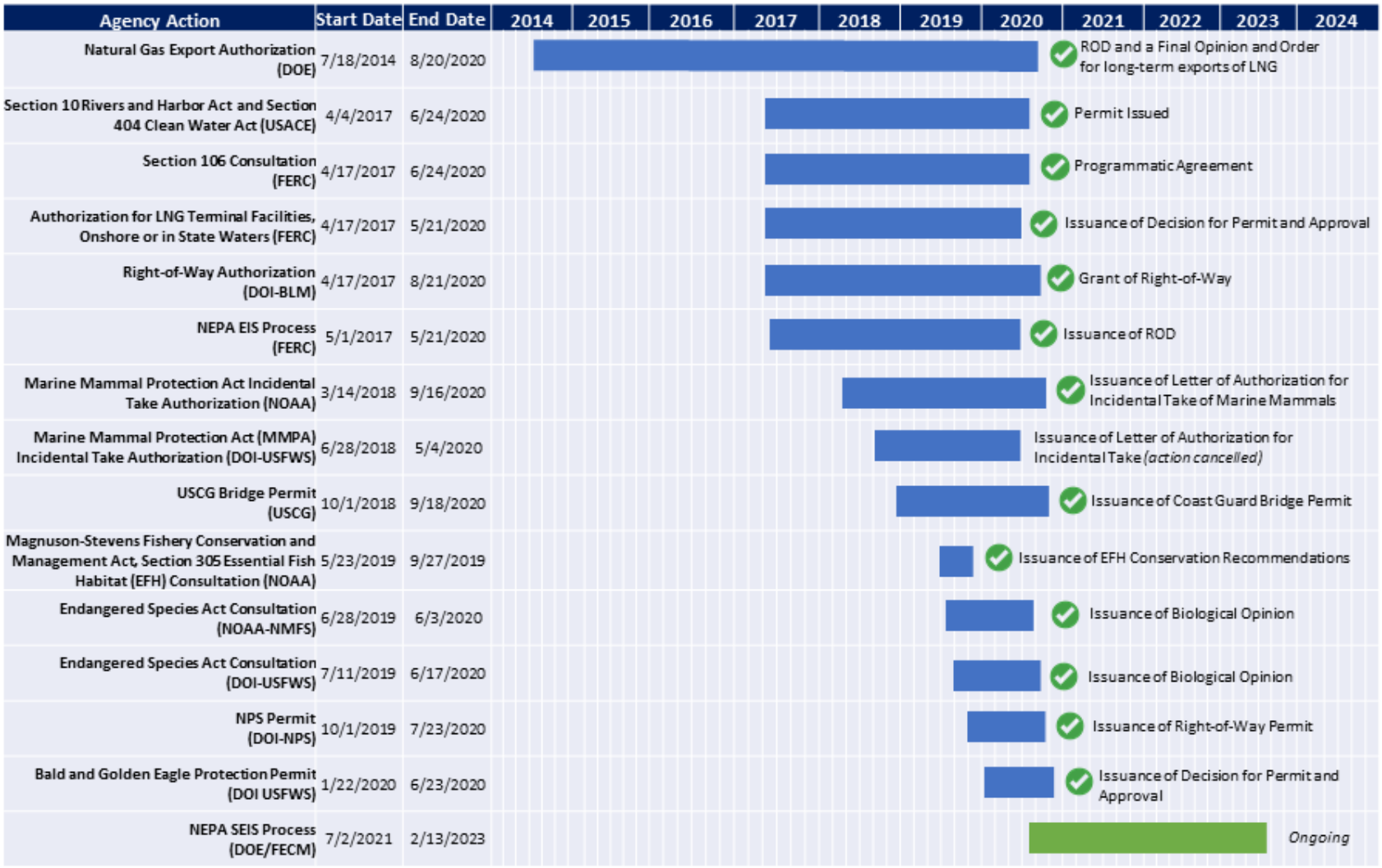
The 2020 EIS identified FERC as that EIS's Lead Federal Agency with the following cooperating agencies: U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, U.S. Environmental Protection Agency, U.S. Army Corps of Engineers (USACE), U.S. Coast Guard, Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, DOE, and National Marine Fisheries Service. Several of the cooperating agencies also had NEPA obligations in order to issue their respective permits on the proposed Project. DOE invited these agencies to be cooperating agencies as part of this SEIS; however, no agencies accepted the invitation.

DOE contacted each of the 78 Alaska Native Tribes involved in the 2020 EIS process, notifying them of DOE's decision to prepare an SEIS and to inquire about their interest. Additionally, DOE provided an opportunity for the Alaska Native Tribes to contribute any traditional knowledge regarding resources on the North Slope potentially affected by upstream development that was not included in the 2020 EIS. To date, DOE has not received responses from any Alaska Native Tribes.

S.1.5 Permits, Approvals, and Consultations

Figure S-1 provides an update of actions or decisions made by agencies undertaking federal authorizations regarding the proposed Project since issuance of the 2020 EIS. As indicated in the figure, all permitting and approvals for the proposed Project are complete with the exception of DOE's preparation of this SEIS.

In addition to the federal permits and approvals summarized in Figure S-1, upstream development activities that would be led by other private entities on the North Slope and additional infrastructure development identified by DOE for this SEIS would require future federal approvals. This includes authorizations from the USACE and U.S. Environmental Protection Agency, and consultations with various resource agencies, such as the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The USACE would determine whether to issue a permit for construction of these projects under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. In addition, the USACE would likely be the lead agency responsible for conducting an environmental review of these projects under NEPA.



✔ = authorization/permit completed; BLM = Bureau of Land Management; DOE = Department of Energy; DOI = Department of Interior; EFH = Essential Fish Habitat; EIS = Environmental Impact Statement; FECM = Office of Fossil Energy and Carbon Management; FERC = Federal Energy Regulatory Commission; LNG = liquefied natural gas; MMPA = Marine Mammal Protection Act; NEPA = National Environmental Policy Act; NMFS = National Marine Fisheries Service; NOAA = National Oceanic and Atmospheric Administration; NPS = National Park Service; ROD = Record of Decision; SEIS = Supplemental Environmental Impact Statement; USACE = United States Army Corps of Engineers; USCG = United States Coast Guard; USFWS = United States Fish and Wildlife Service

Figure S-1. Status of Federal Permits and Approvals for the Alaska LNG Project

S.2 THE PROPOSED ACTION AND NO ACTION ALTERNATIVE

S.2.1 Proposed Agency Action

DOE's Proposed Action is to meet its obligation under Section 3(a) of the NGA to authorize the export of natural gas, including LNG, unless it finds that the proposed import or export would not be consistent with the public interest. In considering this action, DOE has reviewed its existing Alaska LNG Order, Sierra Club's Request for Rehearing, and two recent Executive Orders: E.O. 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, and E.O. 14008, *Tackling the Climate Crisis at Home and Abroad*. DOE has conducted further evaluation of the environmental impacts associated with the action and considered the findings contained in this Draft SEIS concerning impacts associated with potential natural gas production on the North Slope and the LCA Study. Following completion of the NEPA process, DOE intends to issue an order under Section 3(a) of the NGA in which DOE may exercise its authority to reaffirm, modify, or set aside the Alaska LNG Order.

In this Draft SEIS, DOE considers a range of "scenarios" regarding the potential upstream activities on the North Slope. These scenarios, as presented in the North Slope Production Study[4], represent a range of activities that could occur in the North Slope and are also considered in the LCA Study:

- **Scenario 1 "Business as Usual".** This scenario examines the remaining oil production potential from the PBU without Major Gas Sales and no Alaska LNG Project. The currently produced gas and its carbon dioxide (CO_2) content would continue to be reinjected into the PBU for pressure maintenance and miscible injection. This scenario essentially serves as the No Action case for this Draft SEIS, with no development of a pipeline or other means to export gas from the PBU and PTU.
- **Scenario 2 "Reduced Gas Reinjection".** This scenario examines the reduction in oil production from the PBU given the decreasing volumes of gas injection and the steady decline in reservoir pressure due to the Alaska LNG Project. The start of a Major Gas Sales project at the PBU would switch the priority of operations from oil production to gas production. As a result, reservoir pressure would steadily decrease as gas is extracted for Major Gas Sales, reducing the volume of oil produced from the PBU. This scenario assumes that by-product CO_2 is not used in enhanced oil recovery (EOR) and is stored in saline formations beneath the PBU.
- **Scenario 3 "Use and Storage of By-product CO_2".** This scenario examines the potential for utilization and storage of the by-product CO_2 using CO_2 EOR. DOE has identified the Kuparuk River Unit (KRU) as a likely candidate for EOR due to its proximity to the PBU and its reservoir capacity for utilizing CO_2. EOR activities have occurred within KRU in the past; however, broader application of these activities has been constrained by the limited supply of miscible injectant (e.g., natural gas liquids) or CO_2. The volume of oil produced from PBU and from EOR activities at KRU related to Project-produced CO_2 is modeled to be slightly higher than the amount of oil produced under Scenario 1, however, these modeled estimates suggest in practice the two scenarios have the potential to produce similar volumes based on known variability in future reservoir performance.. Scenario 3 would require an approximately 30-mile CO_2 pipeline to transfer the separated CO_2 from the proposed Alaska LNG Project Gas Treatment Plant within the PBU to the KRU gas-handling operations. The CO_2 transportation pipeline would utilize the existing or adjacent right-of-way (ROW) to the maximum extent possible.

Table S-1 compares oil and gas production and life cycle GHG emissions of the Proposed Action and No Action Alternative based on the scenarios identified by DOE in the North Slope Production Study and from the LCA Study. It is important to note that the No Action Alternative (Scenario 1) considers that the proposed Project would not proceed and that commercializing North Slope natural gas would not be

[4] DOE prepared a North Slope Production Study consisting of a series of three reports. The study evaluated the capacity of natural gas supply from the PBU and PTU on the North Slope to meet the authorized LNG export volumes over the proposed Project's operational lifetime.

realized. The additional development activities under Scenarios 2 and 3 provide a basis for the evaluation of representative potential environment effects that could occur on the North Slope due to the proposed Project and are a focus of this Draft SEIS. These activities are based on North Slope development activities identified in the 2020 EIS and the potential scenarios presented in the North Slope Production Study. These scenarios represent a range of reasonable outcomes for the purpose of the environmental impact analysis within the Draft SEIS. Ultimately, the North Slope oil field operators, Alaska LNG, or other entities would select development and management options that best meet their operational requirements and economic criteria.

Table S-1. Comparison of Oil and Gas Production and Life Cycle Greenhouse Gas Emissions between the No Action Alternative and Upstream Development Scenarios

Activity	No Action Scenario 1	Proposed Action Scenario 2 (PBU Storage)	Proposed Action Scenario 3 (KRU EOR)
Oil Production			
Oil Production (MMbbl)	1,355 (PBU)	849 (PBU)	1,361 849 (PBU) 512 (KRU)
Change in Oil Production (MMbbl) from Scenario 1 (No Action)	0	-506 (PBU)	+6 -506 (PBU) +512 (KRU)
Major Gas Sales to Gas Treatment Plant (GTP)			
Major Gas Sales Production (Tcf)[a]	0	36.7	36.7
Change in Gas Production (Tcf) from Scenario 1 (No Action)	0	+27.3 (PBU) +9.4 (PTU)	+27.3 (PBU) +9.4 (PTU)
Available Gas for LNG Export			
Available Gas for LNG Export (Tcf)[a]	0	27.83	27.83
Change in Gas Production (Tcf) from Scenario 1 (No Action)	0	+27.83	+27.83
Carbon Dioxide Storage on North Slope of Alaska			
CO_2 Storage (Tcf) **CO_2 Storage (MMmt)**	0	3.87 205	3.87 205
Life Cycle Greenhouse Gas Emissions[b]			
End Use Power Generation (without CCS) in Receiving Destination			
Cumulative Life Cycle GHG Emissions (MMmt CO_2-eq)	3,348 to 3,363	3,151 to 3,226	3,148 to 3,223
Change in Life Cycle GHG Emissions Relative to Scenario 1 (No Action) (MMmt CO_2-eq)	–	*-201 to -132*	*-203 to -135*
End Use Power Generation (with CCS) in Receiving Destination			
Cumulative Life Cycle GHG Emissions (MMmt CO_2-eq)	1,726 to 1,745	1,533 to 1,628	1,530 to 1,625
Change in Life Cycle GHG Emissions Relative to Scenario 1 (No Action) (MMmt CO_2-eq)	–	*-196 to -110*	*-199 to -113*

[a] The PBU and PTU have available natural gas resources to provide essentially all – 27.83 Tcf of the 27.87 Tcf – of the natural gas resources authorized for export (Wallace et al. 2022). Given the conservative nature of the natural gas resources portion of the study, the recently recognized improved operating practices at the PBU (not included in the natural gas resources study), and inherent uncertainties during the authorized export term, the study determines that sufficient natural gas resources would be available to meet the authorized volumes of LNG exports. The difference between Major Gas Sales to the GTP and Available Gas for LNG Export is the reduction in 8.8 Tcf for extraction of CO_2 and fuel use of pipeline grade natural gas to support the GTP, gas pipeline, and liquefaction operations.

[b] GHG emissions for power generation with and without CCS are provided for comparison only. CCS may be implemented by the end users of exported LNG and would not be related to oil and gas production on the North Slope.

CCS = carbon capture and sequestration; CO_2 = carbon dioxide; CO_2-eq= carbon dioxide equivalent; EOR = enhanced oil recovery; GHG = greenhouse gas; GTP = Gas Treatment Plant; KRU = Kuparuk River Unit; LNG = liquefied natural gas; MMbbl = million barrels of oil; MMmt = million metric tons; PBU = Prudhoe Bay Unit; PTU = Point Thomson Unit; Tcf = trillion cubic feet

S.2.2 No Action Alternative

The No Action Alternative considered in this Draft SEIS assumes that the Alaska LNG Project would not be constructed, and the potential environmental impacts and potential benefits that could occur through development and operation of the proposed Project would not be realized.

S.3 IMPACTS OF THE PROPOSED ACTION

S.3.1 Summary of Environmental Impacts in the Draft SEIS By Resource Area

No changes to the proposed Project have occurred since issuance of the 2020 EIS that affect the analysis or conclusions presented within the 2020 EIS. The analysis in this Draft SEIS considers the additional impacts from potential upstream development along with the GHG emission estimates contained within the LCA Study. Table S-2 defines the terms used in this Draft SEIS to describe potential impacts. Table S-3 summarizes the potential environmental impacts of the Proposed Action by environmental resource area. As previously stated, the No Action Alternative assumes the Project would not occur and no impacts as part of the Proposed Action described in the 2020 EIS and in Table S-3 would occur.

Table S-2. Draft SEIS Impact Terminology

Impact Type	Definition
Beneficial	Impact would improve or enhance the resource.
Adverse	Impact would negatively affect the resource.
Negligible	No apparent or measurable impacts are expected, and may also be described as “none,” if appropriate.
Less-than-Significant	The action would have a noticeable or measurable adverse impact on the resource. This category could include minor to moderate impacts or potentially significant impacts that could be reduced by the implementation of mitigation measures.
Significant	The action would have obvious and extensive adverse impacts that could result in potentially significant impacts on a resource despite mitigation measures.
Temporary	Temporary, short-term impacts generally occur during construction with the resource returning to its preconstruction condition almost immediately afterward. A short-term impact could continue for up to 3 years following construction. A subset of temporary impacts would include areas that would be disturbed intermittently for shorter periods during a construction or maintenance phase.
Permanent	Permanent, long-term impacts could occur as a result of any activity that modifies a resource to the extent that it would not return to preconstruction conditions during the life of the portion of the proposed project. An impact is considered long-term if the resource would require more than 3 years to recover.

SEIS = Supplemental Environmental Impact Statement

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Geologic Resources and Geologic Hazard		
PTU	**Construction**	Negligible to less-than-significant: Impacts due to surficial levels of disturbance for majority of construction and dredging activities; no new quarrying necessary. Permanent impacts from drilling of new production wells. Plans and permits for development of wells subject to ADNR approval.
	Operations	Less-than-significant: Permanent impacts due to extraction and diminishment of natural gas resources. Plans and permits for operation of wells subject to ADNR approval.
PBU	**Construction**	Negligible to less-than-significant: Temporary impacts due to surficial levels of disturbance for majority of construction, and permanent impacts from drilling new production and injection wells. Granular fill would be sourced outside of PBU. Plans and permits for development of wells subject to ADNR approval. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant: Permanent impacts due to extraction and diminishment of natural gas resources and from injection of by-product CO_2 into saline formation under Scenario 2. Volume of oil production would decrease from baseline conditions under Scenario 2. Plans and permits for operation of wells subject to ADNR approval.
KRU	**Construction**	Negligible: Impacts due to surficial levels of disturbance for majority of construction; permanent impacts from drilling new wells. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant: Permanent impacts due to extraction and diminishment of natural gas resources and from using by-product CO_2 for CO_2 EOR under Scenario 3, which would alter subsurface composition and pressure. Volume of oil production would increase from baseline conditions under Scenario 3. Plans and permits for operation of wells subject to ADNR approval.
No Action		Adverse effects to geologic resources as described in Section 4.1 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include increases or decreases in oil production and would depend on scenario selection, as identified in the North Slope Production Study. Cumulative impacts from regional projects on existing mineral resources and/or future mineral development and ongoing oil and gas exploration and production would be less-than-significant. Impacts would be mitigated by monitoring, regulation compliance, adherence to project-specific plans, and implementation of mitigation measures. Cumulative impacts from geologic hazards, such as seismicity and mass wasting would be less-than-significant; development of projects would be designed and constructed in accordance with required design standards to mitigate impacts from geologic hazards.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Soils and Sediment		
PTU	**Construction**	Negligible to less-than-significant: Impacts due to disturbance of permafrost and permafrost degradation.
	Operations	Less-than-significant: Impacts due to permafrost degradation.
PBU	**Construction**	Negligible to less-than-significant: Impacts due to disturbance of permafrost and permafrost degradation. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipeline under Scenario 3.
	Operations	Less-than-significant: Impacts due to permafrost degradation.
KRU	**Construction**	Less-than-significant: Impacts due to disturbance of permafrost and permafrost degradation. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant: Impacts due to permafrost degradation.
No Action		Adverse effects to soil and sediments as described in Section 4.2 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include: local increases in soil erosion, sedimentation, and compaction; and permafrost degradation. Due to sensitivity of permafrost from development, cumulative impacts from regional projects on permafrost degradation could be significant, leading to increased soil erosion and sedimentation. Impacts could be mitigated to less-than-significant with implementation of construction mitigation measures and environmental plans.
Water Resources		
PTU	**Construction**	Less-than-significant: Impacts due to degradation of water quality from increased erosion and sedimentation; increased sedimentation from dredging; and water use for ice construction.
	Operations	Less-than-significant: Impacts arising from hydrostatic testing of new pipelines due to water use and disposal of water into injection wells.
PBU	**Construction**	Negligible to less-than-significant: Impacts due to degradation of water quality from increased erosion and sedimentation; risk of accidental release of product during pipeline construction; and water use for ice construction. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant: Impacts arising from hydrostatic testing of new pipelines due to water use and disposal of water into injection wells.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
KRU	**Construction**	Less-than-significant: Impacts due to degradation of water quality from increased erosion and sedimentation. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant: Impacts arising from hydrostatic testing of new pipelines due to water use and disposal of water into injection wells.
No Action		Adverse effects to water resources as described in Section 4.3 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include: increases in withdrawal rates groundwater and surface waters, leading to temporary drawdown; and discharges to water. Cumulative impacts from regional projects would be less-than-significant as activities would be subject to state regulatory requirements. Surface water withdrawals would be subject to permitting limits and reporting to protect aquatic resources; discharges would also be subject to permitting requirements and environmental plans.
Wetlands		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance resulting in increased erosion and sedimentation and degradation of wetland water quality and vegetation. Some permanent fill or temporary or permanent alteration of hydrology or vegetation may occur due to the prevalence of wetlands throughout the area.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance resulting in increased erosion and sedimentation and degradation of wetland water quality and vegetation. Some permanent fill or temporary or permanent alteration of hydrology or vegetation may occur due to the prevalence of wetlands throughout the area. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations.
KRU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance resulting in increased erosion and sedimentation and degradation of wetland water quality and vegetation. Potential adverse impacts would be similar between Scenarios 2 and 3, but with the additional potential impacts from pipelines construction required under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations.
No Action		Adverse effects to wetlands as described in Section 4.4 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Cumulative Impacts		Potential impacts include: permanent loss of wetlands or conversion of wetland types; increased turbidity and sedimentation; changes to wetland values and functions; and increased likelihood of the release of hazardous materials and fuel to wetlands. Cumulative impacts from regional projects could result in significant impacts from permanent loss of wetlands. Implementation of construction BMPs and mitigation permitting requirements should offset potential wetland impacts.
Vegetation		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance and the clearing of existing vegetation within construction areas.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance and the clearing of existing vegetation within construction areas. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations.
KRU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance within an existing ROW and placement of vertical support members and horizontal support members to support the proposed pipeline. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts confined to previously disturbed and approved locations.
No Action		Adverse effects to vegetation as described in Section 4.5 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include ground disturbance and clearing of existing vegetation. Cumulative impacts from regional projects would be less-than-significant due to the existing developed oil and gas infrastructure within the ROI and the likely locations of proposed activities within and directly adjacent to developed areas. Additionally, impacts could be reduced from implementing mitigation measures and plans during and after construction.
Wildlife Resources		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to noise, disturbance, or displacement of local wildlife and surrounding habitat. There is the potential for limited mortality of terrestrial wildlife due to use of the ice road; however, this is unlikely to affect wildlife on a species level, especially due to the limited timeframe of ice road use.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the Central Pad.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to noise, disturbance, or displacement of local wildlife and surrounding habitat. There is the potential for limited mortality of terrestrial wildlife due to presence of heavy machinery to construct the pipeline and vehicles using the ice road; however, this is unlikely to affect wildlife on a species level, especially due to the limited timeframe of ice road use. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the CGF Pad.
KRU	**Construction**	Negligible to less-than-significant. Impacts within existing ROW; therefore, no native habitat would be altered, and the elevated pipelines would not represent new barriers to wildlife movement through the area. There is the potential for limited mortality of terrestrial wildlife due to presence of heavy machinery to construct the pipelines; however, this is unlikely to affect wildlife on a species level. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the KRU.
No Action		Adverse effects to wildlife as described in Section 4.6 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include: increased disturbance, displacement, injury, or mortality of wildlife; and temporary/permanent alteration or reduction in suitable habitat. Cumulative impacts from regional projects would be less-than-significant due to existing developed oil and gas infrastructure within the ROI and the likely locations of proposed activities within and directly adjacent to developed areas. Additionally, impacts could be reduced from implementing mitigation measures and plans during and after construction.
Aquatic Resources		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance resulting in increased erosion and sedimentation to nearby freshwater and marine waterways; drawing water from surface waterbodies for creation of the ice pad and ice road, impinging fish on intake structures; and new impacts to marine species from dredging.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the Central Pad.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
PBU	**Construction**	Negligible to less-than-significant. Impacts due to ground disturbance resulting in increased erosion and sedimentation to nearby freshwater and marine waterways; and drawing water from surface waterbodies for creation of the ice pad and ice road, impinging fish on intake structures. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts from activities confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the CGF Pad.
KRU	**Construction**	Less-than-significant. Impacts due to ground disturbance and associated increase in erosion and sedimentation into surface waters during emplacement of vertical support members. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts confined to previously disturbed and approved locations and similar to ongoing activities currently conducted at the KRU.
No Action		Adverse effects to aquatic resources as described in Section 4.7 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include degradation of water quality, leading to increased disturbance, displacement, injury, or mortality of fish. Cumulative impacts from regional projects would be less-than-significant as standard BMPs, adherence to project-specific plans, and implementation of mitigation measures would minimize impacts.
Threatened, Endangered, and Other Special Status Species		
PTU	**Construction**	Negligible to less-than-significant. Impacts to polar bear critical habitat and spectacled eider nesting habitat due to land development and indirect impacts to sensitive species from noise disturbances. There is the potential for impacts due to dredging activities, but these are not likely to adversely affect species protected by the NMFS.
	Operations	Negligible. Impacts due to noise and mortality of a limited number of individuals due to minor increases in human activity and use of ice roads along new routes. Operational activities generally confined to limited areas in existing disturbed/approved locations and unlikely to adversely affect sensitive species or their habitat.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to noise and the incidental take of a limited number of individuals through increased number of vehicles during construction and use of the proposed ice road; and direct impacts due to disturbance of existing habitat for protected species, including polar bear critical habitat during pipeline construction. Construction activities may affect, but are not likely to adversely affect, federally protected species that may be present in the ROI, including the spectacled eider, Steller's eider, and polar bear. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
	Operations	Negligible. Impacts due to noise and mortality of a limited number of individuals due to minor increases in human activity and use of ice roads along new routes. Operational activities generally confined to limited areas in existing disturbed/approved locations and unlikely to adversely affect sensitive species or their habitat.
KRU	**Construction**	Less-than-significant. Impacts due to disturbance of existing habitat for protected species, including polar bear critical habitat, during pipeline construction. Indirect effects due to construction-related noise. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts due to noise and mortality of a limited number of individuals due to presence of heavy machinery during construction of new pipelines. Operational activities generally confined to limited areas in existing disturbed/approved locations and unlikely to adversely affect sensitive species or their habitat.
No Action		Adverse effects to threatened, endangered, and other special status species as described in Section 4.8 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include the "take" of special status species or the alteration or destruction of critical habitat of ESA-listed, NMFS-protected, or Alaska SGCN species. Cumulative impacts would be less-than-significant and mitigated through consultation efforts with appropriate federal and state agencies, surveys for protected species, and avoidance.
Land Use, Recreation, and Special Interest Areas		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to permanent conversion of open land to developed land for oil and gas industrial use during expansion of the Central Pad, drilling of four new production wells, and drilling of a new underground injection control Class I disposal well.
	Operations	Less-than-significant. Impacts due to permanent land use conversion of open land to developed land for oil and gas industrial use.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to permanent land use conversion of open land to developed land for oil and gas industrial use, though final locations of proposed facilities, including the expansion of the CGF Pad, drilling of new wells, and construction of pipelines are not yet known. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts due to permanent land use conversion of open land to developed land for oil and gas industrial use, though final locations of proposed facilities, including the expansion of the CGF Pad, drilling of new wells, and construction of pipelines are not yet known.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
KRU	**Construction**	Negligible to less-than-significant. Impacts due to permanent land use conversion of open land to developed land for oil and gas industrial use, though proposed distribution pipelines would be constructed within KRU and potentially in developed areas, and the CO_2 pipeline would be constructed within an existing ROW. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant. Impacts due to permanent land use conversion of open land to developed land for oil and gas industrial use.
No Action		Adverse effects to land use, recreation, and special interest areas as described in Section 4.9 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include conversion of open land or open water to developed land. Cumulative impacts from regional projects would be less-than-significant. Land use changes would not occur where portions of a project would lie within existing ROWs, roads, or drill pads.
Visual Resources		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to occurrence of machinery, supplies, land-clearing, artificial nighttime lights, and placement of dredged materials. The setting is already industrial in nature and is not open to the general public.
	Operations	Negligible. Impacts due to the introduction of new structures, though activities would be within the PTU. The setting is already industrial in nature and is not open to the general public.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to the occurrence of machinery, supplies, land-clearing, and artificial nighttime lights. The setting is already industrial in nature and viewshed for general public is limited. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts from the introduction of new structural elements to the viewshed. The setting is already industrial in nature and viewshed for general public is limited.
KRU	**Construction**	Negligible to less-than-significant. Impacts due to occurrence of machinery, supplies, land-clearing, and artificial nighttime lights. The setting is already industrial in nature and is not open to the general public. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts from the introduction of new structural elements to the viewshed. The setting is already industrial in nature and is not open to the general public.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
No Action		Adverse effects to visual resources as described in Section 4.10 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include increased visual contrast with existing or desired landscape conditions. Cumulative impacts from regional projects would be less-than-significant as most projects are located within or adjacent developed settings, having similar visual characteristics and, therefore, would have little to no change in visual contrast.
Socioeconomics		
PTU	**Construction**	Negligible to beneficial. Impacts due to slight, temporary increases in population, purchases of local materials/products and services, employment opportunities across most local industries and sectors, and in state/local government revenues from increased taxes. No changes expected in demand/supply of housing and public services; no disproportionately high and adverse impacts on environmental justice communities.
	Operations	Negligible to beneficial. Impacts similar to construction phase, but extent and level would be less as activities unlikely to increase permanent population. No changes expected in demand/supply of housing and public services; no disproportionately high and adverse impacts on environmental justice communities.
PBU	**Construction**	Negligible to beneficial. Impacts due to slight, temporary increases in population, purchases of local materials/products and services, employment opportunities across most local industries and sectors, and in state/local government revenues from increased taxes. No changes expected in demand/supply of housing and public services, and no disproportionately high and adverse impacts on environmental justice communities.
	Operations	Negligible to beneficial. Impacts similar to construction phase, but extent and level would be less as activities unlikely to increase permanent population. No changes expected in demand/supply of housing and public services, and no disproportionately high and adverse impacts on environmental justice communities.
KRU	**Construction**	Negligible to beneficial. Impacts due to slight, temporary increases in population, purchases of local materials/products and services, employment opportunities across most local industries and sectors, and state/local government revenues from increased taxes. No changes expected in demand/supply of housing and public services, and no disproportionately high and adverse impacts on environmental justice communities.
	Operations	Negligible to beneficial. Impacts similar to construction phase, but extent and level would be less as activities unlikely to increase permanent population. No changes expected in demand/supply of housing and public services, and no disproportionately high and adverse impacts on environmental justice communities.
No Action		Effects to socioeconomics as described in Section 4.11 of the 2020 EIS would not occur as the proposed Project would not be constructed. Since construction and operations of the proposed Project would not occur, no changes to the existing socioeconomic conditions or effects to minority or low-income populations would occur. Beneficial impacts to the local economy as described for upstream development under Scenarios 2 and 3 would not occur.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Cumulative Impacts		Potential impacts related to population growth include increased tax revenues, employment, and spending. Cumulative impacts from regional projects could result in beneficial to negligible effects; however, change in local residences and spending activity is not expected to be substantial due to rotational work schedules and on-site work camps.
Transportation		
PTU	**Construction**	Negligible to less-than-significant. Impacts on roads due to increased traffic delays and congestion though limited to near/within PTU footprint and limited to roads for industrial use; majority of equipment, material, and modules would be transported via marine vessels and impact marine traffic due to increased congestion, delays, and hazards at/near Thomson Marine Facilities; and increases in delays at Deadhorse Airport and Point Thomson airstrip due to transport of workers at beginning and end of construction cycles.
	Operations	Negligible. Impacts on roadways limited to industry-used roads; volume of equipment and material deliveries via marine vessels would be minimal; personnel use of Deadhorse Airport and Point Thomson airstrip would be minimal.
PBU	**Construction**	Negligible to less-than-significant. Impacts on roads due to increased traffic delays and congestion on Dalton Highway, Spine Road, and local roads, though limited to routes leading to construction camps and work sites within industrial areas; shuttle buses would transport workers between camps and work sites; equipment, material, and modules would be transported via marine vessels and impact marine traffic due to increased congestion, delays, and hazards at/near West Dock Causeway in Prudhoe Bay; increases in delays at Deadhorse Airport due to transport of workers at beginning and end of construction cycles.
	Operations	Negligible. Impacts on roads due to minimal increases in traffic delays and congestion on Dalton Highway, Spine Road, and local roads; minimal increases in marine vessels; minimal increases in delays at Deadhorse Airport from transporting personnel.
KRU	**Construction**	Negligible to less-than-significant. Impacts on roads due to increased traffic delays and congestion on local roads, though limited to routes leading to construction camps and work sites within industrial areas; equipment, material, and modules would be transported via marine vessels and impact marine traffic due to increased congestion, delays, and hazards at/near West Dock Causeway in Prudhoe Bay; increases in delays at Deadhorse Airport due to transport of workers at beginning and end of construction cycles.
	Operations	Negligible. Impacts on roadways limited to industry-used roads; volume of equipment and material deliveries via marine vessels would be minimal; personnel use of Deadhorse Airport would be minimal.
No Action		Adverse effects to transportation resources as described in Section 4.12 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Cumulative Impacts		Potential impacts include increases in traffic volumes leading to increased congestion, delays, and safety risks for road, marine, and air transportation. Cumulative impacts from regional projects would mainly occur during construction and be less-than-significant. Location and magnitude of impacts would depend on timing of projects. Transportation resources that would overlap with use by general public within ROI primarily include Dalton Highway and Deadhorse Airport.
Cultural Resources		
PTU	**Construction**	Negligible to less-than-significant. Impacts limited to archaeological resources due to ground disturbance; no documented historic structures exist within vicinity of Central Pad and docking facilities. Project proponent for the PTU Expansion would conduct the necessary surveys to identify any historic properties within the APE. Permits for well drilling issued by the AOGCC would require review/approval by the ADNR, which includes the Office of History and Archaeology regarding protection of cultural resources.
	Operations	Negligible. Impacts unlikely as operational activities would be confined to existing disturbed/approved locations.
PBU	**Construction**	Negligible to less-than-significant. Impacts limited to archaeological resources due to ground disturbance; no documented historic structures exist within vicinity of CGF Pad and potential location of new wells and pipelines. Project proponent for the PBU MGS Project would conduct the necessary surveys to identify any historic properties within the APE. Permits for well drilling issued by the AOGCC would require review/approval by the ADNR, which includes the Office of History and Archaeology regarding protection of cultural resources. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts unlikely as operational activities would be confined to existing disturbed/approved locations.
KRU	**Construction**	Less-than-significant. Impacts limited to archaeological resources due to ground disturbance; no documented historic structures exist within vicinity of existing injection well sites at KRU or along the existing Kuparuk Pipeline and Kuparuk Extension Pipeline. Project proponent for the KRU EOR would conduct the necessary surveys to identify any historic properties within the APE. Permits for well drilling issued by the AOGCC would require review/approval by the ADNR, which includes the Office of History and Archaeology regarding protection of cultural resources. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible. Impacts unlikely as operational activities would be confined to existing disturbed/approved locations.
No Action		Adverse effects to cultural resources as described in Section 4.13 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Cumulative Impacts		Potential impacts could include: destruction or damage to all, or a portion, of a historic property; alteration of a property including restoration, rehabilitation, repair, maintenance, or stabilization inconsistent with federal standards; removal of the property from its historic location; change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; and introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features. As a large portion of Alaska, including the North Slope, remains unsurveyed, significant cumulative adverse effects could occur if present in areas of the regional projects. Coordination with SHPO and interested tribes, as applicable in accordance with the NHPA, could avoid or mitigate adverse effects.
Subsistence		
PTU	**Construction**	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife, vegetation, aquatic); potential for contamination in vegetation and wildlife/aquatic habitats; increased costs and greater travel to harvest resources; increased competition for resources; and changed migration patterns for large terrestrial mammal and aquatic species. Terrestrial subsistence impacts would primarily occur to the Kaktovik community as their subsistence area overlaps with PTU, PBU, and KRU. Impacts to marine harvests, however, could occur to both the Kaktovik and Nuiqsut communities as both communities conduct marine mammal harvests in marine waters of the ROI.
	Operations	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife and vegetation); potential for contamination in vegetation and wildlife habitat.
PBU	**Construction**	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife, vegetation); potential for contamination in vegetation and wildlife habitat; increased costs and greater travel to harvest resources; increased competition for resources; and changed migration patterns for large terrestrial mammal species. Terrestrial subsistence impacts would primarily occur to the Kaktovik community as their subsistence area overlaps with PTU, PBU, and KRU. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife and vegetation); potential for contamination in vegetation and wildlife habitat. Greater impacts would occur for locations where new pipeline could not be placed in an existing ROW.
KRU	**Construction**	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife, vegetation); potential for contamination in vegetation and wildlife habitat; increased costs and greater travel to harvest resources; increased competition for resources; and changed migration patterns for large terrestrial mammal species. Terrestrial subsistence impacts would primarily occur to the Kaktovik community as their subsistence area overlaps with PTU, PBU, and KRU. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
	Operations	Less-than-significant. Impacts due to decreased availability and accessibility of resources (wildlife and vegetation); potential for contamination in vegetation and wildlife habitat. Greater impacts would occur for locations where new pipeline could not be placed in an existing ROW.
No Action		Adverse effects to subsistence as described in Section 4.14 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts could include: decrease in resource availability; increase in competition for local resources and supplies; and decrease in availability of wildlife resources, specifically caribou for regional communities. Cumulative impacts from regional projects could result in significant adverse impacts to specific subsistence users in the ROI; however, it is assumed that communities as a whole would use other areas within the region for subsistence, away from oil and gas development activities.
Air Quality		
PTU	**Construction**	Less-than-significant. Impacts due to increased air emissions from ground-disturbing activities, vehicles transporting equipment/materials, and operation of drilling, dredging, and general construction equipment.
	Operations	Less-than-significant. Impacts due to increased emissions from operation equipment.
PBU	**Construction**	Less-than-significant. Impacts due to increased air emissions from ground-disturbing activities, vehicles transporting equipment/materials, and operation of drilling and general construction equipment. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Less-than-significant. Impacts due to increased air emissions from operation equipment, including new valve module heating and fugitive emissions of organic compounds emitted from piping components and connectors. Reduction of net PBU emissions as PBU turbine usage for gas reinjection would be reduced.
KRU	**Construction**	Less-than-significant. Impacts due to increased air emissions from ground-disturbing activities, vehicles transporting equipment/materials, and operation of drilling and general construction equipment. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts from increased air emissions from operation equipment. Operation of new pipeline compressor stations would result in air emissions, in addition to emissions from well operations and maintenance.
No Action		Adverse effects to air quality as described in Section 4.15 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Cumulative Impacts		Potential impacts during construction include increases in air pollutants resulting from fugitive dust, equipment, and other stationary sources and mobile-source emissions. Cumulative impacts from regional projects would be less-than-significant given the temporary and localized nature of the dust emissions, as well as the ability to mitigate as needed. Potential impacts during operation include increases in air pollutants resulting from: mobile-source emissions; indirect emissions from electrical power plants; and fugitive emissions at well sites and facilities. To reduce emissions, operators could develop a fugitive dust control plan to minimize fugitive dust.
Noise		
PTU	**Construction**	Less-than-significant. Impacts due to intermittent, localized increases in noise levels from use of construction and drilling equipment; increased underwater noise levels from dredging activities; and increased noise levels from transporting equipment and materials along ice roads.
	Operations	Negligible to less-than-significant. Impacts due to increased noise levels from maintenance and monitoring activities.
PBU	**Construction**	Less-than-significant. Impacts due to intermittent, localized increases in noise levels from use of construction and drilling equipment; increased noise levels from transporting equipment and materials along regional roads. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts due to increased noise levels from maintenance and monitoring activities.
KRU	**Construction**	Less-than-significant. Impacts due to intermittent, localized increases in noise levels from use of construction and drilling equipment; increased noise levels from transporting equipment and materials along regional roads. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts due to increased noise levels from maintenance and monitoring activities.
No Action		Adverse effects to noise as described in Section 4.16 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include increased noise levels, which would mainly occur during construction and be temporary. Cumulative impacts from regional projects would be minor as construction noise would be intermittent, temporary, and generally managed in conformance with federal, state, and local codes and ordinances, and manufacturer-prescribed safety procedures and industry practices. Long-term perceptible increases in ambient noise levels to sensitive receptors would be negligible as development of projects would occur at separate locations and, therefore, would not contribute to cumulative impacts.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
Public Health and Safety		
PTU	**Construction**	Negligible to less-than-significant. Impacts due to increased transmission rate of disease and increased strain on healthcare system from increase in workforce; community access to water and sanitary systems not expected to change.
	Operations	Negligible to less-than-significant. Impacts from rates of infectious diseases, increased strain on healthcare resources, and community access to water and sanitary systems not expected to change. Impacts from increasing chronic respiratory conditions to sensitive populations could result from air emissions from operation activities.
PBU	**Construction**	Negligible to less-than-significant. Impacts due to increased transmission rate of disease and increased strain on healthcare system from increase in workforce; community access to water and sanitary systems not expected to change. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts from rates of infectious diseases, increased strain on healthcare resources, and community access to water and sanitary systems not expected to change. Impacts from increasing chronic respiratory conditions to sensitive populations could result from air emissions from operation activities.
KRU	**Construction**	Negligible to less-than-significant. Impacts due to increased transmission rate of disease and increased strain on healthcare system from increase in workforce; community access to water and sanitary systems not expected to change. Potential adverse impacts similar between Scenario 2 and Scenario 3, with the exception of the proposed injection wells under Scenario 2 and the proposed pipelines under Scenario 3.
	Operations	Negligible to less-than-significant. Impacts from rates of infectious diseases, increased strain on healthcare resources, and community access to water and sanitary systems not expected to change. Impacts from increasing chronic respiratory conditions to sensitive populations could result from air emissions from operation activities.
No Action		Adverse effects to public health and safety as described in Section 4.17 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		Potential impacts include: increase in accidents (from transportation- or workplace-related activities) resulting in fatal injuries; increase in chronic respiratory conditions to sensitive populations; and increase in transmission of diseases. Cumulative impacts from regional projects would be less-than-significant. BMPs to reduce emissions, enforcement of required safety training, and implementation of safety plans would minimize accidents and safety risks to general public health.
Reliability and Safety		
PTU	**Construction**	N/A
	Operations	Negligible. Impact due to increased risk of a potential release from new wells.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit		Summary of Potential Impacts
PBU	**Construction**	N/A
	Operations	Negligible. Impact due to increased risk of a potential release from new wells.
KRU	**Construction**	N/A
	Operations	Negligible. Impact due to potential for spill incident (total of 49 miles of proposed new CO_2 pipeline results in anticipated incident rates of approximately 0.037 small spill per year, 0.01 medium spill per year, 0.004 large spill per year, and 0.001 catastrophic spill per year along the new pipelines).
No Action		Adverse effects to reliability and safety as described in Section 4.18 of the 2020 EIS would not occur as the proposed Project would not be constructed. In addition, upstream development impacts within the PTU, PBU, and KRU under Scenarios 2 and 3 would be unlikely to occur.
Cumulative Impacts		For spills or releases to have cumulative effect, incidents would need to affect two or more pipelines, and resulting spills or releases would need to occur near and within timeframes so that plumes from releases would overlap. While each new well or pipeline would introduce a new potential location of a release, this slight increase in risk represents a negligible adverse impact on cumulative reliability and safety.
Greenhouse Gases and Climate Change		
Scenario 1 (No Action)		Life cycle GHG emissions under Scenario 1 would depend on the destination country where LNG is ultimately consumed and on whether CCS technology is in use at the destination facility. If CCS is assumed to be in use at the destination facility, GHG emissions under Scenario 1 would be approximately 1,726 to 1,745 MMmt CO_2-eq per year, depending on the country where LNG is ultimately consumed. Without CCS, emissions would be approximately 3,348 to 3,363 MMmt CO_2-eq per year.
Scenario 2		Less-than-significant. Exporting LNG from the North Slope would not increase GHG emissions when providing the same services to society (through production of natural gas and oil) as the No Action Alternative. Life cycle GHG emissions under Scenario 2 would depend on the destination country where LNG is ultimately consumed and on whether CCS technology is in use at the destination facility. If CCS is assumed to be in use at the destination facility, GHG emissions under Scenario 2 would be approximately 110 to 196 MMmt CO_2-eq per year lower than under the No Action Alternative, depending on the country where LNG is ultimately consumed. Without CCS, emissions would be approximately 132 to 201 MMmt CO_2-eq per year lower than under the No Action Alternative.
Scenario 3		Less-than-significant. Exporting LNG from the North Slope would not increase GHG emissions when providing the same services to society (through production of natural gas and oil) as the No Action Alternative. Life cycle GHG emissions under Scenario 3 would depend on the destination country where LNG is ultimately consumed and on whether CCS technology is in use at the destination facility. If CCS is assumed to be in use at the destination facility, GHG emissions under Scenario 3 would be approximately 113 to 199 MMmt CO_2-eq per year lower than under the No Action Alternative, depending on the country where LNG is ultimately consumed. Without CCS, emissions would be approximately 135 to 203 MMmt CO_2-eq per year lower than under the No Action Alternative.

Table S-3. Summary of Environmental Impacts from North Slope Development

Unit	Summary of Potential Impacts
Cumulative Impacts	Potential impacts include: increase in GHG emissions from construction- and operation-related equipment, vehicles, and facilities. Cumulative impacts from development of projects would contribute incrementally to global climate change, which is a significant phenomenon that is inherently cumulative in nature and is occurring as a result of human activities across the globe. Environmental effects from climate change include changes to temperature and precipitation, ice cover and sea level rise, ocean temperatures and chemistry, land-based ecosystems, extreme weather events, and impacts to human health and society.

ADNR = Alaska Department of Natural Resources; AOGCC = Alaska Oil and Gas Conservation Commission; APE = Area of Potential Effect; BMP = best management practice; CCS = carbon capture and sequestration; CGF = Central Gas Facility; CO_2 = carbon dioxide; CO_2-eq = carbon dioxide equivalent; EIS = Environmental Impact Statement; EOR = enhanced oil recovery; ESA = Endangered Species Act; GHG = greenhouse gas; KRU = Kuparuk River Unit; LNG = liquefied natural gas; MGS = Major Gas Sales; MMmt = million metric tons; N/A = not applicable; NHPA = National Historic Preservation Act; NMFS = National Marine Fisheries Service; PBU = Prudhoe Bay Unit; PTU = Point Thomson Unit; ROI = region of influence; ROW = right-of-way; SGCN = Species of Greatest Conservation Need; SHPO = State Historic Preservation Office