Appendix C

Draft Section 404 (b)(1) Guidelines Evaluation

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OCTOBER 2011

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Clean Water Act Section 404(b)(1) Guidelines Evaluation for the Point Thomson Project

POA-2001-1082-M1, Beaufort Sea

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List of Acronyms and Abbreviations

ACP	Arctic Coastal Plain
Arctic Refuge	Arctic National Wildlife Refuge
Corps	U.S. Army Corps of Engineers
CPF	Central Processing Facility
CWA	Clean Water Act
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ExxonMobil	Exxon Mobil Corporation
LEDPA	least environmentally damaging practicable alternative
LRD	long reach directional
NEPA	National Environmental Policy Act
NSB	North Slope Borough
ODPCP	Oil Discharge Prevention and Contingency Plan
RHA	Rivers and Harbors Act
ROD	Record of Decision
SPMT	self-propelled modular transporter
TAPS	Trans-Alaska Pipeline System
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
VSM	vertical support members

1. Introduction

The ExxonMobil Development Company (the Applicant) proposes to construct an oil and gas development project at Point Thomson on the northern edge of Alaska's Arctic Coastal Plain (ACP) adjacent to the Beaufort Sea (ExxonMobil 2011a). The proposed project would include the discharge of fill material into 276.5 acres of jurisdictional waters of the United States (U.S.) as part of the construction of the facility. The discharge of fill material into waters of the U.S. requires a Department of the Army permit from the U.S. Army, Corps of Engineers (Corps) under Section 404 of the Clean Water Act (CWA).

As part of its permitting decision regarding the Point Thomson Project, the Corps must evaluate the compliance of the proposed project with the Section 404(b)(1) Guidelines (Guidelines)[1]. This document constitutes a draft of the Corps' Point Thomson Project evaluation of compliance with the Guidelines. This document has been prepared to serve three primary purposes:

1) To present the preliminary information that will ultimately be used as part of the Corps' 404(b)(1) compliance determination and decision-making process regarding the proposed Point Thomson Project

2) To inform the public of the Corp's decision-making process with respect to the 404(b)(1) compliance evaluation of the Point Thomson Project and to invite the public to participate and provide comments relevant to the Guidelines compliance evaluation.

3) To highlight gaps in information and issues of concern related to the Applicant's proposed Point Thomson project.

Notably, this draft Guidelines evaluation is based on the information contained in the Draft Environmental Impact Statement (Draft EIS), and is provided for information. The Corps will not finalize its Guidelines compliance determination regarding the Point Thomson Project permit application until after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS. After the Corps has published the Final EIS, a Record of Decision (ROD) will be issued describing the Corps' decision on the permit application and its determination of whether the Point Thomson Project complies with the Guidelines.

1.1 PROJECT BACKGROUND

The proposed Point Thomson Project would allow for the development of the Thomson Sand reservoir for hydrocarbon production and further exploration. Development of the project would include the fill of jurisdictional wetlands for the construction of a central gravel pad for wells and facilities, two lateral gravel pads for additional wells, an airstrip, a service dock, a sealift facility and barge mooring dolphins, a gravel mine site, infield gravel roads, and infield gathering pipelines. A 22-mile-long export pipeline would be constructed to transport hydrocarbon liquids from Point Thomson to the existing common carrier pipelines at the Badami Development to the west. The project would also include infrastructure such as communications towers and staging facilities at Badami, Prudhoe Bay, and Deadhorse. A complete description of the Applicant's proposed project appears in Section 2.4.3 of the Draft EIS

[1] 40 CFR 230. The Section 404(b)(1) Guidelines, prepared by EPA, are the substantive criteria used by the Corps for the evaluation of a Section 404 permit.

1.1.1 Project Area

The proposed project is located at Point Thomson on the coast of Lion Bay and the Beaufort Sea, 60 miles east of Deadhorse and Prudhoe Bay and 60 miles west of the village of Kaktovik. The project area is defined to extend eastward from Deadhorse to the Staines River, and from the lagoon side of Flaxman Island and the Maguire Islands along the Beaufort Sea coast to approximately 8 miles south of the coast line. Most of the Thomson Sand Reservoir is offshore under state coastal waters, while most of the proposed facilities would be located on land. The western boundary of the Arctic Refuge is approximately 2 miles from the easternmost extent of the proposed project. An export pipeline and transportation routes would extend from the Point Thomson facilities to existing facilities to the west. There are currently no pipelines or permanent roads leading to the project area from the industrial facilities elsewhere on the North Slope. The Point Thomson Project would be the first permanent oil and gas infrastructure in the remote region of the eastern North Slope.

Ecosystems on the North Slope are shaped by the extreme conditions of the climate. The average minimum winter temperature in the project area of -24^{O}F while in the summer, the average maximum temperature is only 55^{O}F despite continuous daylight. The project area is covered with snow for about 8 months of the year; however, snow may fall at any time of the year. Soils in the project area are characterized by thick permafrost, which leads to waterlogging of surface soils. As a result, the Point Thomson area is characterized by extensive wetlands and water bodies. Less than one percent of the mapped project area is comprised of uplands (see Section 3.8m of the Draft EIS). Drainage in the project area is generally north and occurs via wetlands, small streams, larger streams, and rivers. Out of channel sheetflow is also common during spring breakup and peak water flow. The primary streams, rivers, and lakes provide habitat for anadromous and resident fish. The project area also provides habitat for numerous species of birds and terrestrial and marine mammals.

1.2 THE CORPS' AUTHORITY AND SCOPE OF ANALYSIS

1.2.1 Section 404 of the Clean Water Act

Many activities that impact wetlands and water bodies of the United States (U.S.) are subject to the jurisdiction of the Corps under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act (RHA) of 1899. Under Section 404 of the CWA, the Corps has authority to permit the discharge of dredged or fill material in waters of the U.S. while the authority to permit work and the placement of structures in navigable waters of the U.S. is delegated to the Corps under Section 10 of the RHA[2].

The permit application evaluation requirements of Section 404 of the CWA are guidelines developed by the Environmental Protection Agency (EPA) in conjunction with the Corps and codified in 40 CFR Part 230. Under Subpart B of the 404(b)(1) Guidelines, the Corps' evaluation of the Point Thomson Project is required to address four tests that the project must meet in order to receive a Section 404 permit. These tests include:

- **40 CFR 230.10 (a)**: Whether there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. The alternative identified by this test is referred to as the *least environmentally damaging practicable alternative* or the LEDPA. The

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[2] The authority to issue or deny permits related to actions under both the CWA and RHA is delegated to the Corps' District Commander by 33 CFR 325.8.

evaluation of the proposed Point Thomson project with respect to this compliance test may be found in Chapter 2, Finding of Practicable Alternatives;

- **40 CFR 230.10 (b):** Whether the discharge would violate any applicable state water quality standards, Section 307 of the CWA, the Endangered Species Act (ESA), or federal laws concerning marine sanctuaries. The evaluation of the proposed Point Thomson project with respect to this compliance test may be found in Chapter 3, Restrictions on Discharge;
- **40 CFR 230.10 (c):** Whether the discharge would cause or contribute to significant degradation of the waters of the U.S. The evaluation of the proposed Point Thomson project with respect to this compliance test may be found in Chapter 4, Finding of No Significant Degradation.
- **40 CFR 230.10 (d):** Whether appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem. The evaluation of the proposed Point Thomson project with respect to this compliance test may be found in Chapter 5, Minimization of Potential Adverse Impacts.

The evaluation of a proposed project under all four of the tests listed above constitutes a determination of compliance with the Guidelines.

While making a compliance determination, the Corps may gather information sufficient to support and make its decisions by soliciting comments from other Federal, Tribal, State, and local resource agencies and the public. The Corps, however, is solely responsible for reaching a decision on the merits of the permit application including determination of the project purpose, the extent of the alternatives analysis, which alternatives are practicable, the LEDPA, the amount and type of mitigation that is to be required, and all other aspects of the decision-making process (Corps 2009).

1.2.2 National Environmental Policy Act

Because the required permit authorization from the Corps is a major federal action, the Corps is also the lead federal agency in the preparation of an EIS required under National Environmental Policy Act (NEPA)[3]. The Corps is being assisted in the NEPA process by several Cooperating Agencies, including the EPA, U.S. Fish and Wildlife Service (USFWS), and the State of Alaska. Responsibilities of the Cooperating Agencies include assisting the Corps in identifying issues of concern and providing meaningful and timely comment and input throughout the NEPA process.

According to the Guidelines, the NEPA alternative and impact analysis should provide information sufficient for the evaluation of compliance with the Guidelines. As stated in the Guidelines “For actions subject to NEPA, where the Corps of Engineers is the permitting agency, the analysis of alternatives required for NEPA environmental documents, including supplemental Corps’ NEPA documents, will in most cases provide the information for the evaluation of alternatives under these Guidelines.” Similarly, the Corps’ Standard Operating Procedures for the Corps’ Regulatory Program state that “districts should not conduct or document separate alternatives analyses for NEPA and the 404(b)(1) Guidelines” (Corps 2009).

The Draft EIS was prepared by the Corps to meet the NEPA and Guidelines requirements under the Corps’ regulatory program. The Corps developed the Draft EIS cognizant of the requirements of the

[3] Guidance for NEPA implementation under the Corps’ regulatory program is published in Appendix B of 33 CFR Part 325.

Guidelines. Alternatives were developed so that the LEDPA should be included in the alternatives and their collective components, and no additional alternatives will need to be developed as part of the Corps' Guidelines evaluation process. Notably, this draft Guidelines evaluation is not intended to replace any of the findings or conclusions in the Draft EIS. Rather, this draft Guidelines evaluation document builds on the alternatives and impact analysis developed within the Draft EIS, with a focus on the specific decision-making framework required by the Guidelines.

As a result of the development of the Draft EIS within the context of the 404(b)(1) evaluation process, this draft Guidelines evaluation relies on the findings and conclusions of the Draft EIS. For example, the Draft EIS establishes the range of reasonable alternatives to the Applicant's proposed project. These alternatives provide a starting point for the Corps' practicability analysis under the Guidelines. The Draft EIS also analyzes the potential direct, indirect, and cumulative impacts of the development of the Point Thomson Project under each of the Draft EIS action alternatives. This analysis serves as the starting point for the Corps' evaluation of the impact of alternatives and alternative components to waters of the U.S. and special aquatic sites. Information from the Draft EIS is incorporated extensively into this draft Guidelines evaluation both by reference and through the direct use of information contained therein.

2. Finding of Practicable Alternatives (40 CFR 230.10 (a))

The first compliance test of the Guidelines states that:

> *Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.*

The Guidelines define a practicable alternative as one that is "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.10 (a)(2))." This chapter will form the basis of the Corps' analysis of practicable alternatives for the Guidelines evaluation.

The first compliance test of the Guidelines establishes two presumptions that must be rebutted if a proposed project would have impacts to special aquatic sites[4] and waters of the U.S. First, the guidelines state that when an activity associated with the discharge of dredged or fill material in a special aquatic site does not require access or proximity to that special aquatic site to fulfill its basic purpose, then the activity is not "water dependent" and practicable alternatives that do not include impacts to special aquatic sites are presumed to exist unless clearly demonstrated otherwise. Second, the Guidelines also establish that all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. The evaluation of the water dependency of the Point Thomson Project and the availability of practicable alternatives that do not involve special aquatic sites is discussed in Section 2.1.2 below.

After evaluating the water dependency of the proposed project, the Corps must then consider the full range of practicable alternatives that are capable of achieving the overall project purpose. The overall project purpose, as defined by the Corps, is discussed in Section 2.1.3. According to the Guidelines, the Corps' consideration of practicable alternatives should also consider:

i) Activities which do not involve a discharge of dredged or fill materials into waters of the U.S. or ocean waters; and

ii) Discharges of dredged or fill material at other locations in waters of the U.S. or ocean waters.

The evaluation of practicable alternatives in this section is based on the range of reasonable alternatives developed through the Draft EIS alternatives development process. As discussed above, the Draft EIS alternatives development process was implemented in a manner cognizant of the requirements of the Guidelines such that the range of reasonable alternative identified for the Draft EIS can provide a starting point for the Corps' practicability analysis under the Guidelines. Thus, Draft EIS alternatives form the basis from which the Corps will identify practicable alternatives and determine if the Applicant's proposed project is the least environmentally damaging practicable alternative (i.e. the LEDPA). The

[4] *Special aquatic sites are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region (40 CFR 230.3).These include wetlands, sanctuaries and refuges, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes.*

Draft EIS alternatives are discussed in Section 2.3 of this draft Guidelines evaluation. Discussion of the practicability analysis methodology and preliminary discussion on practicability themes can be found in Section 2.4.

2.1 PROJECT PURPOSE

Establishing the underlying purpose and need for the project is a key step in the evaluation of a project under the Guidelines. Corps' regulations require three ways of examining the underlying goals, or purpose, of a project:

1) The Applicant's stated purpose and need;
2) A "basic" purpose defined by the Corps specifically for addressing a project's water dependency;
3) An "overall" purpose, which is defined by the Corps and takes into account the Applicant's stated purpose and need (33 CFR 325 Appendix B).

These three statements of the project purpose and need form the basis by which the Corps will evaluate the project under the Guidelines, and were also used as part of identifying the project purpose for the NEPA process. The three statements are developed to meet distinct objectives within the Corps' evaluation of the project's compliance with the Guidelines, but may overlap to some extent.

2.1.1 Applicant's Stated Purpose and Need

The Applicant's stated purpose and need are discussed in detail in Section 1.2.1 of the Draft EIS and in the Applicant's Final Department of the Army Permit Application (ExxonMobil 2011a). The Applicant's stated purpose and need is an expression, typically in the Applicant's own words, of the underlying goals for a proposed project. The Corps takes an applicant's purpose and need into account when determining the Corps' overall purpose.

2.1.2 The Corps' Basic Project Purpose

The Corps defines the basic project purpose and uses it to determine water dependency. An activity is defined as not water dependent if it does not require access or proximity to, or siting within, a special aquatic site to fulfill its basic purpose (40 CFR 230.10(a)(3)). If an activity or project is not water dependent, alternatives that do not involve impacts to special aquatic sites are presumed to be available, and to be less damaging, unless clearly demonstrated otherwise.

The Point Thomson Project's basic project purpose, as defined by the Corps, is: 1) to produce and transport hydrocarbon liquids, and 2) to delineate and test for oil and natural gas extraction. The exploration, production, and extraction of hydrocarbon resources are not activities that require access or proximity to a special aquatic site to achieve their goal. Therefore, the Corps finds that the basic purpose of the project is not water dependent, which requires that the Corps evaluate the rebuttable presumption that practicable alternatives that do not involve special aquatic sites are available.

Although the Point Thomson Project is not water dependent, the Corps understands practicable alternatives that do not impact waters of the U.S. and/or special aquatic sites do not exist as a result of geographical and technological constraints on project siting. The Thomson Sand reservoir is located beneath wetlands and other waters of the US, with the majority of the reservoir being located offshore. Access to the hydrocarbon reservoir is constrained to a zone defined by the technological limits of drilling. These limits constrain the location of potential drilling and well pads to on and offshore locations in the Point Thomson area and in close proximity to the Beaufort Sea Coastline.

As part of the Draft EIS alternative development process (see Section 2.2), the Corps and Cooperating Agencies examined a full range of alternatives to determine if practicable alternatives that do not involve special aquatic sites exist. The Corps and Cooperating Agencies excluded offshore development from further consideration due to the added environmental risk associated with offshore development and the uncertain regulatory environment as perceived during development of the Applicant's previous 2002 proposal for offshore development and following the Deepwater Horizon oil spill in the Gulf of Mexico (see Section 2.2.2 Viability Analysis). As a result, all reasonable alternatives considered by the Corps for the Draft EIS and the Guidelines analysis include onshore development near the coastline in the Point Thomson area.

The onshore locations in the Point Thomson area are characterized by extensive wetland and water body cover. Less than one percent of the Point Thomson project area has been identified as uplands. With the prevalence of special aquatic sites in the ACP and the geographical constraints on the location of the Point Thomson Project, it has been clearly demonstrated that impacts to special aquatic sites are unavoidable under all reasonable alternatives and a practicable alternative that does not involve special aquatic sites does not exist. Thus, the Corps may authorize the proposed project, although it is not defined as water dependent, provided the activity is in compliance with other Guidelines requirements, that the action is not contrary to the public interest, and that all other applicable regulatory requirements are met (33 CFR 325).

2.1.3 The Corps' Overall Project Purpose

The Corps uses the overall project purpose to define alternatives for evaluation in the EIS and to determine if the Applicant's proposed project is the LEDPA. According to Corps' guidance, the overall purpose must be specific enough to define the Applicant's project, but not so restrictive as to preclude all discussion of alternatives to the Applicant's proposed project (Corps 2009). The Point Thomson Project's overall project purpose as defined by the Corps is:

1) To produce hydrocarbon liquids from the Thomson Sand reservoir; and
2) To further evaluate and delineate the Thomson Sand reservoir and evaluate the Brookian Group sandstones.

See Draft EIS Section 1.2.3 for additional discussion of the Corps' overall purpose.

2.2 ALTERNATIVES DEVELOPMENT

Having established the basic and overall purposes of the Point Thomson Project, the Corps then conducted a multistep alternatives development process as part of the NEPA process and to initiate evaluation of the proposed project under the first testing requirement of the Guidelines. As part of this process, the Corps and Cooperating Agencies developed and screened a full range of alternatives in light of the overall project purpose described in Section 2.1, Project Purpose. The goal of this process was to consider the broadest range of possible alternatives and to identify the range of reasonable alternatives that could meet the overall project purpose and that would advance for comparative analysis in the Draft EIS. The intent of the iterative process was to eliminate infeasible and unreasonable concepts and alternatives as early in the process as practical to allow the Corps and the Cooperating Agencies to focus on more feasible concepts and alternatives. Alternative evaluation criteria for each step were identified early in the alternatives development process.

As a result, the range of reasonable alternatives identified by the Corps in the Draft EIS forms the starting point for the evaluation of practicable alternatives to Applicant's proposed project and determination if the Applicant's proposed project is the LEDPA. By examining the full scope of possible alternatives and systematically narrowing down potential alternatives to incorporate all reasonable alternatives in the Draft EIS, the Corps believes that it has captured all of the alternatives necessary to determine whether the Applicant's proposed project is the LEDPA.

Furthermore, the Corps structured the Draft EIS development process to allow for the consideration of alternative components within the context of the Draft EIS alternatives (e.g. infield ice roads, a 3,700 ft long airstrip, no barge access). This provides the Corps with the flexibility to evaluate the existence of practicable alternative components to elements of the Applicant's proposed project in the Corps' determination of whether or not the Applicant's proposed project is the LEDPA.

The Draft EIS alternative development process is described in Sections 2.2.1 through 2.2.3 below.

2.2.1 Conceptual Themes and Component Options

The initial step in the Draft EIS alternative development process was identification of possible alternative concepts capable of achieving the overall purpose of the project. During public scoping, a number of potential concerns and issues associated with the Point Thomson Project were identified and many alternative concepts for addressing the project purpose were suggested. The Corps and Cooperating Agencies used those suggestions to develop a broad set of nine alternative conceptual themes:

- Concept 1: No Action - as required by the CEQ guidelines
- Concept 2: Applicant's Proposed Action
- Concept 3:Minimizing Coastal Impacts
- Concept 4: Minimizing Infrastructure
- Concept 5: Maximizing Reservoir Access
- Concept 6: Limiting Activity Near the Refuge
- Concept 7: Maximizing Production
- Concept 8: Minimizing Onsite Activity
- Concept 9: Accommodating Significant Future Activity

Different component options, including alternative facility layouts, equipment, and strategies that could be used with different conceptual themes were also discussed for their ability to help meet the purposes of the proposed project and minimize impacts with the end goal of creating feasible concepts. Specific details of all of these conceptual themes and components can be found in Sections 2.2.1, Conceptual Theme Development and 2.2.2, Component Options, of the Draft EIS.

2.2.2 Viability Analysis

The identified alternative concepts and components were assessed based on their viability, which incorporated their ability to meet the Corps overall purpose; the technological feasibility of the concept or component; the extent to which the concept or component would ultimately accommodate full-field development; and a general assessment of the concept's environmental risks. The viability analysis also considered if the theme or component seemed reasonable in terms of past permit experience such as whether similar projects have been permitted in the past, and whether a particular theme or concept was distinct from other concepts. Table 2.1 summarizes the findings of the viability analysis for each conceptual theme.

Based on the viability analysis, the following four conceptual themes were eliminated from further consideration:

- Concept 5: Maximizing Reservoir Access, which would have included offshore development, was eliminated due to the added environmental risk of offshore development and the uncertain regulatory environment surrounding offshore oil and gas development following the April 2010 Deepwater Horizon oil spill in the Gulf of Mexico. It was also determined that currently available long-reach directional drilling would allow sufficient access to the offshore reservoir from an onshore location, making the offshore drilling proposed in Concept 5 unnecessary.
- Concept 8: Minimize Onsite Activity was eliminated from further consideration because it was deemed to be technologically infeasible. Locating personnel and processing infrastructure at BP Exploration, Inc's Badami facility, west of the Point Thomson unit, would require the compression of gas to extremely high pressures to transport the gas over 20 miles back to Point Thomson and still maintain the required wellhead pressure of 10,000 psig. The necessary gas compression would require increased fuel consumption for electric power, resulting in additional air emissions, and would increase the risks associated with pipeline failure (see RFI 64 in Appendix D of the Draft EIS).
- Concept 6: Limiting Activity near the Arctic Refuge did not satisfy the project's overall purpose of fully delineating and developing the reservoir as eliminating an eastern well site would prevent access to approximately one-third of the known gas resource.
- Concept 9: Accommodating Significant Future Development was eliminated because it was deemed not sufficiently distinct from Applicant's Proposed Action (Concept 2).

Table 2.1 Viability Analysis Results

The Concept	Satisfies the Purpose and Need to: Produce Condensate	Satisfies the Purpose and Need to: Delineate the Reservoir	Satisfies the Purpose and Need to: Evaluate the Resource	Technologically Feasible	Allows for Full-field Development	Seems Reasonable in Terms of Permit Experience: Positive Regulatory Precedent	Seems Reasonable in Terms of Permit Experience: Potential Benefits Support Additional Analyses	Unique and Distinct from Other Concepts
Concept 1: No Action	No	No	No	Yes	No	N/A	N/A	Yes
Concept 2: Applicant's Proposed Action	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concept 3: Minimize Coastal Impacts	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concept 4: Minimize Infrastructure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concept 5: Maximize Reservoir Access	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Concept 6: Limit Activity Near the Arctic Refuge	Yes	No	No	Yes	No	Yes	Yes	Yes
Concept 7: Maximize Production	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Concept 8: Minimize Onsite Activity	Yes	Yes	Yes	No	Yes	No	No	Yes
Concept 9: Accommodate Significant Future Development	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

In addition to eliminating conceptual themes, the viability analysis also eliminated several project components from further consideration. These included pipelines buried in the tundra, the use of the power generated at Badami, the development of an automated facility with offsite controls, and buried subsea export pipelines. These components were eliminated for a variety of reasons including technological challenges and increased environmental risks. A more detailed discussion of each of the conceptual themes and components eliminated from further consideration can be found in Section 2.2.4, Concepts and Component Options Eliminated, of the Draft EIS.

2.2.3 Range of Reasonable Alternatives

Out of the conceptual theme and viability analysis process, the following six alternatives were brought forward as the full range of alternatives for consideration in the Draft EIS:

- Alternative 1: No Action (based on Concept 1)
- Alternative 2: Applicant's Proposed Action (based on Concept 2)
- Alternative 3a: Inland Pads with Gravel Access Road (based on Concept 3)
- Alternative 3b: Inland Pads with Seasonal Ice Access Road (based on Concept 3)
- Alternative 4: Coastal Pads with Seasonal Ice Roads (based on Concept 4)
- Alternative 5: Coastal Pads with Centrifugal Compression (based on Concept 7).

See Section 2.3, Screening of the Full Range of Alternatives, of the Draft EIS for additional discussion of each of these alternatives.

Following their identification, the alternatives were further refined through a comparative screening process that included information gained through a series of workshops; the Request for Information process (see Appendix D of the Draft EIS); and technical review by the Applicant addressing logistics, technical capabilities, and other project-related details. Based on this information, the criteria developed for the viability analysis of the conceptual themes was reapplied to identify and eliminate components that appeared to satisfy the purpose of the project but that, after additional research, did not enable production, delineation, or resource evaluation. Alternatives and component options that were not technologically feasible or were redundant also were eliminated from further consideration. The comparative screening processes further refined which alternatives and/or component options would best meet the overall project purpose as defined by the Corps, and ultimately resulted in the range of reasonable alternatives used in the Draft EIS alternative impact analysis.

During the comparative screening process, Alternative 5: Coastal Pads with Centrifugal Compression was eliminated because it was deemed to be too similar to Alternative 2: Applicant's Proposed Action. Additionally, several components options, including gathering lines buried in infield roads, ice airstrip extension, light-duty infield roads, centrifugal compression, and use of seasonal infield ice roads only, were also eliminated for redundancy with other components, high risk of environmental impacts, logistical constraints, unproven technology, and technical infeasibility. A more detailed discussion of the alternative and components eliminated from further consideration can be found in Section 2.3.1, Alternatives and Components Eliminated, of the Draft EIS.

From the comparative screening process, five reasonable alternatives were carried forward for full evaluation. Alternatives were renamed at this point in the process in order to more clearly differentiate them within the Draft EIS. The reasonable alternatives were identified as follows:

- Alternative A: No Action (formerly Alternative 1)

- Alternative B: Applicant's Proposed Action (formerly Alternative 2)
- Alternative C: Inland Pads with Gravel Access Road (formerly Alternative 3a)
- Alternative D: Inland Pads with Seasonal Ice Access Road (formerly Alternative 3b)
- Alternative E: Coastal Pads with Seasonal Ice Roads (formerly Alternative 4)

The four action alternatives B, C, D, and E meet the Corps' overall purpose and are discussed in more detail below and in Section 2.4 of the Draft EIS.

2.3 DRAFT EIS ALTERNATIVES DESCRIPTIONS

As discussed in Section 2.2, Alternatives Development, the Corps led the Draft EIS alternatives development and screening process, cognizant of the requirements of both NEPA and the Guidelines. The four Draft EIS action alternatives that emerged from the alternatives development and screening process establish the range of reasonable alternatives that form the starting point for the Corps' analysis of practicability and under the Guidelines. The Corps seeks public comment on the merits of each of the Draft EIS alternatives and individual components with the alternatives as it relates to the Guidelines evaluation for its use in determining whether the Applicant's proposed project is the LEDPA. The following sections provide descriptions of each of the four action alternatives and their components.

2.3.1 Components Common to All Draft EIS Alternatives

All action alternatives would result in the construction of facilities needed to explore and recover hydrocarbon liquids. All action alternatives would include the following components: gravel pads to support drilling and production operations; gravel and/or ice roads and airstrips to support transportation needs; and export and infield pipelines. While the action alternatives are distinct alternatives, several components are common to all action alternatives. These commonalities are largely due to the use of standard North Slope construction and mitigation methods. Components common to all action alternatives are discussed below, as well as in Section 2.4.2, Components Common to All Action Alternatives, of the Draft EIS.

2.3.1.1 Wells and Production Pads

The gravel pads proposed in all four action alternatives would require the discharge of material into the waters of the U.S., an activity under the jurisdiction of the Corps under Section 404 of the CWA. Each alternative has a unique configuration of pads for drilling and production. However, each action alternative would have a minimum of four production wells, one injection well, and one disposal well arranged as follows: one production and one injection well on the Central Well Pad, one production well on the East Pad, one production well on the West Pad, one additional production well on one of the three well pads, and one disposal well on the Central Processing Pad.

Each of the production wells would be designed to access the reservoir using both traditional and long-reach directional (LRD) drilling. The current 13,000 foot limit of existing LRD drilling technology would enable each of the action alternatives to access offshore portions of the reservoir from onshore well pads. The wells on the East and West Pads would be used initially to delineate and evaluate the reservoir, and to determine whether the rim of oil surrounding the gas reservoir is viable for production.

In each alternative, the East and West Pads would be connected to the Central Processing Facility (CPF) by infield gathering pipelines. The CPF would be located either on the Central Well Pad (Alternatives B and E) or on a separate Central Processing Pad (Alternatives C and D). The CPF is where product from the wells would be separated and liquid condensate would be recovered. The Central Processing Pad would also accommodate living quarters and support facilities, warehouse and storage space, a water treatment and waste disposal system, communication facilities, power generation, diesel fuel storage tanks, and an emergency boat launch. Most of the facility infrastructure would be transported to the site as prefabricated modules requiring minimal construction in place. The size, number, and transportation method of the modules varies by alternative. See Draft EIS Section 2.4.2.1, Wells and Production Pad for more detailed descriptions of the each of the pads and their components.

2.3.1.2 Export and Infield Pipelines

Each alternative would include a configuration of infield gathering lines to bring produced fluids from the well pads to the CPF for processing and an export pipeline to bring hydrocarbon products to the Trans-Alaska Pipeline System (TAPS). All pipelines would be elevated on vertical support members (VSM) with a minimum 7- foot clearance between the bottom of the pipe and the tundra surface. The 7-foot clearance would allow free passage by wildlife and subsistence hunters on snow machines. The length, route, and number of pipelines needed vary by alternative.

2.3.1.3 Access and Transportation Infrastructure

Personnel, equipment, and supplies would be transported to and within Point Thomson by land, air, and in some alternatives, sea. Most modes of transportation are season dependent, which can greatly affect the logistics and timing of project construction.

Each alternative would use seasonal ice roads for access to Point Thomson during construction, as well as to enable construction of gravel infrastructure and pipeline. Ice roads are one of the fundamental ways to get goods, equipment, and people around the North Slope in winter. Ice road construction is weather-dependent, and generally begins in late December or early January. The main ice road would generally be ready by mid-February and would be thick enough to accommodate normal trucks for up to 300,000 pounds. For drill rig and module transport, the ice road would need to be thicker and wider, and would generally take an additional three weeks to prepare. Ice road are generally available for use until late April.

Airplane and helicopter traffic are key elements for the transport of personnel, supplies, and emergency response equipment. Each alternative includes a gravel airstrip for year-round, fixed-wing aircraft access to Point Thomson. While the size and location of the airstrip would vary by alternative, each would include a helipad, runway lighting with buried power lines, an airport control building, an airstrip apron, and navigational aid pads, adjoining the airstrip. Typically-sized aircraft using the runway would include the 19-passenger Beechcraft 1900D or a deHavilland Twin Otter for personnel and light freight transport. The airstrips proposed in all four action alternatives will require the discharge of material into the waters of the U.S., an activity under the jurisdiction of the Corps under Section 404 of the CWA.

The number, type, and route of gravel roads would depend upon the alternative, though each alternative includes a road from the Central Processing Pad to the airstrip to accommodate frequent personnel transport. The gravel roads in each alternative would have an average footprint width of 58 feet (HDR 2011a). Culverts would be installed after the initial road installation and would be designed for a 50-year flood event. Additional culverts would be added to the roads in late summer if observations during spring breakup identify areas where the road infrastructure does not allowing sufficient water flow. Bridges would consist of pipe piling supports with sheet piling abutments and precast concrete decks. The road routes in each alternative would determine the number and location of bridges for that alternative. Infield gravel roads would, wherever possible, be located a minimum of 500 feet from elevated pipelines, in accordance with the USFWS, ADF&G, NSB, and AOGA Steering Committee's 1994 caribou mitigation guidelines (Cronin, et al. 1994). The gravel roads proposed in all four action alternatives will require the discharge of material into the waters of the U.S. under the jurisdiction of the Corps under Section 404 of the CWA.

Barging is an additional form of transportation to the Point Thomson site that is incorporated into Alternatives B and E only. Marine access enables the transport of equipment and materials to Point Thomson during the open water seasons when ice roads are not available or when heavy loads exceed aircraft capacity. Depending on nearshore ice conditions, the open water season is generally from late July/early August through the end of September. This season is not entirely available for barging due to subsistence whaling activity. The Applicant has voluntarily signed a Conflict Avoidance Agreement with the Alaska Eskimo Whaling Commission that affects barging activity. Through the agreement, the Applicant agrees to avoid barging during the Village of Kaktovik's and Nuiqsut's whaling season (generally from August 24 to September 23), to the greatest extent possible, in order to minimize potential impacts to subsistence hunting (ExxonMobil 2011b). When barging during the whaling season is needed, the Applicant will follow the protocols outlined in the Conflict Avoidance Agreement to avoid or minimize interactions with whaling vessels and whales.

In Alternatives B and E, two forms of barging would be available to access Point Thomson: coastal barges and oceangoing (sealift) barges. Coastal barges would be used to deliver small modules, foundation materials, and construction equipment to the project site from Deadhorse. Coastal barging would also provide a means for the resupply of bulk materials and for the removal of wastes and excess equipment. Coastal barging would require the construction of a 70 foot long service pier and four mooring dolphins as well as dredging and screeding of the sea floor to provide a stable base for barge offloading. Sealift barges are considerably larger than coastal barges and can carry heavier loads with relatively shallow draft. These loads would include larger processing and prefabricated facility modules, and even portions of the drill rig. Barges would transport equipment to Point Thomson from suppliers worldwide. To unload sealift barges, a sealift facility would be constructed adjacent to the service pier at the Central Pad. This would include an offloading bulkhead and offshore mooring dolphins to secure the barges as they are offloaded at the site.

As part of the bulkhead construction the seafloor would require dredging and screeding to safely ground the large oceangoing barges sufficiently close to the bulkhead. The seafloor would be dredged and screeded approximately 300 feet northward of the service pier. For the sealift barge facility, dredging and subsequent screeding would begin approximately 40 to 60 feet from the bulkhead and proceed north approximately 500 feet. Removed seafloor sediments would be placed along the shoreline to the west of the Central Pad location. Approximately 1,500 cubic yards would be dredged during each year of construction to support use of the service pier and sealift barge facility (ExxonMobil 2011b). Dredged material disposal in waters of the U.S. falls under the Corps jurisdiction under Section 10 of the Rivers and Harbors Act.

2.3.1.4 Support Facilities

In addition to the main project facilities, numerous support facilities are required for the construction and operation of all of the action alternatives. These facilities include the development of a gravel mine site, access to and use of a potable freshwater source, storage space, and temporary construction camp space. In addition, all action alternatives would require approximately 1.5 million gallons of diesel fuel supplied by truck over the course of the first winter construction season and stored in 60 stackable, 25,000-gallon temporary fuel tanks on the existing Central Pad footprint.

In all action alternatives, the primary gravel source for the project would be from a new gravel mine site. The size of the new gravel mine would be determined by the gravel requirements of the alternative. The mine's precise location and layout would depend upon both the alternative and the results of an analysis of core samples prior to construction of the mine. To access the gravel, a surface layer of organic and inorganic material called "overburden" would need to be removed and stockpiled on seasonal ice pads. Mining operations would include blasting and mechanical excavation to a depth ranging between 40 and 50 feet below the overburden, depending upon the gravel content of the mine. After construction is completed, the new gravel mine site would be rehabilitated through the replacement of the overburden, the creation and contouring of stable side walls, and then by being allowed to fill with water. Once filled with water, the new mine site reservoir could be used as either a primary or secondary source of water for the project, depending upon the alternative. The discharge of excavated (dredged) material, including stockpiling, in jurisdictional wetlands, falls under the permitting authority of the Corps under Section 404 of the CWA.

2.3.1.5 Logistics and Sequencing

The logistics and sequencing of the alternatives vary greatly, though each follows a standard pattern of phasing within the project. Construction in each action alternative would begin with a mobilization, using various modes of transportation, to move equipment, supplies, and personnel to the project site. The construction phase of project development would include gravel mining; infrastructure installation, including roads, pads, airstrips, and pipelines; and facility modules transport, installation, and commissioning. In each alternative, the drill rig would arrive onsite once the well pads were ready for use, generally during the last year of onsite construction, initiating the natural gas drilling phase. The operations phase would begin as soon as the first wells were complete and sending condensate to the CPF. In each alternative, first production would occur while the final wells are being drilled.

2.3.2 Alternative B: Applicant's Proposed Action

Alternative B would configure the drilling and production facilities onto three gravel pads located near the coastline and incorporating portions of two existing gravel pads (see Figures 2.4-5 and 2.4-6 in the Draft EIS). A 22-mile long export pipeline would be constructed from the Central Pad to the common carrier pipeline at Badami. The proposed pipeline route from Point Thomson to Badami is generally located more than a mile inland. Approximately 10 miles of infield gathering pipeline would be constructed to transport produced hydrocarbons from the East and West Pads to the Central Processing Facility located on the Central Pad.

Access to Point Thomson in Alternative B would provided by ice road, air, and coastal and sealift barge during construction and primarily by air and coastal barge during operations. During construction, large modules would be brought to Point Thomson via sealift barge and small modules would be trucked to Prudhoe Bay and then transported to Point Thomson via ice road. Some modules may be staged in Deadhorse awaiting ice road opening. A 5,600-foot by 200-foot gravel airstrip and helipad would be constructed south of the Central Pad, approximately 3 miles inland from the coast. The runway would be designed to provide landing and take-off capabilities for a Lockheed C-130 Hercules cargo plane (minimum 5,000 ft length plus a 600 foot safety buffer zone) for maintenance and servicing of large equipment or potentially for emergency response. Most aircraft that would commonly land to Point Thomson would be smaller. Transportation within the Point Thomson area would be provided by ice road during initial construction, followed by 12 miles of infield gravel roads that would connect the gravel pads, gravel mine, airstrip, and water source. The infield gravel roads would require nine stream crossing structures (culverts or bridges) to cross creeks and small tundra streams.

Most gravel for Alternative B would come from the new gravel mine site located approximately 2 miles south of the Central Pad and just north and east of the proposed airstrip. It is estimated that approximately 2.2 million cubic yards of gravel would be removed from the 58-acre mine site. After completion of mining activity, the gravel mine site would be rehabilitated. Over the course of 5 to 11 years, natural sheetflow would fill the mine site and create a reservoir that could be used as a permitted backup water supply in future years (ExxonMobil 2011b).

In Alternative B, pipeline and infrastructure construction would be executed over three winter construction seasons. The drilling program would take place over approximately 2.5 years. If a permit were issued for this alternative, facility start up would be expected to occur in year 4 following the ROD. Additional detail regarding infrastructure and logistics of Alternative B can be found in Section 2.4.3, Alternative B: Applicant's Proposed Action, of the Draft EIS.

2.3.3 Alternative C: Inland Pads with Gravel Access Road

The intent of Alternative C is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, and coastal processes, and to avoid potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move project components inland and as far away from the coast as practicable and feasible (see Figures 2-11 and 2-12 in the Draft EIS). This alternative also attempts to minimize impacts to hydrologic connectivity by moving linear facilities, such as infield roads, further inland and orienting them in a north/south direction in alignment with the areas' predominant hydraulic gradient. To provide year-round access to Point Thomson, this alternative also includes the construction of a 44-mile, all-season gravel road from Point Thomson to the Endicott Spur Road (see Figures 2.4-14 and 2.4-15 in the Draft EIS).

Alternative C would locate the drilling and production facilities on four onshore gravel pads that would consist of a Central Well Pad, a Central Processing Pad, and two East and West pads. The East and West Pads would be located approximately 4 miles away from the Central Processing Pad and one-half mile inland. A 51-mile elevated export pipeline would be constructed from the Central Processing Pad to the existing Endicott common carrier pipeline, which connects to TAPS Pump Station No. 1. The pipeline alignment would parallel the all-season gravel road, approximately 500 feet south of the road. Alternative C would include approximately 9 miles of gathering pipelines connecting the East and West Pads to the Central Processing Pad, 3 miles of production pipeline from the Central Well Pad to the Central Processing Pad, and an additional 3 miles of high pressure injection pipeline from the Central Processing Pad back to the Central Well Pad.

Alternative C relies upon ice roads, gravel roads, and aircraft for transportation. It does not include barging or barge facilities to provide access Point Thomson. All modules would be transported to the site from Deadhorse by ice road. During construction, two main ice roads, an access road and a pipeline construction road, would need to be constructed between the Endicott Spur Road and Point Thomson to transport materials, supplies, and modules to and from Point Thomson. Due to an anticipated amount of heavy traffic the two ice roads would be connected via 35-foot-wide ice road bypass ties every mile to facilitate traffic flow. A 5,600-foot by 200-foot gravel airstrip and helipad would be constructed in the location of the former West Staines gravel airstrip. The runway would be designed to provide landing and take-off capabilities for a Lockheed C-130 Hercules cargo plane. Within Point Thomson, the 20 mile infield gravel road network would be the primary means of in field transportation for personnel, materials, and equipment.

A unique feature of Alternative C is a new 44-mile all-season grave road that would be constructed to provide access to and from Point Thomson during drilling and operations. This road would be located between 3 and 8 miles south of the coastline and would generally follow the proposed Bullen Point Road Corridor, beginning at the Endicott Spur Road, south of the Badami common carrier pipeline (and east of the Kadleroshilik River), and continue eastward to Point Thomson. The infield and all-season access gravel roads would require 50 stream crossing structures (culverts or bridges) to cross rivers, creeks, and streams including three at major water bodies.

Gravel for Alternative C would be obtained from a new 66 acre gravel mine site located near the proposed Central Processing Pad. Approximately 2.9 million cubic yards of gravel would be removed from the mine. Before breakup in Year 3, the mine would be rehabilitated and allowed to fill with water from runoff. Construction of the gravel access road would also require up to five additional gravel mines, sited approximately every 10 miles along the road corridor. These additional mines would each be approximately 13 acres in size with accompanying 13-acre seasonal ice pads to store overburden.

In Alternative C, additional detailed engineering would be needed to design modules capable of transport overland to Point Thomson via ice road. If a permit were to be issued for this alternative, construction would be unlikely to begin until Year 3 following the ROD and would be executed over three winter construction seasons. The drilling program would take place over approximately four seasons. Facility startup is estimated to occur in Year 6. Additional detail regarding infrastructure and logistics of Alternative C can be found in Section 2.4.4, Alternative C: Inland Pads with Gravel Access Road, in the Draft EIS.

2.3.4 Alternative D: Inland Pads with Seasonal Access Road

The intent of Alternative D is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities and coastal processes, and to reduce potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move the project components inland and as far away from the coast as practicable and feasible (see Figures 2-16 and 2-17 in the Draft EIS). Alternative D is similar in design to Alternative C, but does not include the construction of or access by an all-season gravel road. Rather, ground access to and from Point Thomson in Alternative D would occur via an inland 48-mile seasonal ice road, running east from the Endicott Spur Road to the northern end of the Point Thomson project area (See Figures 2.4-21 and 2.4-22 in the Draft EIS).

The drilling and production facilities in Alternative D would be located in a four-pad configuration in a manner similar to Alternative C. The four gravel pads and airstrip would be connected by an 18-mile gravel road network. The infield gravel roads would require seven stream crossing structures (culverts or bridges).

The infield gathering pipelines, production lines, and their supports would be the same as those described in Alternative C. The export pipeline would differ in that it would tie into the existing common carrier pipeline at Badami. The export pipeline would be 23 miles long and follow a route generally located more than 4 miles inland. Infield pipelines would be similar to those described in Alternative C.

In Alternative D, the ice road from the Endicott Spur Road and aircraft would be the two primary methods of transport to move materials, equipment, and personnel to and from Point Thomson.

Alternative D does not include barging or barging facilities to access Point Thomson. All modules would be transported to the site from Deadhorse by ice road. At least three seasonal tundra ice roads would be built each year during construction to connect Point Thomson to Badami and then to the Endicott Spur Road. Similar to Alternative C, the parallel ice roads would be connected via 35-foot-wide bypass ties every mile along the two roads to facilitate traffic flow. A 5,600-foot by 200-foot gravel airstrip and helipad would be constructed one mile northeast of the former West Staines gravel airstrip. The runway would be designed to provide landing and take-off capabilities for a Lockheed C-130 Hercules cargo plane. Within Point Thomson, the 18-mile infield gravel road network would be the primary means of infield transportation for personnel, materials, and equipment.

The primary gravel source for the project would be a new 66-acre gravel mine site located less than 2 miles south of the Central Well Pad and near the proposed Central Processing Pad. Approximately 2.8 million cubic yards of gravel would be removed from the mine. Before breakup in Year 3, the mine would be closed and rehabilitated. An inlet structure would be constructed to divert water from an adjacent stream during spring breakup to fill the mine site for use as a new freshwater reservoir (HDR 2011b).

The logistics and sequencing for Alternative D would be similar to that described in Alternative C, though Alternative D would use an annual ice access road for to resupply its drilling and operations activities each year. This transportation method would extend the drilling program by one year relative to Alternative C and two years relative to Alternative B. If a permit were to be issued for this alternative, facility startup is expected to occur in Year 6 following the ROD. Additional detail regarding infrastructure and logistics of Alternative D can be found in Section 2.4.5, Alternative D, Inland Pads with Seasonal Ice Access Road, in the Draft EIS.

2.3.5 Alternative E: Coastal Pads with Seasonal Ice Roads

The intent of Alternative E is to minimize the development footprint to reduce impacts to wetlands and surrounding water resources. Alternative E would locate the drilling and production facilities onto a three-pad configuration similar to that of Alternative B, but that would consist of an enlarged Central Pad and two other ice-gravel combination pads at the East and West Pads (see Figures 2-19 and 2-20 in the Draft EIS). The gravel footprint of the East and West Pads would allow for adequate pad space for operations and would be supplemented with a multiseason ice pad extension to accommodate additional infrastructure needed during the drilling phase. The gravel footprint would also be reduced by the use of annually built, infield ice roads in lieu of constructing infield gravel roads to the East and West Pads (see Figures 2.4-26 and 2.4-27 in the Draft EIS).

Ten miles of infield gathering pipelines would be constructed to connect the East and West Pads to the CPF in a layout similar to that of Alternative B. The Central Pad would connect to the airstrip and C-1 storage pad and reservoir via a 4-mile gravel road. The infield gravel roads would require one stream crossing structure. Alternative E would include the construction of a 3,700-foot by 200-foot airstrip. This airstrip would not be capable of accommodating a C-130 Hercules cargo plane. Rather, the shortened airstrip would be capable of landing aircraft with a capacity of 5,000 lbs or 15 people.

The primary gravel source for the project would be a new gravel mine site located 2 miles south of the Central Pad. Approximately 1.7 million cubic yards of gravel would be removed from the mine. As described in Alternative B, the goal would be to complete gravel mining in two winter seasons, after which the mine would be rehabilitated. This new reservoir could be used as a secondary water source as needed during field life.

The logistics and sequencing of Alternative E would be similar to that described in Alternative B, although the limitations to drill rig transportation between the East and West Pad would extend the drilling schedule by two seasons. If a permit were to be issued for this alternative, facilities start up is estimated to occur in Year 5 following the ROD. Additional detail regarding infrastructure and logistics of Alternative E can be found in Section 2.4.6, Alternative E, Coastal Pads with Seasonal Ice Roads, in the Draft EIS.

2.4 ALTERNATIVES PRACTICABILITY ANALYSIS

Having established the full range of reasonable alternatives through the Draft EIS alternatives development process, the Corps must then evaluate the practicability of the alternatives to determine if a practicable alternative to the Applicant's proposed project exists which "would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." (40 CFR 230.10(a))

To make this determination, the Corps will evaluate the Draft EIS alternatives and alternative components using the definition of practicability established by the Guidelines. As discussed in Section 2.2, Alternatives Development, the Corps believes that it has captured all of the reasonable alternatives and components necessary to determine whether the Applicant's proposed project is the LEDPA. The evaluation of detailed component alternatives within the Draft EIS alternatives also provides the Corps with additional flexibility to ensure that the full extent of practicable alternatives is considered when determining if the Applicant's proposed project is the least environmentally damaging alternative among all of the alternatives identified as practicable. The Corps may only issue a permit for the Applicant's proposed project if it is found to be the LEDPA.

The practicability analysis being conducted by the Corps is not intended to alter the conclusions reached by the Draft EIS for the NEPA process, nor need it incorporate alternatives or alternative components that were eliminated from consideration as part of the alternative development process in the Draft EIS. Rather, the purpose of the practicability analysis is to supplement the information and findings presented in the Draft EIS, to meet the needs of the alternatives analysis requirements of the Guidelines.

The discussion in this section provides the methodology by which the Corps will ultimately determine the practicability of the Draft EIS alternatives and alternative components including some practicability themes that have been identified as part of the Draft EIS alternatives development process. However, at this point in time, the Corps considers all Draft EIS alternatives and alternative components to be practicable and the Corps will not make a final determination on practicability until the issuance of a ROD. The Corps invites the public to review the practicability methodology and themes presented in this section. The Corps also solicits public comment on the practicability of the alternatives and components presented.

2.4.1 Practicability Analysis Methodology

The Guidelines provide a two-fold definition of a practicable alternative:

1. A practicable alternative is one that is available and capable of being done after taking into consideration cost, existing technology, and logistics.
2. The three practicability criteria (cost, existing technology, and logistics) apply in light of the overall project purpose.

Thus, in order to be practicable, an alternative must not only meet the three practicability criteria but must also fulfill the overall project purpose. The overall purpose of the Point Thomson project, as described in Section 2.1, is to:

- To produce hydrocarbon liquids from the Thomson Sand reservoir; and
- To further evaluate and delineate the Thomson Sand reservoir and evaluate the Brookian Group sandstones.

As part of its practicability analysis, the Corps is working with the Applicant to evaluate the logistical and technological constraints associated with the Draft EIS alternatives. The Applicant is uniquely positioned to help identify key differences between the four alternatives based on three years of engineering and planning related to the proposed Point Thomson Project, previous experience conducting exploratory drilling at the Point Thomson site, and global experience in hydrocarbon development projects.

In full compliance with NEPA guidelines, all information provided by the Applicant has been and will continue to be validated and verified by several third-party reviewers. Third-party reviewers are selected for their extensive experience constructing, operating, and managing similar hydrocarbon production facilities on Alaska's North Slope and their knowledge and familiarity of the oil and gas industry standard practices in Alaska. Third-party reviewers include experts in hydrocarbon facility design, existing technologies, costs, and logistics.

At this point in time, the Applicant has completed extensive analyses on existing technology and logistics as it relates to the practicability of the Draft EIS alternatives (ExxonMobil 2011c). Third-party reviews of the information provided by the Applicant have the found that the conclusions developed as part of the practicability analysis conducted by the Applicant were reasonable and presented a best-case scenario for the development of all action alternatives.

At this time, however, the Corps has not received information on estimated project cost that is sufficient to fully evaluate the practicability of the Draft EIS alternatives and components. This information is necessary to complete the practicability analysis and must be provided by the Applicant before a decision can be made on compliance with the Guidelines and a ROD can be issued. Due in part to the lack of information on cost, the Corps considers all Draft EIS alternatives and alternative components to be practicable.

2.4.2 Practicability Themes

While the Corps currently considers all Draft EIS alternatives and alternative components to be practicable under the Guidelines, several practicability themes have been identified during the development of the Draft EIS alternatives. These themes are likely to form the basis of the Corps' practicability analysis and evaluation of the Applicant's proposed project under the Guidelines.

2.4.2.1 Transportation Alternatives to the Point Thomson Site

The construction of the Point Thomson facility would require the transportation of production modules, construction materials and equipment, and personnel to and from the Point Thomson site. However, the harsh climate conditions and remote nature of the Point Thomson project lead to transportation constraints that have significant impacts on project logistics and costs for all alternatives. Currently, helicopter provides the only year-round access to the site. However, based on the Applicant's past experience at the site, helicopters are likely to be grounded 20 percent of the time due to weather concerns. Year-round, fixed wing aircraft access would become available upon the completion of the gravel airstrip infrastructure planned as part of all action alternatives.

The Point Thomson area is accessible by ground transportation only in limited seasonal windows. Potential transportation methods under consideration include ice road (available January through April), barge (available July through September), and unrestricted tundra travel (available December and January). Within these availability windows, unpredictable weather and seasonal variations, such as lingering sea ice that delays the start of the barging season or winter storm surges that disrupts ice road construction may reduce available transportation windows even further. Outside of these availability windows, the Point Thomson site would be accessible only by air.

In addition to seasonal constraints, each transportation method has limitations in terms of load capacity. For example, a single sealift barge has the capability to transport a load of 4,000 tons while a regular tractor-trailer load, transported over an ice or gravel road is limited to about 40,000 lbs (~20 tons). The maximum loads of fixed wing and helicopter vary by aircraft type but range from 5,000 lbs (Twin Otter or Cessna) to 45,000 lbs (C-130 Hercules; ExxonMobil 2011c). Load capacities and restrictions on the size and shape of loads, influences the size of modules that can be prefabricated offsite and transported to Point Thomson for assembly and hookup. For example, using larger modules leads to greater gains in efficiency in transportation and assembly (ExxonMobil 2009). The result of reducing load capacity is that facility modules would need to be reduced in size and weight, but would increase in number, such that there more smaller loads required. These factors directly affect project logistics and costs.

The design, sequencing, and logistics detailed in the Applicant's proposed project (Alternative B) is the result of extensive front-end engineering and a modularization study conducted by the Applicant to determine the Applicant's preferred approach for development at Point Thomson (ExxonMobil 2009). In developing its proposal for project development, the Applicant evaluated the fabrication, transportation, logistics, and installation of housing, process, and utility modules and equipment. Of the options and components evaluated, the Applicant determined that the combination of landing sealift barges with 11 large modules at Point Thomson and trucking smaller modules via ice road to Point Thomson was the preferred approach for mobilization and development. Using sealift barges allows the Applicant to maximize the size of modules prefabricated offsite and to complete delivery, installation, and commissioning of the modules within a 60-day window in the third year of construction. Large modules would be transported the short distance from the sealift facility to their installation location on the Central Pad via self-propelled modular transporters (SPMTs). Other construction equipment and materials, including fuel, will be transported via coastal barge from Deadhorse.

Alternatives C and D incorporate alternatives to the construction of barge offloading facilities and to the use of barges to transport modules infrastructure, construction equipment, and supplies to the Point Thomson site. Alternative C replaces the use of barging with the construction of a 44-mile long, all-season gravel access road. The construction of the all-season gravel road would occur concurrently with construction of infrastructure at the Point Thomson site. Thus, the gravel road would not be available for use during the construction phase of the project. Alternative D relies on annually constructed and seasonally available ice roads to provide access to the Point Thomson site.

The absence of barging in Alternatives C and D would require more complex logistics and construction sequencing, would pose technological challenges, and would result in a later start up of project facilities, as compared to the Applicant's proposed project. The differing constraints of using ground transportation instead of transportation by sealift barge directly affects the size and number of prefabricated modules needed for project development, the timing of materials resupply, and the quantity of resupply materials needed during the seasonal ice road window.

Moving prefabricated modules overland from Deadhorse to Point Thomson imposes limits on the size and weight of the infrastructure modules. While gravel roads in the Deadhorse area have been specially designed for heavy transports and can bear loads up to 5,400 tons, ice roads are only capable of bearing loads of up to 1,300 tons, a value based on industry experience from ConocoPhillips Alaska's Alpine development (ExxonMobil 2011c). As a result, prefabricated modules used in Alternatives C and D would need to be smaller to be transported overland via ice road. Consequently they would also need to be more numerous to make up for the decrease in size, resulting in the need for about 32 modules in Alternatives C and D as opposed to the 11 planned for Alternative B (ExxonMobil 2011c). The change in module size and number would require the redesign and reengineering of the modules, which would result in a later start of construction by about two years (ExxonMobil 2011c). The increased number of modules would also require additional staff and would increase the time and manhours needed for assembly and commissioning following the delivery of the modules to Point Thomson (ExxonMobil 2011c).

In addition to altering the size and number of modules, the timing of module delivery would also be impacted. Modules would still be transported to the North Slope from production facilities worldwide by sealift barge during the summer barging season. Modules would be delivered to the West Dock near Deadhorse and would require storage in the Deadhorse area until an ice road is constructed to Point Thomson the following winter season. This results in a delay of module installation of approximately 8 months. The transport of large modules to the West Dock and the movement and storage of the modules in the Deadhorse area is likely to require Deadhorse facility upgrades and the possible construction of additional storage areas in the Deadhorse area.

The movement of large modules from Deadhorse to Point Thomson via ice road also poses technological challenges. While SPMTs are commonly used for movements over short distances and during summer conditions, industry experience moving SPMT loads during the winter is more limited. The Alpine development project provides industry experience with the use of SMPTs for winter transportation in Alaska, highlighting several potential technological issues with winter module movement (ExxonMobil 2011c). SPMTs rely on hydraulics and computers to keep the load balanced. These systems do not function well in cold winter conditions on the North Slope. The operators at Alpine found that the whole hydraulic system needed to be covered with a skirt and continuously heated to prevent the hydraulic fluid from freezing. In addition, the use of lighter hydraulic fluid, which is less susceptible to freezing, caused additional issues with broken linkages on the steering of the SPMT (ExxonMobil 2011c).

Another potential concern with winter module transport is ice road failure, which if it occurs in one location, can trigger a failure of a large area of the road surface as the SPMT computers transfer the weight of the load to other wheels. Road failure could cause the whole transport to become stuck until the road can be repaired. To prevent this issue, SPMT transports require personnel to walk alongside the transporter for the entire length of the trip to monitor the transport and the road surface. While walking alongside the transporter is common in summer months, the sub-zero temperatures of winters on the North Slope add additional personnel safety concerns and would necessitate a traveling caravan of support personnel and vehicles to move with each SMPT along the entire route (HDR 2011c).

At this point in time, modules of the size proposed for Alternatives C and D have not been moved in winter conditions over an ice road of the proposed length. The total length of module movement for the

Alpine development was about 34 miles. The Point Thomson project would require a trip of approximately 49 miles for Alternative C and 47 miles for Alternative D. Even under ideal summer conditions SMPTs move slowly, generally at a maximum speed of 3 mph (ExxonMobil 2011c).The Applicant estimates that that under ideal winter conditions and with no transporter breakdowns, it would take about 48 hours to move a single module one way to Point Thomson. Module transport via ice road would require the construction of a carefully engineered, heavy-duty ice road that would not exceed a 3 percent grade anywhere along its length. The slow moving SPMT caravans would monopolize traffic on the main ice road, requiring the Applicant to construct ice road tie-ins to the pipeline construction ice road to allow fuel and other materials transport vehicles to move around the slow-moving SPMTs.

The absence of barging in Alternatives C and D also alters the transportation of other supplies and materials to the Point Thomson site. The lack of coastal barge access requires all bulk materials, including diesel fuel and construction equipment, be moved to the site during the available ice road season. This would necessitate the movement of a year's worth of fuel to the Point Thomson site between the months of January and April. In addition to the initial fuel storage needs of 1.5 million gallons of diesel described in Section 2.3.1 for all alternatives, Alternative C and D would require an estimated additional 6 million gallons of diesel fuel to support construction activities between the end of the ice road season in the second and third years of construction. Moving this fuel would require about 3,450 fuel truck trips over the course of construction (ExxonMobil 2011c). In contrast, Alternative B would require the storage of just 2.4 million gallons of diesel fuel and would require approximately 880 fuel truck trips during construction because resupplies of fuel would be barged in during the summer barging season (ExxonMobil 2011c). As a single coastal barge has the capacity to carry as much fuel as 10 fuel trucks (ExxonMobil, 2011c). The absence of barging in Alternatives C and D would also increase the total number of helicopter and fixed wing aircraft flights needed to transport materials to Point Thomson.

As discussed in Section 2.3.3, Alternative C replaces barge access to the Point Thomson Site with ground access via an all-season gravel access road. The construction of the 44-mile all season gravel road between the Point Thomson facility and the Endicott Spur road introduces logistical challenges during construction but ultimately would provide reliable year-round, ground access to the site, resulting in long-term logistical benefits to the project. The all-season gravel road would require five additional mine sites and an independent crew of construction workers to complete the project simultaneously with facility construction. The road would likely take at least three years to construct, making it unavailable for module or fuel transport during the construction of the rest of the Point Thomson facility. The gravel road would come online for transportation of personnel and materials during the drilling and operations phases, allowing for year-round ground transportation to the site during these phases.

Alternative D, on the other hand, utilizes annually constructed, seasonal ice roads to provide access to Point Thomson. Having seasonally limited ground access (e.g., seasonal ice road, tundra travel, and air) to the site during drilling and operations greatly limits the transportation and logistical options for the life of the project.

2.4.2.2 Minimization of Coastal Infrastructure

Based on comments received during the EIS Scoping process, the Corps and Cooperating Agencies sought to develop project designs and component alternatives that minimized coastal infrastructure. Alternative C and D include the separation of the Central Well Pad and the Central Processing Facilities, a setback on the East and West Pads one-half mile from the coastline, and a setback of the export pipeline from the coastline.

The setback of the East and West Drilling Pads has the potential to pose technological challenges in the development of the Point Thomson Project. Under any development scenario, the current known characteristics and uncertainties associated with the Thomson Sands reservoir and the challenges of drilling wells in a high-pressure reservoir add technological risks to the project relative to many other hydrocarbon development projects on the North Slope. If completed, the Point Thomson would be the highest pressure, hydrocarbon production field in Alaska and among the highest in the world (White 2011).

The range of locations of drilling sites that can be used to effectively access the Thomson Sand reservoir is constrained by the limitations of the LRD drilling technology. Offshore development, which would provide the largest degree of access to the reservoir (ExxonMobil 2009), was eliminated from consideration as part of the range of reasonable alternatives because of concerns about additional environmental risks and a lack of regulatory and permitting precedence for offshore development on the North Slope (see Section 2.2.2, Viability Analysis). Furthermore, it was established that LRD drilling would allow the Applicant to access a majority of the reservoir from onshore pads.

Based on currently available public information, however, it is not possible to determine how far inland the drilling pads may be moved while still allowing sufficient access to the reservoir to fully delineate and develop the hydrocarbon resources of the Thomson Sands. The proposed project is, in part, intended to provide additional reservoir information in support of a more comprehensive development plan. Current LRD drilling technology in reservoir conditions similar to those found in the Thomson Sands reservoir has a proven horizontal reach of approximately 10,000 to 13,000 feet (Appendix D, RFI 63 of the Draft EIS). Based on proprietary information not currently available to the Corps, the Applicant has determined that the drilling reach from the proposed pads in Alternatives B and E would provide adequate access to drilling targets and would be sufficient to fully delineate and develop the Thomson Sands reservoir (Appendix D, Technical Brief 1 of the Draft EIS).

For the purposes of this analysis, a rough estimate of reservoir coverage in two dimensions was developed using the assumption that the Applicant could achieve a 13,000 ft horizontal drilling reach and that the reservoir is homogeneous. Under these very basic assumptions, drilling from the pads proposed in Alternatives B and E would allow access to approximately 88 percent of the reservoir. Based on the same assumptions, drilling from the East and West pads proposed in Alternatives C and D, located one-half mile inland from the coast, would provide access to approximately 79 percent of the reservoir. It is not known if this coverage would be sufficient to fully develop the hydrocarbon resources in the Thomson Sands reservoir. The Applicant has stated that the "set back of the East and West Pads from the coast one-half mile is not optimal to fully evaluate and develop the Thomson Sand Reservoir" (ExxonMobil 2011c) but the Corps is currently unable to independently verify this statement or determine if this setback would still allow the project to meet the overall purpose. Moving the drilling pads inland may increase the risk that additional drilling pads would be necessary for full-field access and future development.

2.4.2.3 Minimization of Gravel Infrastructure

During the Draft EIS alternative development process, the Corps and Cooperating Agencies also sought to develop an alternative that allowed for the minimization of impacts on wetlands within the project area. Alternative E incorporates these project components, including the use of seasonal, infield ice roads to provide access to the East and West Pads, the use of multi-season ice pads to provide additional acreage at the East and West Pads during the drilling phase, and the use of a shorter airstrip than that planned for

Alternative B. Each of these project components has the potential to influence the project schedule and execution.

Infield Ice Road Infrastructure

The minimization of gravel infrastructure through the use of infield ice roads instead of gravel roads to provide access to the East and West Pads has the potential to reduce the acreage of gravel fill by about 55 acres. The use of ice roads as an alternative to gravel infield roads limits ground access to the East and West Pads to the three months in which ice roads are available for use.

The timeframe for drilling into hydrocarbon bearing formations would be limited under all action alternatives by the terms and conditions of the Applicant's Oil Discharge Prevention and Contingency Plan (ODPCP); the ODPCP, in accordance with 18 ACC 75.445(f) limits drilling in hydrocarbon bearing formations to the period between November 1 through April 15, as planned spill response methods are less effective outside of this period when there is a risk of oil reaching open tundra (Appendix U of the Draft EIS). The seasonal drilling restriction would be included as part of the ODPCP for all action alternatives, but is of particular importance in Alternative E because the seasonal drilling restriction, when combined with the seasonal restrictions on rig movement, would result in a shortened drilling season. The use of seasonal ice roads limits movement of the drill rig to the short period of time when the rig-ready ice roads are available, usually between late January and late April. The combination of these two seasonal constraints could result in the rig being stranded and sitting idle on a pad from late April to the following January when an ice road is available to move the rig to its next target. This stranding could result in the loss of three months of the winter drilling season during November, December, and January, because the rig is unable to be moved to its next target.

Limitations to movement due to the use of seasonal ice roads instead of gravel roads also have impacts on the transportation of construction and drilling materials and personnel. The drilling program relies on the movement of bulk materials, including drilling muds, chemicals, and fuel between the East and West pads and the Central Pad, where most storage occurs. As material movement via ice road would be limited, additional storage space would be needed at the East and West pads and the use of rolligons and other tundra travel vehicles would likely increase relative to the other alternatives.

The limited period of infield ice road transportation would also require extensive helicopter support. Alternative E may require as many as 8,000 trips for construction and drilling and an additional 730 annual trips for operations. These trips would be used to move crew and materials out to the site when the ice road is not available. They could be particularly important in the event of an emergency, such as a medical evacuation or spill response, because helicopters will be the only method of accessing the East and West pads for most of the year. Helicopter access is not always reliable, however; based on experience gained during the exploratory phase of the project, the Applicant estimates that helicopters will be grounded 20 percent of the time due to weather concerns (ExxonMobil 2011c).

Multi-season Ice Pads

The design and construction of the multi-season insulated ice pad extensions at the East and West Pads would allow restoration of vegetation communities beneath those structures to begin to occur shortly after the completion of drilling. However, the lack of prior experience building multi-season pads of the type required results in technological uncertainties. Single season ice pads are a relatively common construction tool used on the North Slope but the use of multi-season ice pads has been more limited. Multi-season ice pads have been used in the past for two projects on the North Slope, one for an exploration well in Umiat and another for BP's Yukon Gold (Ragsdale 2007). The ice pads constructed for the 1993 Yukon Gold exploratory project were 2.5 acres in size, six inches of ice thick with insulation board on top, and designed to last two winter drilling seasons (ExxonMobil 2011c).

In contrast, the Alternative E multi-season ice pads would be about 11 acres in size, 6 feet of ice thick, and overlain by rigmats. The pads would be designed to last for the entire five-year duration of the drilling program. There is currently no prior experience on the North Slope that can inform the technological feasibility of the construction, maintenance, and operation of an ice pad of the required size and thickness. In addition to the estimated 3.4 million gallons of water needed to build the ice pads, additional water will be needed each year for ice pad maintenance. Over the course of the summer, each of the ice pad extensions would likely lose between 8 to 10 feet around each exposed edge due to melting and would require maintenance work in early winter to recover the area before drilling could begin. The construction, maintenance, and performance of the multi-season ice pads pose technological uncertainties in the implementation of Alternative E.

Shortened Airstrip

The shorter gravel airstrip (3,700 by 200 ft) included in Alternative E would reduce the acreage of gravel fill by 14 acres relative to Alternative B, but may also have an impact on the number of material and personnel flights needed outside of the barging and ice road seasons. The Applicant estimates that the shorter airstrip would limit the size of aircraft capable of landing at Point Thomson to those with a capacity of 5,000 lbs or 15 people or less as compared to the average capacity of planes capable of landing on the longer airstrips in Alternatives C, D, and E (~ 24,000 lbs or 30 people). The effect of shortening the airstrip would be to double the number of flights needed during construction, drilling, and operations. In addition, the airstrip would not be capable of accommodating a C-130 craft (capacity of 45,000 lbs), which the Applicant has proposed for use in case of emergency. This may result in alterations to the Applicant's emergency response capability (ExxonMobil 2011c).

2.5 PRACTICABILITY SUMMARY

Based on the practicability information and environmental considerations discussed above, sufficient information is not yet available to determine if the Applicant's proposed project is the LEDPA, or if alternatives with less impact to the aquatic ecosystem have other significant adverse environmental consequences. As discussed in Section 2.2, Alternatives Development, the Corps believes that it has captured all of the reasonable alternatives and components necessary to determine whether the Applicant's proposed project is the LEDPA. However, information on the cost of project alternatives and alternative components will be a crucial aspect in the Corps' final determination of practicability, information that must be provided by the Applicant before this evaluation can be completed.

Preliminary consideration of all four Draft EIS action alternatives reveals that each alternative contains drawbacks and benefits with respect to technology, logistics, and the potential for environmental impacts. The incorporation of alternative components into Draft EIS Alternatives C, D, and E has varying effects on the logistics, technology, and schedule of the plan for development of the Point Thomson Project. However, these tradeoffs do not necessarily result in Alternatives C, D, and E being not practicable. At this point in time, the Corps considers all Draft EIS alternatives and alternative components to be practicable.

The Corps seeks public comment on the determination of practicability and invites the public to provide input regarding the evaluation of the Point Thomson project under the Guidelines.

3. Restrictions on Discharge (40 CFR 230.10(b))

The second compliance test under the Guidelines considers specific impacts that may warrant additional restrictions on discharge. Specifically, the Guidelines state that no discharge of dredged or fill material may be permitted if it will:

1) Causes or contribute to violations of any applicable State water quality standard;
2) Violate any applicable toxic effluent standard or prohibition under Section 307 of the CWA;
3) Jeopardize the continued existence of species listed as endangered or threatened under the ESA of 1973, or result in the potential for adverse impacts (destruction or adverse modification) of a habitat which is determined by the Secretary of the Interior or Commerce to be a critical habitat under the ESA of 1973. If an exemption has been granted by the Endangered Species Committee, the terms of the exemption shall apply, in lieu of this paragraph; or
4) Violate any requirement imposed by the Secretary of Commerce to protect any marine sanctuary designated under title III of the Marine Protection, Research, and Sanctuaries Act of 1972.

If the proposed discharge is found to violate the standards or cause any of the adverse impacts listed above, the discharge may not be permitted.

The Corps has not yet made a determination regarding the compliance of the Applicant's proposed project with the restrictions on discharge test of the Guidelines. A determination of whether the proposed project meets the standards listed above will ultimately be based on the findings outlined in Appendix A, Factual Determinations, and Appendix B, Technical Evaluation Factors.

The Corps invites the public to review the analysis of impacts found in the Draft EIS and incorporated by reference into the Factual Determinations and Technical Evaluation Factors (Appendices A and B). The Corps seeks public comment on the evaluation of the compliance or non-compliance of the Applicant's proposed project with the restrictions on discharge listed above.

4. Finding of No Significant Degradation (40 CFR 230.10 (c))

The third compliance test under the Guidelines considers the potential for the proposed discharge to cause or contribute to the degradation of waters of the U.S. The Guidelines state that except as provided under Section 404(b)(2), the discharge of dredged or fill material that will cause or contribute to significant degradation of waters of the U.S. may not be permitted. The Guidelines further define the types of effects that may, either individually or collectively, contribute to the significant degradation of waters of the U.S. These include:

1) Significant adverse effects of discharge of pollutants on human health or welfare, through pollution of municipal water supplies, fish, shellfish, wildlife and special aquatic sites;

2) Significant adverse effects of discharge of pollutants on life stages of aquatic wildlife and other wildlife dependent on aquatic ecosystems, to include the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and/or chemical processes;

3) Significant adverse effects of discharge of pollutants on aquatic ecosystem diversity, productivity, and stability including but not limited to the loss of fish and wildlife habitat, or the loss of the capacity of wetland to assimilate nutrients, purify water, or reduce wave energy; and

4) Significant adverse effects of discharge of pollutants on recreational, aesthetic, and/or economic values.

At this time, the Corps has not yet made a determination of the compliance of the Applicant's proposed project with the test of no significant degradation. The determination of whether the Applicant's proposed project causes or contributes to significant degradation of waters of the U.S. will ultimately be based on the conclusions of the Factual Determinations (Appendix A) and the Evaluation of Dredged or Fill Material (Appendix B, Section 5). The conclusions of these two Appendices also take into account the detailed analysis of impacts on specific physical, chemical, biological and human characteristics of the aquatic ecosystem found in the Technical Evaluation Factors (Appendix B, Sections 1 though 4). The determination of compliance will also take into consideration Actions to Minimize Adverse Effects, found in Appendix C.

The Corps invites the public to review the analysis of impacts found in the Draft EIS and incorporated by reference into the Factual Determinations, Technical Evaluation Factors, and Actions to Minimize Adverse Effects in this document (Appendices A, B, and C). The Corps seeks public comment on the evaluation of the compliance or non-compliance of the Applicant's proposed project with the standards of no significant degradation outlined above.

5. Minimization of Potential Adverse Impacts (40 CFR 230.10(d))

The fourth compliance test under the Guidelines considers the extent to which steps have been taken to minimize potential adverse effects. The Guidelines state that except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.

At this time, the Corps has not yet made a determination of the compliance of the Applicant's proposed project with the test of minimization of potential adverse impacts. This determination, however, will ultimately be based on the minimization measures identified in Subpart H, Actions to Minimize Adverse Effects (Appendix C).

The Applicant has already identified several potential measures to minimize adverse impacts. These measures are outlined in the Applicant's Environmental Mitigation Report (ExxonMobil 2011d) and Final Department of the Army Permit Application (ExxonMobil 2011a). These measures are also discussed in detail in Section 4.4, Impact Avoidance, Minimization, and Mitigation, in the Draft EIS and by resource section in Chapter 5, Environmental Consequences, of the Draft EIS.

The Corps has reviewed the minimization measures proposed by the Applicant and considers them to be a reasonable starting point for developing the list of all appropriate and practicable steps which can be taken to minimize the potential adverse impacts of the proposed project. However, the Corps has not yet determined if the Applicant's proposed minimization actions include all appropriate and practicable measures. The Corps invites the public to comment on the current list of Applicant proposed minimization measures and to provide suggestions on additional avoidance and minimization measures that may be appropriate and practicable which will help reduce impacts to waters of the U.S. and aquatic ecosystems. A list of common minimization measures is provided in Appendix C.

6. Summary of Findings of Compliance

This document constitutes a draft of the Corps' evaluation of compliance with the Guidelines. This chapter will ultimately contain the Corps' findings of compliance based on Chapter 2, Finding of Practicable Alternatives (40 CFR 230.10 (a)); Chapter 3, Restrictions on Discharge (40 CFR 230.10 (b)); Chapter 4, Finding of No Significant Degradation (40 CFR 230.10 (c)); and Chapter 5, Minimization of Potential Adverse Effects (40 CFR 230.10 (d)).

As discussed in Chapter 1, however, the Corps will not finalize its compliance determination regarding the Applicant's permit application until after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS. At that time, the Corps will issue a ROD describing its decision on the permit application and its determination of whether the Applicant's proposed project complies with the Guidelines.

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Appendix A:

Factual Determinations (40 CFR 230.11)

Construction of the Applicant's proposed project would include the discharge of dredged or fill material in wetland and waters of the U.S. The Guidelines (40 CFR 230.11, Subpart B) require determination of the potential short-term and long-term effects of the proposed discharges of dredged or fill material on the physical, chemical, and biological components of the aquatic environment. These factual determinations will determine if there is minimal potential for shot-term or long-term significant adverse environmental effects of the proposed discharge. The determinations will be made in Sections 1 through 8 below, based on the findings of Subparts C through F (Appendix B, Technical Evaluation Factors).

1. Physical Substrate Determinations (40 CFR 230.11 (a))

Physical substrate determinations include an evaluation of effect that the proposed discharge will have, individually and cumulatively, on the substrate at the proposed disposal site. Considerations include the similarity in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site, and any potential changes in substrate elevation and bottom contours, including changes outside of the disposal site which may occur as a result of erosion, slumpage, or other movement of the discharged material. The duration and physical extent of substrate changes is also considered. Potential changes in substrate elevation and bottom contours are predicted on the basis of the proposed method, volume, location, and rate of discharge, as well as on the individual and combined effects of current patterns, water circulation, wind and wave action, and other physical factors that may affect the movement of the discharged material.

Sections 3.1, Geology and Geomorphology and 3.2, Soils and Permafrost of the Draft EIS describe the existing substrate under the proposed disposal site within the project area. A determination of impacts on the physical substrate for the Guidelines evaluation will be based on impact analysis included in the Section 5.2, Soils and Permafrost of the Draft EIS, the Technical Evaluation Factors findings of Subpart C (Appendix B, Section 1), and the Actions to Minimizing Adverse Effects found in Subpart H (Appendix C).

2. Water Circulation, Fluctuation, and Salinity Determinations (40 CFR 230.11 (b))

Water circulation, fluctuation, and salinity determinations include evaluation of the nature and degree of effect that the proposed discharge will have individually and cumulatively on water, current patterns, circulation including downstream flows, and normal water fluctuation. Consideration is given to water chemistry, salinity, clarity, color, odor, taste, dissolved gas levels, temperature, nutrients, eutrophication, and any other appropriate characteristics. Consideration is also given to the potential diversion or obstruction of flow, alterations of bottom contours, or other significant changes in the hydrologic regime. Potential impacts on the current patterns, water circulation, normal water fluctuation, and salinity are evaluated on the basis of the proposed method, volume, location, and rate of discharge.

Sections 3.5, Physical Oceanography and Coastal Processes and 3.6, Hydrology of the Draft EIS describe the existing freshwater hydrology and coastal water circulation, including streams, lakes, and nearshore lagoons and basins in the project area. Information regarding the impacts of the proposed Point Thomson Project activities on current patterns and water circulation in the project area may be found in Sections 5.5, Physical Oceanography and Coastal Processes; 5.6, Hydrology; and 5.7, Water Quality of the Draft

EIS. A determination of impacts on water circulation, fluctuation, and salinity will be based on the Technical Evaluation Factors findings in Subpart C as part of Appendix B, Sections 1.3, Water Quality and Chemistry, 1.4, Water Circulation and Current Patterns, 1.5 Normal Water Fluctuations, and.1.6, Salinity Gradients and on the proposed actions for minimizing effects found in Subpart H (Appendix C). The evaluation of impacts will also be based on the analysis of impacts in the Draft EIS.

3. Suspended Particulates and Turbidity Determinations (40 CFR 230.11 (c))

Suspended particulates and turbidity determinations include an evaluation of the nature and degree of effect that the proposed discharge will have on the kinds and concentrations of suspended particulates and turbidity in the vicinity of the disposal site. Consideration is given to the grain size of the material proposed for discharge, the shape and size of the plume of suspended particulates, the duration of the discharge and resulting plume, and whether or not the potential changes will cause violations of applicable water quality standards. Considerations include the proposed method, volume, location, and rate of discharge, as well as the individual and combined effects of current patterns, water circulation and fluctuations, wind and wave action, and other physical factors on the movement of suspended particulates.

Sections 3.5, Physical Oceanography and Coastal Processes; 3.6, Hydrology; and 3.7 Water Quality of the Draft EIS describe existing characteristics of water quality, including suspended particulates and turbidity in both marine and freshwater in the project area. A determination of impacts on suspended particulates and turbidity will be based on the impact analysis found in Sections 5.5, Physical Oceanography and Coastal Processes; 5.6, Hydrology; and 5.7, Water Quality of the Draft EIS, the Technical Evaluation Factors findings in Subpart C as part of Appendix B, Sections 1.2, Suspended Particulates and Turbidity, and the Actions for Minimizing Adverse Effects found in Subpart H (Appendix C).

4. Contaminant Determinations (40 CFR 230.11 (d))

The factual determinations within the Guidelines require a determination of the degree to which the material proposed for discharge could introduce, relocate, or increase contaminants. This determination considers the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants.

Sections 3.2, Soils and Permafrost and 3.24, Contaminated Sites and Spill History of the Draft EIS provide information regarding the character of the materials proposed for discharge and the potential for contamination in discharge material in the project area. The determination of the potential for contaminants will be based on the analysis of impacts in Sections 5.2, Soils and Permafrost and 5.24, Spill Risk and Impact Assessment of the Draft EIS, and on the evaluation of dredged and fill materials conducted as part of the Evaluation of Dredged or Fill Material in Subpart G (Appendix B, Section 5) of this document.

5. Aquatic Ecosystems Structure and Function Determinations (40 CFR 230.11 (e))

The determination of impacts on the structure and function of aquatic ecosystems includes an evaluation of potential changes in substrate characteristics and elevation, water or substrate chemistry, nutrients, currents, circulation, fluctuation, and salinity on the existence or recolonization of indigenous aquatic organisms or communities.

The aquatic ecosystems of the Point Thomson area include both freshwater and marine habitats. These ecosystems support wetland vegetation, fish, invertebrate, bird, and marine mammal populations. A determination of impacts on the structure and function of the aquatic ecosystem will be based on the impact analysis found with in Sections 5.8, Vegetation and Wetlands; 5.9, Birds; 5.11, Marine Mammals; and 5.12, Fish, Essential Fish Habitat, and Invertebrates of the Draft EIS, the Technical Evaluation Factors findings in Subparts D and E as part of Appendix B, Sections 3.2, Wetlands, 2.2, Aquatic Food Web, and 2.3, Other Wildlife, and the Actions for Minimizing Adverse Effects found in Subpart H (Appendix C). In addition, Appendix J, Mapped Land Cover of the Draft EIS, and Appendix K, Wetland Functional Assessment of the Draft EIS provide supporting information on vegetation classification and function assessment. This factual determination may also include information based on the Subpart G: Evaluation of the Dredged or Fill Material (Appendix B, Section 5) to evaluate the effect the discharge may have on communities or populations of organisms expected to be exposed to it.

6. Proposed Disposal Site Determination (40 CFR 230.11 (f))

The proposed disposal sites for dredged and fill materials are described in detail in Section 2.3, Alternatives Descriptions of the Draft EIS and the Applicant’s Final Department of the Army Permit Application (ExxonMobil 2011a). As part of the Applicant’s proposed project, fill materials would be placed for the construction of project components and facilities including gravel infrastructure for roads, pads, and airstrips; gravel infrastructure for export and gathering pipeline supports; bridges and culverts associated with the gravel roads, and the emergency boat ramp facility. In addition to these project components, the proposed project would also include the placement of fill for the construction of the barge offloading facilities and the disposal of dredged materials from the barge offloading area. The location of the proposed disposal sites for all action alternatives can be seen in Figures 2.4-5 and 2.4-6 of the Draft EIS.

The Guidelines state that the mixing zone associated with each specified disposal site shall be confined to the smallest practicable area consistent with the type of discharge dispersion being used. As part of this determination, the Corps’ must evaluate the acceptability of the proposed disposal sites and mixing zone based on the following factors:

- Depth of water at the disposal site;
- Current velocity, direction, and variability at the disposal sites;
- Degree of turbulence;
- Stratification resulting from causes such as obstructions or salinity or density profiles at the disposal site;
- Discharge vessel speed and direction if appropriate;
- Rate of discharge;
- Ambient concentration of constituents of interest;
- Dredged material characteristics, including concentrations of constituents, amount of material, type of material, and settling velocities;
- Number of discharge actions per unit time; and
- Other factors of the disposal site that affect the rates and patterns of mixing.

Sections 3.2, Soils and Permafrost; 3.5, Physical Oceanography and Coastal Processes; 3.6, Hydrology; and 3.24, Contaminated Sites and Spill History, of the Draft EIS provide information regarding existing conditions at the proposed disposal site. The factual determination of the proposed disposal site will be based on the impact analysis found in Sections 5.2, Soils and Permafrost; 5.5, Physical Oceanography and Coastal Processes; 5.6, Hydrology; and 5.24, Spill Risk and Impact Assessment of the Draft EIS. The factual determination will also be based on the findings of Subparts C (Appendix B, Section 1) and H (Appendix B, Section 5) of this document.

7. Determination of Cumulative Effects on the Aquatic Ecosystem (40 CFR 230.11 (g))

Cumulative impacts are the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material. Although the impact of a particular discharge may constitute a minor change in itself, the cumulative effect of numerous such piecemeal changes can result in a major impairment of the water resources and interfere with the productivity and water quality of existing aquatic ecosystems. A determination of cumulative impacts that may result from the discharge of dredged or fill material in waters of the U.S. should be evaluated to the extent reasonable and practical.

Past and present actions in the project area that have affected the aquatic ecosystem in the project area include oil and gas exploration and development, roads, community development, military infrastructure, scientific research, and the release of air pollutants worldwide that has resulted in deposition of pollutants on Alaska's North Slope. Reasonably foreseeable future actions include additional oil and gas developments including the full field development at Point Thomson and the construction of a gas export pipeline; additional transportation infrastructure such as the proposed Foothills West Road; and continued use of the area for tourism, recreation, subsistence uses, and scientific research. See Section 4.2, Cumulative Impacts Methodology of the Draft EIS for a full list of past and present actions in the project area.

Sections 5.8, Vegetation and Wetlands; 5.9, Birds; 5.11, Marine Mammals; and 5.12, Fish, Essential Fish Habitat, and Invertebrates of the Draft EIS contain detailed analysis of potential cumulative impacts to the aquatic ecosystem from past, present, and reasonably foreseeable future actions that could result under all Draft EIS alternatives. The determination of cumulative effects on the aquatic ecosystem will be based on these Draft EIS impact analyses with consideration for impacts discussed in the Technical Evaluation Factors in Subparts D (Appendix B, Section 2) and E (Appendix B, Section 3) of this document.

8. Determination of Secondary Effects on the Aquatic Ecosystem (40 CFR 230.11 (h))

Secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material. For the proposed Point Thomson Project, a consideration of secondary effects may include the potential for a spill of hydrocarbon or other toxic materials; impacts to wetlands, vegetation, and water bodies as a result of dust, snow buildup, impoundments and thermokarst effects; the disturbance of wildlife populations as a result of noise or human activity; and a change in wildlife survival or productivity.

Sections 5.8, Vegetation and Wetlands; 5.9, Birds; 5.11, Marine Mammals; 5.12, Fish, Essential Fish Habitat, and Invertebrates; and 5.24, Spill Risk and Impact Assessment of the Draft EIS contain detailed analysis of potential secondary impacts to the aquatic ecosystem. The factual determination of secondary effects will be based on these impact analyses and on the analyses found in Subparts D (Appendix B, Section 2) and E (Appendix B, Section 3) of this document.

Appendix B:

Technical Evaluation Factors

The technical evaluation factors discussed in this appendix evaluate potential impacts on the physical and chemical characteristics of the aquatic ecosystem (Subpart C), biological characteristics of the aquatic ecosystem (Subpart D), special aquatic sites (Subpart E), and human use characteristics (Subpart F). Subpart G discusses the evaluation of the proposed fill material.

1. Subpart C: Potential Impacts on Physical and Chemical Characteristics of the Aquatic Environment

1.1. Substrate (40 CFR 230.20)

The substrate of the aquatic ecosystem underlies open waters of the U.S. and constitutes the surface of wetlands. It consists of organic and inorganic solid materials and includes water and other liquids or gases that fill the spaces between solid particles. Sections 3.1, Geology and Geomorphology and 3.2, Soils and Permafrost of the Draft EIS describe existing characteristics of the substrate within the project area.

The physical substrate on which the proposed fill would be placed primarily consists of an upper layer of organic peat and/or organic silt overlying massive ice, sand, and gravel layers. Permafrost extends from depths of 650 to 2,100 feet below the land surface and is essential for the development of microgeographical features on the ACP. Increases in permafrost thickness and extent are driven by climatic cooling, maturation of vegetation, increased albedo, and decreased snow cover. Climatic warming, removal or compaction of vegetation, and mass wasting will decrease the thickness or extent of the permafrost. The near-surface soils subject to seasonal thaw are referred to as the active layer.

Climate is the dominant soil-forming factor in the ACP. The underlying permafrost creates an impermeable barrier that influences surface morphology and hydrology through the waterlogging of surface soils. The cold climate inhibits certain soil-forming processes such as weathering and movement of clay downward through the soil, while organic matter accumulation is heightened due to the reducing conditions caused by saturation, slowed decomposition in the cold, wet conditions, and churning of the surface organic materials to the lowest parts of the active layer and upper permafrost.

1.1.1. Potential Impacts

The analysis of impacts to the physical substrate may include consideration of potential changes in the complex physical, chemical, and biological characteristics of the substrate. Discharges which alter substrate elevation or contours can result in changes in water circulation, depth, current pattern, water fluctuation, and water temperature. Discharges may adversely affect bottom-dwelling organisms at the site by smothering stationary organisms or forcing mobile organisms to migrate. Benthic forms present prior to a discharge are unlikely to recolonize the area around discharged material if it is too dissimilar from that of the discharge site.

Other potential impacts that will be evaluated include the erosion, slumping, or lateral displacement of dredged and fill material that can adversely affect areas of the substrate outside the perimeters of the disposal site by changing or destroying habitat. The bulk and composition of the discharged material and the location, method, and timing of discharges may all influence the degree of impact on the substrate.

Information regarding the impacts of each alternative on the physical substrate of the project area may be found in Section 5.2, Soils and Permafrost of the Draft EIS. Impact analysis from the Draft EIS will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

1.2. Suspended Particulates and Turbidity (40 CFR 230.21)

Turbidity is cloudiness caused by fine grained, mineral particles of solid matter suspended in water. It is measured by the amount of scattering and absorption of light rays caused by the particles and is reported in nephelometric turbidity units (NTU; (Brooks, et al. 2003). Total suspended solids (TSS), measured in milligrams per liter (mg/l), is a water quality parameter that refers to the weight of solids suspended in water that can be removed by a filter. Section 3.7, Water Quality of the Draft EIS describes existing characteristics of suspended particles and turbidity in the project area.

In the marine environment of the project area, turbidity and suspended particulates vary seasonally. During spring breakup, turbidity and TSS concentrations are usually at their highest due to runoff from watersheds and peak discharges being able to carry a high sediment load downstream and into the marine environment. Coastal erosion also has a large influence on turbidity values and TSS concentrations throughout the open-water season. During the winter, sea-ice conditions prevent wind from being a factor in stirring up the sediments that could increase turbidity or TSS. While there can be under-ice water movement that occasionally causes bottom sediments to be introduced into the water column, winter turbidity concentrations are lower than values observed in the summer.

Freshwater turbidity in the project area can be affected by many factors, including sediment load, organic matter concentration, maximum particle size the stream discharge can carry, the season, and the amount of plant material in the riparian zone of the streams. The highest turbidity concentrations are typically observed during the spring breakup event when discharge is high and overground runoff occurs. Sediments, plant material, and all other organic materials flushed into the water system are the primary causes of increased turbidity during breakup or high-flow events. The transport of material during breakup is an important part of the hydrologic cycle in the area and can result in the movement of more than 80 percent of the total suspended sediment load for the entire year in Alaskan arctic streams and rivers (Rember and Trefry 2004, Trefry, et al. 2009).

1.2.1. Potential Impacts

The analysis of impacts to suspended particulates and turbidity will include consideration of changes to turbidity, such as elevated levels of suspended particulates in the water column for varying lengths of time. Higher turbidity levels may reduce light penetration and lower the rate of photosynthesis and primary productivity of an aquatic area. Sight dependent species may suffer reduced feeding ability, leading to limited growth and lowered resistance to disease if high levels of suspended particulates persist. The biological and the chemical content of the suspended material may react with the dissolved oxygen in the water, which can cause oxygen depletion. Toxic metals and organics, pathogens, and viruses absorbed or adsorbed to fine-grained particulates in the material may become biologically available to organisms either in the water column or on the substrate. Significant increases in suspended particulate levels create turbid plumes which may be highly visible and aesthetically displeasing. The extent and persistence of these adverse impacts depend upon the relative increase in suspended particulates above the amount occurring naturally, the duration of the higher levels, the current patterns, water level, and fluctuations present when discharges occur. Potential impacts also depend on the volume, rate, and duration of the discharge, particulate deposition, and the seasonal timing of the discharge.

Sections 5.6, Hydrology, and 5.7, Water Quality of the Draft EIS describe the potential impacts of the proposed discharge of dredged and fill materials on suspended particulates and turbidity in the project area. The Draft EIS impact analysis of the proposed discharge on suspended particulates and turbidity will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

1.3. Water Quality and Chemistry (40 CFR 230.22)

Water is the part of the aquatic ecosystem in which organic and inorganic constituents are dissolved and suspended. Characteristics, including clarity, nutrients and chemical content, physical and biological content, dissolved gas level, pH, and temperature, contribute to its life-sustaining capabilities. Sections 3.6, Hydrology and 3.7, Water Quality of the Draft EIS describe the existing freshwater and marine resources and water quality. Water quality, as it relates to turbidity, particulates, and salinity are discussed in Sections 1.2, Suspended Particulates and Turbidity and 1.6, Salinity Gradients.

Marine water quality in the study area is good. Temperature in the Beaufort Sea varies depending on location and time of year. In the project area, temperatures can range from 30°F to 37°F (Craig 1984). Dissolved oxygen (DO) concentrations in the Beaufort Sea and Lions Bay also vary by season, with DO concentrations decreasing during winter months when oxygen and carbon dioxide exchange between atmosphere and water cease due to thick ice conditions. However, depending on ice cover and circulation patterns, DO concentrations remain in a range that is conducive to overwintering for many fish species. Trace metals naturally occur in the Beaufort Sea and are introduced from coastal erosion, freshwater inputs, and atmospheric deposition. No elevated concentrations of trace metals, nitrogen, or hydrocarbons have been detected in water sampled from Lion Bay.

Freshwater quality in the study area is good; no freshwater bodies in the project area are listed as impaired. Water quality parameters, such as DO, biochemical oxygen demand (BOD), pH, nitrogen, organic carbon, and trace metals vary by water body type, size, location, and season of the year, but generally fall within ADEC water quality standards for aquatic life and surface and drinking water.

The seasonal effect of freeze-thaw cycles plays a major role in water quality on the North Slope. Water bodies shallower than 7 feet typically freeze to the bottom during the winter. Water bodies that retain liquid water over the winter may experience changes in water quality in that water as DO concentrations are depleted and the concentration of suspended solids can be 30 times higher than in summer months (Hobbie 1980). Each spring, during peak discharge, snowmelt and high sediment loads can also affect water quality parameters including decreasing alkalinity, lowering DO concentrations, and increasing trace metal concentrations. Similarly, nearly half of the annual total concentration of dissolved organic carbon is transported downstream during peak flows at spring breakup (Rember and Trefry 2004).

1.3.1. Potential Impacts

The analysis of impacts to water quality and chemistry will include consideration of changes in the chemistry and the physical characteristics of water at a disposal site through the introduction of chemicals or changes in the clarity, color, odor, and taste of water and the addition of contaminants. Changes in water quality may reduce or eliminate the suitability of water bodies for populations of aquatic organisms, and for human consumption, recreation, and aesthetics. The introduction of nutrients or organic material to the water column as a result of the discharge can lead to a high BOD, which in turn can lead to reduced DO, thus potentially affecting the survival of many aquatic organisms. Increases in nutrients can favor one group of organisms such as algae to the detriment of other more desirable types such as submerged aquatic vegetation.

Information regarding the impacts of the proposed project activities of the Draft EIS alternatives on water resources and water quality in the project area may be found in Sections 5.6, Hydrology; and 5.7, Water Quality of the Draft EIS. The Draft EIS impact analysis of the proposed discharge on water quality and chemistry will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

1.4. Water Circulation and Current Patterns (40 CFR 230.23)

Current patterns and water circulation are the physical movement of water in the aquatic ecosystem. Sections 3.5, Physical Oceanography and Coastal Processes; 3.6, Hydrology; and 3.7, Water Quality of the Draft EIS describe existing freshwater and marine circulation and current patterns of the project area.

1.4.1. Marine Environment

In the project area along the Beaufort Sea coast, the circulation of nearshore waters is driven primarily by the wind. In the passes between barrier islands, as well as between barrier islands and the mainland, currents are aligned with the directional axis of the passes and are responsive to the overall action of wind on the lagoons contained between barrier islands and the mainland.

Water circulation and ocean processes continue during winter, when sea ice covers the water column. Sea ice begins to form within Lion Lagoon, and elsewhere along the Beaufort Sea coast, as early as mid-September. Ice movement is more likely earlier in the winter season, before nearshore ice becomes thicker and landfast; however, landfast ice is still subject to both wind and water movement. Within the lagoons along the Beaufort Sea coast, the landfast ice generally extends from the mainland shore to the barrier islands. Wind stress applied to the ice sheet can trigger movement of the sea ice, which in turn can scour shorelines and the seabed. On shorelines that are exposed to the open sea, onshore winds can push the sea ice onto the beach, producing an ice pile up that can reach many meters high and extend inland several tens of meters.

1.4.2. Freshwater Environment

Freshwater circulation in the project area is characterized by three main river drainages, many smaller rivers and streams, numerous thaw lakes, and shallow, seasonal interstitial groundwater. Three major drainages are located in the western portion of the study area: the Sagavanirktok (5,570 square miles [mi^2]), Kadleroshilik (586 mi^2), and Shaviovik (1,555 mi^2) Rivers, all of which have their headwaters outside of the ACP in the Brooks Range. Smaller streams between the Shaviovik and Staines Rivers originate on the Canning River fan and are contained completely within the ACP. Drainage areas of these smaller streams range from 0.2 to 95.6 mi^2.

Thaw lakes (lakes formed when water melts and collects on the ground surface, above an unbroken permafrost layer) occur in abundance across the ACP and are one of the dominant terrain features. Thaw lakes occur more often in the western ACP than in the eastern ACP. The lakes in the project area vary in size and depth, but tend to be shallow with large surface areas. Lakes shallower than 7 feet typically freeze to the bottom during the winter. During spring breakup, snow and ice melt brings lakes and streams back to their natural water levels and inundate the polygonal ground complexes with microlows in the project area. Lake volumes are largely dependent on the size of the drainage basin, runoff characteristics, amounts of precipitation, and amount of evaporation from the water surface.

Shallow seasonal interstitial groundwater occurs in contact with thaw lakes, rivers, and streams. These shallow bodies of groundwater are isolated, and do not form a water table, even seasonally. The permafrost layer serves as a barrier to surface recharge.

1.4.3. Potential Impacts

The analysis of impacts to water circulation and current patterns will include consideration of potential modifications of current patterns and water circulation created by obstructing flow, changing the direction or velocity of water flow and circulation, or changing the dimensions of a water body. Potential impacts may include adverse changes to the location, structure, and dynamics of aquatic communities; shoreline and substrate erosion and deposition rates; the deposition of suspended particulates; the rate and extent of mixing of dissolved and suspended components of the water body; and water stratification. Sections 5.5, Physical Oceanography and Coastal Processes; 5.6, Hydrology; and 5.7 Water Quality of the Draft EIS describe potential impacts of project infrastructure on water circulation and current patterns. The Draft EIS impact analysis of the proposed discharge on water quality and chemistry will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

1.5. Alteration of Normal Fluctuations (40 CFR 230.24)

Normal water fluctuations in a natural aquatic ecosystem consist of daily, seasonal, and annual tidal and flood fluctuations in water level. Sections 3.5, Physical Oceanography and Coastal Processes; 3.6, Hydrology; and 3.7, Water Quality of the Draft EIS describe existing freshwater and marine water fluctuations in the project area. Additional information is provided in Section 1.4, Water Circulation and Current Patterns.

1.5.1. Marine Environment

Marine water level variations along the Beaufort Sea coast are the result of tides, storm surge, and waves. Tides in the area have a mean diurnal range of only 0.7 feet. Storm surges are a far more important cause of water level variation and are the result of strong winds blowing parallel to the coast. Strong easterly winds can produce negative storm surges of as much as 2 to3 feet, while strong westerlies can produce positive storm surges of 4 to 6 feet or even more. Wave heights observed within Lion Lagoon during a 1982 study were mostly less than 2 feet, although occasional storms caused waves as high as 5 feet.

1.5.2. Freshwater Environment

Streamflow on the North Slope follows a seasonal pattern as streams begin to freeze in September, are at or near zero during December or January, and then rapidly release more than half of annual flow during the 1 to 2 week melting window in late May or early June. The rapid release of such a large volume of water during breakup leads to overbank flooding of the shallow drainage network. Large amounts of sheetflow also results from the fact that most streams and rivers that have water in them in September typically freeze to the bottom and become so clogged with ice and snow that they have very little conveyance. Furthermore, the freezing of the active layer of soil in the fall means that most runoff remains above ground instead of being absorbed by the soil.

Breakup begins earliest in the spring in the mountains, and streamflow persists longer in the fall in longer rivers originating in the mountainous provinces (Sloan 1987). Stream discharge is a function of the volume of ice frozen in channels and drainage basin runoff. Streams originating on the ACP, such as smaller streams on the Canning River fan, are not expected to produce large ice floes or ice damming because these streams are typically dry during late fall and early winter, when the ice would form. Major rivers such as the Sagavanirktok, the Kadleroshilik, and Shaviovik, which often sustain winter baseflows, have higher potential for ice dams and ice debris during spring breakup than smaller streams. While the flooding regime for rivers in this area is dominantly snowmelt-driven, rivers draining the Brooks Range, such as the Sagavanirktok River, also have the potential to produce significant summer precipitation-driven flood discharges

Lake levels in the project area are impacted by evapotranspiration and water withdrawals for human use. Studies of lake recharge following water withdrawal in areas west of Point Thomson found that lakes are able to recharge from spring snow melt. However, the study also suggested that the capacity of water resources to support operations that consume water differs between the regions. No evaluations of lake recharge have been conducted in the project area.

1.5.3. Potential Impacts

The analysis of impacts related to normal water fluctuations will include consideration of changes to the normal water-level fluctuation pattern of an area, resulting in prolonged periods of inundation; exaggerated extremes of high and low water; or a static, non-fluctuating water levels. Such water level modifications may change salinity patterns, alter erosion or sedimentation rates, aggravate water temperature extremes, and upset the nutrient and dissolved oxygen balance of the aquatic ecosystem. In addition, these modifications can alter or destroy communities and populations of aquatic animals and vegetation, induce populations of nuisance organisms, modify habitat, reduce food supplies, restrict movement of aquatic fauna, destroy spawning areas, and change adjacent, upstream, and downstream areas.

Sections 5.5, Physical Oceanography and Coastal Processes; 5.6, Hydrology; and 5.7, Water Quality of the Draft EIS describe potential impacts of project infrastructure on water fluctuations. The Draft EIS impact analysis of the proposed discharge on water quality and chemistry will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

1.6. Salinity Gradients (40 CFR 230.25)

Salinity gradients form where salt water from the ocean meets and mixes with freshwater from land. Sections 3.5, Physical Oceanography and Coastal Processes; 3.6, Hydrology; and 3.7, Water Quality of the Draft EIS describe salinity gradients in aquatic environments in the project area.

The salinity of nearshore waters along the Beaufort Sea coast is strongly influenced by seasonal sea ice and meteorological conditions. Sea ice begins to form in Beaufort coastal lagoons between mid-September and mid-October. Under the ice, the water column is well mixed, with temperature fluctuating around 29°F (-1.5°C) and high salinity (32.4 ppt). During spring breakup in early June, freshwater overflows the sea ice at the river mouths, causing some melting of the sea ice surface and resulting in a freshwater layer in the water column which can extend as deep at 13 feet over a marine water layer (URS 1999). As the open-water season progresses, coastal waters become colder and more saline due to vertical mixing, and as solar strength and freshwater input diminish (Colonell and Niedoroda 1990).

The location of offshore barrier islands and major rivers also play a role in influencing fresh, brackish, and marine waters mixing in the Lion Bay area. The Canning/Staines River is the major freshwater input into the bay. The barrier islands act as a natural barrier for brackish water entering the greater Lion Bay marine environment (URS 2000). When the wind currents originate from the west, fresh water from the Sagavanirktok and Shaviovik Rivers, located approximately 40 miles west of Lion Bay, moves eastward along the surface and shoreline. This freshwater thoroughly mixes with marine water at lower depths to become brackish water by the time it reaches Lion Bay (URS 1999).

In the freshwater environment, the salinity and water quality of streams in the project area are influenced by spring breakup, precipitation events, surface runoff, and by saltwater intrusions from the Beaufort Sea. Several thaw lakes and ponds along the coastal area and near the pad locations are influenced by saline water from storm surges, ocean spray, and inundated troughs (microlows) connecting the Beaufort Sea estuaries to coastal lakes. Concentrations of total dissolved solids (TDS) in both lakes and streams in the project area increase the closer they are to the Beaufort Sea. Near the mouth where streams empty into the bay, conductivity values indicates mixing of freshwater with marine waters. Closer to the coast, water bodies tend to be dominated by sodium chloride (ocean-derived salt). Farther from the coast, water bodies are dominated by calcium bicarbonates, indicative of freshwater.

1.6.1. Potential Impacts

The analysis of impacts related to the salinity gradients will include consideration of changes in existing salinity gradients resulting from obstructions which divert or restrict flow of either fresh or salt water. For example, changes in the movement of the salt water into and out of that area can effectively lower the volume of salt water available for mixing within that estuary. The downstream migration of the salinity gradient can occur, displacing the maximum sedimentation zone and requiring salinity-dependent aquatic biota to adjust to the new conditions, move to new locations if possible, or perish. In the freshwater zone, discharge operations in the upstream regions can have equally adverse impacts. A significant reduction in the volume of fresh water moving into an estuary can affect the location and type of mixing thereby changing the characteristic salinity patterns. The resulting changed circulation pattern can cause the upstream migration of the salinity gradient displacing the maximum sedimentation zone. This migration may affect those organisms that are adapted to freshwater environments.

Information regarding the impacts of the proposed project activities on salinity gradients in the project area may be found in Sections 5.6, Hydrology; and 5.7, Water Quality of the Draft EIS. The Draft EIS impact analysis of the proposed discharge on salinity gradients will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

2. Subpart D: Potential Impacts on the Biological Characteristics of the Aquatic Ecosystem

2.1. Threatened and Endangered Species (40 CFR 230.30)

An endangered species is a plant or animal in danger of extinction throughout all or a significant portion of its range. A threatened species is one in danger of becoming an endangered species in the foreseeable future throughout all or a significant portion of its range. Threatened and endangered species that may be affected by the proposed project are described in Sections 3.9, Birds and 3.11, Marine Mammals of the Draft EIS. Furthermore, the Applicant requested designation as the "non-federal representative" to prepare Biological Assessments (BA) for threatened and endangered species as part of Section 7 of the ESA; the Corps approved the request and the BAs for all threatened and endangered species in the project area are included as Appendix M of the Draft EIS.

2.1.1. Birds

The project area provides habitat for two species of birds, the Steller's eider and spectacled eider, which have been federally listed as threatened under the ESA, and one species of bird, the yellow-billed loon, which is under consideration for listing as threatened.

Both the Steller's eider and spectacled eider have had critical habitat designated in western Alaska, but no critical habitat for either bird has been designated on the ACP or within the project area. Currently, the Barrow area appears to be the center of abundance and primary nesting area for the low densities of Steller's eiders that do occur on the ACP. Steller's eiders have been observed since the 1970s in the Kadleroshilik, Shaviovik, and Canning River deltas and at Bullen Point during May to September (Quakenbush, et al. 2002). However, neither nesting or post-nesting Steller's eiders have been recorded in the Point Thomson study area in recent years and the study area appears to be east of the Steller's eiders' recently document breeding range and post-breeding and molting area (Fischer et al. 2002, Fischer and Larned 2004)

On the ACP, nearly all spectacled eiders breed north of 70° latitude between Icy Cape and the Shaviovik River, within about 50 miles of the coast (65 FR 6114). Within this region, most spectacled eiders occur between Cape Simpson and the Sagavanirktok River. During four years of surveys conducted between 1998 and 2001, 100 percent coverage surveys for eiders in a portion of the Point Thomson study area documented seven pairs of spectacled eiders (TERA 2000, 2002). Zero to three pairs of spectacled eiders occurred within the Point Thomson Unit survey area, resulting in an average annual nesting density of less than 1 pair/mi^2 within the 76.7 mi^2 survey area (TERA 2002). A 2010 aerial nesting survey of the study area did not document any spectacled eiders (Johnson et al. 2011).

Yellow-billed loon density in the study area is also very low (Larned et al. 2009). No yellow-billed loon nests have been found in the Point Thomson study area, although the breeding pair survey data and density contours indicate there may be nest habitat about 14 miles southwest of the project area. A study area-specific aerial survey for nesting yellow-billed loons was conducted in 2010 and no nesting birds were observed (Johnson et al. 2011). However, yellow-billed loons have been observed using coastal areas in the study area for summer foraging (Fischer et al. 2002, Rodrigues 2002a, 2002b, Noel et al. 2003, Fischer and Larned 2004) and for fall staging and migration (WCC and ABR 1983). An average of two yellow-billed loons were observed during late-June or early July coastal surveys during between 1999 and 2009, while an estimated six yellow-billed loons use the nearshore and lagoon habitats in the study area.

2.1.2. Marine Mammals

The project area provides habitat for one species of marine mammal, the bowhead whale which has been federally listed as endangered under the ESA, one species of marine mammal, the polar bear which has been federally listed as threatened, and two species of marine mammal, the bearded seal and ringed seal, which are under consideration for listing as threatened.

The bowhead whale, which was listed as endangered by the National Marine Fisheries Service (NMFS) in 1970, prefers shallow, continental shelf waters and is associated with relatively heavy ice cover for much of the year. The extent, nature, and location of ice cover in the Beaufort Sea appear to influence the timing, duration, and location of the bowhead whale migration. In May and June, most bowhead whales from the Western Stock migrate eastward along the Beaufort Sea coast, seaward of the barrier islands, though some remain to feed off Barrow. The spring migration tends to occur far offshore, outside of the

Point Thomson study area. The return westward migration, starting in August and lasting through October, also occurs primarily seaward of the barrier islands, but closer to shore than the spring migration. A large proportion of the population transits through the Point Thomson study area at this time, but few whales pass landward of the barrier islands.

In May 2008, the USFWS listed the polar bear as a threatened species due to concerns over the threat to polar bear habitat posed by the trend of rapidly diminishing sea ice cover and thickness in the Arctic Ocean. Designated critical habitat includes (1) sea ice habitat over the continental shelf; (2) terrestrial denning habitat; and (3) barrier island habitat. All three types of critical habitat can be found in the Point Thomson study area. The Southern Beaufort Sea (SBS) stock of polar bears is the only stock that occurs in the project area. Although polar bears may be encountered year-round in nearshore and coastal areas of the Beaufort Sea (Schliebe, et al. 2006), individuals are usually absent from the study area during early summer (June-July). Numbers begin to increase in the project area in August and peak in September; these bears are believed to be moving through the area to reach newly-forming pack ice to forage. The barrier islands in the study area, especially Flaxman Island, are consistently used by denning females from fall through winter (Durner, et al. 2006, Smith, et al. 2007), although the number of denning bears is relatively small compared to other known denning areas.

On December 10, 2010, NMFS proposed listing five subspecies of ringed seals and one subspecies of bearded seal as threatened due to the threat posed by a decline in sea ice with which they are closely associated (Cameron, et al. 2010, Kelly, et al. 2010). The ringed seal is the most abundant marine mammal in the Beaufort sea while the bearded seal is the second most common seal species in the Beaufort Sea (Frost, et al. 1988, Funk, et al. 2010, Kelly, et al. 2010, Laidre, et al. 2008). The density and distribution of both species varies between nearshore and offshore waters by season and ice cover (Moulton and Lawson 2002, Kelly, et al. 2010, Kovacs 2008, Cameron, et al. 2010). Ringed seals are expected to occur commonly in and near the study area in coastal waters during the summer/fall open-water season. During winter and spring, the proportion of ringed seals in the study area is anticipated to be small relative to the estimated size of the Beaufort Sea population, given existing records and the limited availability of ice habitat with suitable water depths. Bearded seals, which are normally found in broken ice that is unstable, typically only inhabit the Beaufort Sea during the summer. This species is also unlikely to occur in the study area in winter or early spring.

2.1.3. Potential Impacts

The analysis of impacts on threatened or endangered species will include consideration of direct impacts such as the killing of a species individual; the facilitation of incompatible activities; or the impairment or destruction of habitat to which a species is limited. The characteristics of aquatic habitats that are particularly crucial to the continued survival of threatened or endangered species will be evaluated, including consideration of water quality; spawning and maturation areas; nesting areas; protective cover; adequate and reliable food supply; and resting areas for migratory species. Potential impacts to crucial aquatic habitats may include changes in normal water conditions for clarity, chemical content, nutrient balance, DO, pH, temperature, salinity, current patterns, circulation, and fluctuations.

Sections 5.9, Birds and 5.11, Marine Mammals of the Draft EIS discuss potential impacts to threatened and endangered species in the project area. The Draft EIS impact analysis of the proposed discharge on these species will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

2.2. Aquatic Food Web (40 CFR 230.31)

Aquatic organisms in the food web include fish, invertebrates, and the plants and animals on which they feed and depend upon for their needs. Section 3.12, Fish, Essential Fish Habitat, and Invertebrates of the Draft EIS describes organisms in the aquatic food web.

Fifty-eight species of fish have been found in the nearshore marine environment near the project area. Thirteen species of fish have been documented in the freshwater habitats of the study area. Eight fish species were identified as species of importance or concern for the Point Thomson Project. These include arctic cisco, least cisco, Dolly Varden, arctic grayling, broad whitefish, humpback whitefish, arctic cod, and pacific salmon.

Marine habitat for fish in the study area includes coastal waters between the Canning/Staines and Sagavanirktok Rivers; Lion Bay, Mikkelsen Bay, Foggy Island Bay, and portions of the Canning/Staines and Sagavanirktok River deltas. The marine study area, particularly the nearshore environment, is used by fish species for migration (e.g., adult Pacific salmon, adult and immature arctic cisco and Dolly Varden), foraging (e.g., adult arctic cisco, least cisco, Dolly Varden, broad whitefish, and humpback whitefish), and spawning (e.g., arctic cod).

Freshwater habitat of the study area includes shallow, seasonally flooded ponds and wetlands, small tundra streams, and larger, braided rivers and streams. Most freshwater habitat in the study area is available only during the open water season because most of these habitats freeze to the bottom during winter. Overwintering habitat in the study area is rare due to the shallow depth of most lakes, ponds, and streams. Some aquatic invertebrates overwinter in frozen sediments. Freshwater habitat is reduced by 95 percent by late winter (Craig 1989). Overwintering sites for Dolly Varden include portions of the Canning/Staines, Sagavanirktok, Kavik, and Shaviovik Rivers.

In addition to fish species, invertebrates, algae, and phytoplankton are also critical components of marine and freshwater habitats in the study area. Invertebrates include a diverse array of organisms such as polychaete and oligochaete worms, clams, crustaceans (which include a diversity of species from microscopic sized copepods and amphipods to large crabs), and insects (particularly larval forms). Aquatic invertebrates are the primary food for many fish and marine mammal species. Primary productivity in the marine environment is primarily driven by epontic (ice) algae and phytoplankton in the spring and early summer and phytoplankton in the mid to late summer.

2.2.1. Potential Impacts

The analysis of impacts related to the aquatic ecosystem and food web will include consideration of the debilitation or death of organisms by smothering, exposure to chemical contaminants in dissolved or suspended form, exposure to high levels of suspended particulates, reduction in food supply, or alteration of the substrate upon which aquatic organisms are dependent. Sedentary organisms are particularly sensitive to the discharge of material during periods of reproduction, growth, and development due to their limited mobility. An increase in suspended particulates can also result in the smothering of attached or buried eggs of many organisms by limiting or sealing off their exposure to oxygenated water.

Impacts on populations of fish and invertebrates may also occur through the release of contaminants which can adversely affect adults, juveniles, larvae, or eggs. Increased contaminants also may result in the establishment or proliferation of an undesirable competitive species of plant or animal at the expense of the desired resident species. The discharge of dredged or fill material can redirect, delay, or stop the reproductive and feeding movements of some species of fish and invertebrates, thus preventing their aggregation in accustomed places such as spawning or nursery grounds and potentially leading to reduced populations. Reduction of detrital feeding species or other representatives of lower trophic levels can impair the flow of energy from primary consumers to higher trophic levels. The reduction or potential elimination of food chain organism populations may decrease the overall productivity and nutrient export capability of the ecosystem.

For the proposed Point Thomson Project, key considerations in the evaluation of impacts on aquatic ecosystems include the maintenance of adequate winter habitat, suitable feeding and spawning habitats, and passage to and from these areas for fish and invertebrates. Section 5.12, Fish, Essential Fish Habitat, and Invertebrates of the Draft EIS discuss potential impacts to aquatic ecosystems and organisms in the project area. The Draft EIS impact analysis of the proposed discharge on these species will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

2.3. Other Wildlife (40 CFR 230.32)

Wildlife associated with aquatic ecosystems includes resident and transient mammals and birds. Sections 3.9, Birds; 3.10, Terrestrial Mammals; and 3.11, Marine Mammals of the Draft EIS describe other wildlife present in the Point Thomson Project area.

2.3.1. Birds

More than 70 bird species have been documented in the study area. Of these, 29 are listed as species of concern by the USFWS, Audubon, and/or Alaska Shorebird Group because of small population sizes, population declines, sensitivity to disturbance, or other reasons. Two of these 29 species, the spectacled eider and Steller’s eider, are also listed as threatened under the ESA and one of them, the yellow-billed loon, is a candidate species for listing; however, these three species are considered uncommon in the study area.

Bird groups that occur in the project area include waterbirds such as waterfowl, loons, cranes, seabirds, and shorebirds, and landbirds such as raptors, owls, ptarmigan, and songbirds. Waterbirds dominate the study area because of the abundance of surface water caused by the underlying permafrost. All waterbirds in the study area are migratory as aquatic habitats are frozen during the winter. Most waterfowl, ducks, geese, and swans use aquatic habitats in the study area between May and September for spring and fall migration (resting and foraging), nesting, molting, and escape cover. Bird use of tundra habitats in the study area is low relative to habitats to the east and west. However, the Sagavanirktok River delta provides high quality habitat for numerous species. The shoreline and coastal lagoons in the study area provide important post-nesting and molting habitat for birds, and these habitats are included in the Eastern Beaufort Sea Lagoons and Barrier Islands Important Bird Area.

2.3.2. Terrestrial Mammals

Terrestrial mammal groups represented in the study area include rodents (ground squirrels, lemmings, and voles), carnivores (shrews, foxes, bears, and weasels), and ungulates (caribou and muskoxen). Terrestrial mammals of concern for the Point Thomson project are caribou, muskoxen, brown bears, foxes, and small mammals.

Caribou use the study area for calving, summer foraging, and parasitic insect relief. During this time, caribou, potentially from several herds, are constantly on the move within, into, and out of the Point

Thomson area as they forage and seek relief from insects. The Central Arctic Herd is the predominant herd in the study area. Caribou calving ranges and post-calving movements vary from year to year depending on a variety of factors (e.g., weather, forage condition, insect abundance and activity, predators, disturbance). Caribou are an important subsistence resource and also are hunted recreationally.

The muskoxen population in the study area descends from a herd of muskoxen that was reintroduced to the North Slope between 1969 and 1970. Following reintroduction, the North Slope population declined from over 500 animals to about 200 animals between the late 1990s and the mid-2000s; in recent years the population appears to have stabilized at around 200. Muskoxen use the study area year-round, using riverine and riparian habitats in the summer and windswept hilltops, slopes, and plateaus in winter.

Brown bears occur at a low to moderate density on the North Slope. Bears spend between 5 and 8 months in dens, which are commonly located in streambanks, hillsides, and terraces where snow accumulates. Within the study area, brown bear dens have been documented between the Sagavanirktok and Shaviovik Rivers. During their active period, brown bears range widely for food. Within the study area they have been observed foraging and moving through riparian habitats.

Arctic foxes spend summers on land and winters primarily along the coast and on sea ice. Red foxes tend to be most abundant in the foothills and riparian areas on the North Slope. Arctic foxes are attracted to human development and their numbers on the North Slope have been stable in recent years. Red and arctic foxes compete for resources. Where they occur together, the larger red fox often displaces the smaller arctic fox.

Small mammals, such as arctic ground squirrels, collared and brown lemmings, root voles, and barren ground shrews occur in the study area. Small mammals are an integral part of the arctic ecosystem as they form the prey base for many mammals and birds.

2.3.3. Marine Mammals

There is documented occurrence of 16 marine mammal species within or adjacent to the study area: five baleen whale species, four toothed whale species, six pinniped species, and the polar bear. However, nine of these species do not regularly occur in the Beaufort Sea and are not likely to occur in the Point Thomson area. Species of concern for the proposed Point Thomson project include: the bearded seal, beluga whale, bowhead whale, polar bear, and ringed seal. Of these, the bowhead whale and polar bear are listed as threatened or endangered under the ESA while the bearded seal and ringed seal have been proposed for listing as threatened. Of the three non-threatened/non-endangered marine mammal species with occurrence in the study area, only the beluga whale is anticipated to occur regularly, and only in relatively low numbers. The two other species (gray whale and spotted seal) have a rare occurrence (i.e., sporadically occurring in the study area).

The general distribution pattern for beluga whales in the Beaufort Sea shows major seasonal changes (Allen and Angliss 2010). During the winter, they occur in offshore waters associated with pack ice. In the spring, beluga whales migrate to warmer coastal estuaries, bays, and rivers where they may molt, give birth, and care for their calves. Small numbers of beluga whales of the Beaufort Sea stock may occur in the study area seaward of the barrier islands, most likely during the fall westward migration from late August through mid-September. It is possible, though highly unlikely, that a few belugas from the Eastern Chukchi Sea stock could occur in the study area, also during the fall westward migration from late August to mid-September. No belugas are expected in the region during the winter and spring seasons.

2.3.4. Potential Impacts

The analysis of impacts related to other wildlife will include consideration of the loss or change of breeding and nesting areas, escape cover, travel corridors, and preferred food sources for resident and transient wildlife species associated with the aquatic ecosystem. Adverse impacts upon wildlife habitat may result from changes in water levels, water flow and circulation, salinity, chemical content, substrate characteristics, and elevation. Increased water turbidity can adversely affect wildlife species which rely upon sight to feed, and disrupt the respiration and feeding of certain aquatic wildlife and food chain organisms. An increase in the availability of contaminants from the discharge of dredged or fill material may lead to the bioaccumulation of such contaminants in wildlife. Changes in physical and chemical factors of the environment may favor the introduction of undesirable plant and animal species at the expense of resident species and communities. In some aquatic environments lowering plant and animal species diversity may disrupt the normal functions of the ecosystem and lead to reductions in overall biological productivity.

Impacts to other wildlife are discussed in Section 5.9, Birds; 5.10 Terrestrial Mammals; and 5.11 Marine Mammals of the Draft EIS. Additional impacts are detailed in Appendix L, Bird Nesting and Breeding Tables of the Draft EIS. The Draft EIS impact analysis of the proposed discharge on these species will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

3. Subpart E: Potential Impacts on Special Aquatic Sites

Special aquatic sites are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region (See 40 CFR 230.10(a)(3)).

3.1. Sanctuaries and Refuges (40 CFR 230.40)

Sanctuaries and refuges consist of areas designated under State or Federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife resources. Section 3.14, Arctic National Wildlife Refuge of the Draft EIS, discusses the only sanctuary in proximity to the project area.

The Arctic Refuge is part of the National Wildlife Refuge system. The western edge of the Canning/Staines River delta forms the western refuge boundary, which lies approximately 5.5 miles from the current Point Thomson development area and about 2 miles from the proposed East Pad location in Alternative B. The Arctic Refuge includes 19 million acres, 8 million acres of which are designated as Molly Beattie Wilderness. The Point Thomson project site is located 30 miles northwest of the Molly Beattie Wilderness area.

The Arctic Refuge as a whole contains the greatest diversity of wildlife species of any protected area in the circumpolar north, including nearly 45 mammal, 180 bird, and 36 fish species (USFWS 2008). Many fish and wildlife resources are shared by the Arctic Refuge and the proposed project area, creating the potential for impacts on resources within the Arctic Refuge from the Point Thomson Project. In addition, impacts to wetlands, vegetation, recreation, visual aesthetics, and noise in the project area may also extend in the Arctic Refuge. These impacts are discussed by resources, elsewhere in this evaluation (see Sections 3.2, Wetlands, 4.3, Water-Related Recreation, and 4.4, Aesthetics); resource impacts specific to the Arctic Refuge are discussed below.

3.1.1. Potential Impacts

The analysis of impacts related to sanctuaries and refuges in the project area will include consideration of the disruption of the breeding, spawning, migratory movements, or other critical life requirements of resident or transient fish and wildlife; the creation of easy and incompatible human access to remote aquatic areas; the creation of the need for frequent maintenance activity; the establishment of undesirable competitive species of plants and animals; changes in the balance of water and land areas needed to provide cover, food, and other fish and wildlife habitat requirements in a way that modifies sanctuary or refuge management practices; and any other adverse impacts discussed in Subparts C, D, or F (Sections 1, 2, and 4) as they relate to a particular sanctuary or refuge.

Section 5.14, Arctic National Wildlife Refuge of the Draft EIS, discusses the potential for impacts to the Arctic Refuge that may occur as the result of the proposed Point Thomson Project. . The Draft EIS impact analysis of the proposed discharge on these species will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

3.2. Wetlands (40 CFR 230.41)

Wetlands consist of areas that are inundated or saturated by surface or ground water at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Section 3.8, Vegetation and Wetlands of the Draft EIS and Appendices J, Mapped Land Cover and Wetlands, and K, Wetland Functional Assessment of the Draft EIS, discuss the prevalence and location of wetlands in the project area.

Vegetation on the ACP is dominated by cold and high-moisture tolerant species. Small topographic differences affect soil moisture which, in turn, strongly affects the vegetation of any site. Margins of thaw lakes, drained thaw lake basins, ice-wedge polygon troughs, and low-centered polygons, all features common to the study area, tend to be saturated throughout the growing season and have high-moisture tolerant species, including sedges or grasses occupying lower wetter areas, and dwarf scrub communities occupying areas with better drainage (Gallant, et al. 1995).

The aquatic ecosystems of the project area are characterized by extensive wetland and water body habitats. Mapped areas include terrestrial and marine areas in and near where infrastructure is proposed for all alternatives. Seventy-one percent (45,796 acres) of the mapped study area is covered by wetlands, notably wet tundra (28 percent), moist tundra (22 percent), and moist/wet tundra complexes (17 percent). Table 6.1 describes the cover classes common in Point Thomson study area wetlands.

Table 6.1: Wetland Cover Classes found in the Point Thomson Study Area	
Class	Description
Wet tundra	Occupies wetter environments such as drained lake basins and poorly drained river terraces. Typically characterized as saturated or inundated emergent and scrub-shrub wetland. Ranges from saturated to permanently flooded.
Moist tundra	Covers broad expanses of open tundra above shallow water tables. Moist tundra is characterized as saturated wetland, dominated by scrub-shrub and emergent vegetation.
Wet/moist complex	Includes areas of tundra with a mosaic of wet and moist tundra, generally with moist ridges dominated by dwarf shrubs and wetter basins dominated sedges. Common in drier portions of drained lake basins and on poorly drained river terraces. Wet/moist tundra complexes are generally characterized as saturated or inundated emergent and scrub-shrub wetland, ranging from seasonally saturated to permanently flooded.

Wetlands serve important biological and ecological functions and support key bird, terrestrial mammal, and fish habitat within the study area. Some of the most prevalent functions served by wetlands in the study area include:

- Maintenance of soil thermal regime (62 percent of study area)
- Waterbird support (56 percent of study area)
- Resident and diadromous fish support (38 percent of study area)
- Production and export of organic matter (29 percent of study area)
- Flood flow moderation and conveyance (28 percent of study area)

Water bodies include unvegetated intertidal and subtidal bays and inlets, rivers, streams, lakes, ponds, and their associated barren mud flats, gravel bars, and drained lake basins. Water bodies and their associated barrens occupy approximately 29 percent (18,354 acres) of the study area and comprise areas of open water (26 percent), river gravels/beaches (2 percent), wet mud (1 percent) and bare peat (less than 0.1 percent) associated with lakes, ponds, and coastal areas.

Areas not classified as water bodies or wetlands are considered uplands. Uplands occupy less than one percent (205 acres) of the study area. Areas mapped uplands include existing, man-made gravel pads. Vegetation types that may be a mosaic of upland and wetland, however, are considered wetland for this analysis. Upland areas serve as well-drained components in mosaics of wetland habitat and consist of a typically higher diversity of plant species than in the surrounding wetlands.

3.2.1. Potential Impacts

The analysis of impacts related to wetlands will include consideration of potential for the damage or destruction of wetland habitat resulting from adverse impacts to the biological productivity of wetlands ecosystems by smothering, dewatering, permanently flooding, altering substrate elevation, or altering periodicity of water movement. The addition of dredged or fill material may destroy wetland vegetation or result in advancement of succession to dry land species. Other impacts may include the reduction or elimination of nutrient exchange by a reduction of the system's productivity, or by altering current patterns and velocities. Disruption or elimination of the wetland system can degrade water quality by obstructing circulation patterns that flush large expanses of wetland systems, by interfering with the filtration function of wetlands, or by changing the aquifer recharge capability of a wetland.

The discharge of fill material can also change the wetland habitat value for fish and wildlife as discussed in Subpart D (Section 2). When disruptions in flow and circulation patterns occur, apparently minor loss of wetland acreage may result in major losses through secondary impacts. Discharging fill material in wetlands may modify the capacity of wetlands to retain and store floodwaters and to serve as a buffer zone shielding upland areas from wave actions, storm damage and erosion.

Section 5.8, Vegetation and Wetlands of the Draft EIS, discusses the potential impacts to wetlands under all Draft EIS alternatives. The Draft EIS impact analysis of the proposed discharge on wetland ecosystems will be incorporated into this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

3.3. Mudflats (40 CFR 230.42)

Mudflats are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems. The substrate of mudflats contains organic material and particles smaller in size than sand. They are either un-vegetated or vegetated only by algal mats. The prevalence and location of mudflats in the project area is also discussed in Section 3.8, Vegetation and Wetlands and Appendix J, Mapped Land Cover and Wetlands of the Draft EIS.

Mudflats are not common in the project area and are primarily found near the mouths of the Sagavanirktok and Shaviovik Rivers. Mudflats were captured in vegetation mapping of the project area in the Wet Barren/Wet Graminoid Tundra Complex (barren/saline tundra complex/saltmarsh; vegetation class IXh) and River Gravels and Beaches (vegetation class Xa). Wet Barren/Wet Graminoid Tundra Complexes include Estuarine Intertidal, Regularly Flooded Mud Flats (NWI classes E2USN and E2USP) as the dominant cover present as large patches of wet mud interspersed among Emergent Intertidal (E2EM1P) saline tolerant plants. River Gravels and Beaches include Riverine, Seasonally Flooded Areas (NWI classes R2USC and R3USC) and Estuarine, Intertidal, Irregularly Flooded Areas (NWI class E2US1P). Mudflats captured by vegetation class Xa were identified by hand based on aerial interpretation and proximity to the coast and were distinguished from river gravels and beaches within this class.

3.3.1. Potential Impacts

The analysis of impacts related to mudflats will include consideration of the potential for changes in water circulation patterns, which may permanently flood or dewater the mud flat or disrupt periodic inundation, resulting in an increase in the rate of erosion or accretion. Such changes can deplete or eliminate mud flat biota, foraging areas, and nursery areas. Changes in inundation patterns can affect the chemical and biological exchange and decomposition process occurring on the mud flat and change the deposition of suspended material affecting the productivity of the area. Changes may reduce the mudflat's capacity to dissipate storm surge runoff.

Appendix J, Mapped Land Cover and Wetlands of the Draft EIS discusses the location and prevalence of mudflats in the project area and provides the basis for analysis of impacts to mudflats by Draft EIS alternative. Impact analysis of the proposed discharge on wetland ecosystems will be included in this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

3.4. Vegetated Shallows (40 CFR 230.43)

Vegetated shallows are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes. The location of vegetated shallows in the project area is presented in Section 3.8, Vegetation and Wetlands and Appendix J, Mapped Land Cover and Wetlands of the Draft EIS.

Freshwater vegetated shallows in the project area were captured in the vegetation mapping in the Aquatic Graminoid Tundra (emergent vegetation; vegetation class IIb) and Water/Tundra Complex (interconnected ponds with emergent vegetation; vegetation class IId) classes. Aquatic Graminoid Tundra includes Lacustrine and Palustrine permanently flooded emergent marshes (NWI classes L2EM2H and PEM1H) which primarily include communities dominated by *Arctophila fulva* and *Carex aquatilis* associated with the shallow waters of ponds, lakes, and slow moving streams. Water/Tundra Complex vegetation includes Lacustrine and Palustrine complexes of open water and emergent vegetation (NWI classes L2UB/EM2H and PUB/EM2H) which primarily include complexes of water and intervening tundra. Water is the dominant land cover with large areas of emergent vegetation in the water bodies.

In addition to these two primary vegetated shallows classes, some vegetated shallows may also be captured under the Wet Sedge Tundra/Water Complex class (vegetation class IIIc), which includes Lacustrine and Palustrine complexes of emergent vegetation and open water (NWI classes L2EM2/UBH and PEM1/UBH). Only those areas of this class that are associated with permanent water bodies were included as vegetated shallows.

In the marine ecosystem, vegetated shallows in the project area are captured in the vegetation mapping in the Wet Graminoid Tundra (wet saline tundra/salt marsh; vegetation class IIIb). This class includes Estuarine Emergent Intertidal vegetation (NWI classes E2EM1N AND E2EM1P), which primarily includes communities dominated by saline tolerant graminoid species present at the mouths of rivers and streams.

3.4.1. Potential Impacts

The analysis of impacts related to vegetated shallows will include consideration of the potential for the smothering or creation of unsuitable conditions for vegetation or benthic organisms as a result of:

1) changing water circulation patterns;
2) releasing nutrients that increase undesirable algal populations;
3) releasing chemicals that adversely affect plants and animals;
4) increasing turbidity levels, thereby reducing light penetration and hence photosynthesis; and
5) changing the capacity of a vegetated shallow to stabilize bottom materials and decrease channel shoaling.

The discharge of dredged or fill material may reduce the value of vegetated shallows as nesting, spawning, nursery, cover, and forage areas, as well as their value in protecting shorelines from erosion and wave actions. It may also encourage the growth of nuisance vegetation.

All vegetated shallows in the project area fall under the definition of wetlands as they are “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Vegetated shallows that do not fall under the wetlands definition (such as eelgrass beds) do not exist in the project area. Thus, all impacts to vegetated shallows will be considered under the discussion of wetland impacts in Section 3.2, Wetlands. No additional impacts to vegetated shallows, beyond those already discussed for wetlands, are expected to occur.

3.5. Coral Reefs (40 CFR 230.44)

Coral reefs consist of the skeletal deposit of anthozoan polyps or other invertebrate organisms present in growing portions of a reef. Corals are rare in the Alaskan Beaufort Sea due to the lack of hard rock substrates needed for attachment. The Alaskan Beaufort Sea shelf is blanketed predominantly by silty sands and muds (Dunton, et al. 1982).

A small population of corals does exist, however, in the Boulder Patch, an unusual Beaufort Sea ecosystem offshore of the Endicott causeway in Stefansson Sound. The Boulder Patch is characterized by abundant kelp and diverse invertebrate fauna attached to cobbles and boulders in an area where the benthic environment is protected from ice movement by offshore islands and shoals (Dunton, et al. 1982). One species of soft coral, *Gersemia rubiformis*, has been identified living on the rock substrates. The Boulder Patch is not within the immediate vicinity of Point Thomson, but is considered within the project area as it may be traversed by coastal barges transporting goods and materials from Deadhorse to Point Thomson (ExxonMobil 2011b).

The Boulder Patch has been extensively studied for potential impacts related to the oil and gas development at Endicott. No adverse effects have been detected on the community health or diversity (Martin and Gallaway 1994).

3.5.1. Potential Impacts

The analysis of impacts related to coral reefs will include consideration of the potential for changes related to sedimentation, degradation of water quality, and the reduction of the penetration of light through the water column.

3.6. Riffle and Pool Complexes (40 CFR 230.45)

Riffle and pool complexes sometimes characterize steep gradient sections of streams where the rapid movement of water over a course substrate in riffles results in rough flow, a turbulent surface, and high DO levels. Riffles are intermixed with pools, which are characterized by slower stream velocity, a steaming flow, smooth surface, and a finer substrate. Riffle and pool complexes are particularly valuable habitat for fish and wildlife. There are no riffle and pool complexes identified in the project area.

4. Subpart F: Potential Effects on Human Use Characteristics

4.1. Municipal and Private Water Supplies (40 CFR 230.50)

Municipal and private water supplies consist of surface or ground water which is directed to the intake of a municipal or private water supply system. There are no municipal or private water supplies in the project area at this time. However, under the development of any of the action alternatives, the C-1 reservoir would be used as a potable water source during the construction of the Point Thomson development. Under Alternatives B, C, and E, the C-1 reservoir would continue to be the primary water source for the life of the project, with the rehabilitated gravel mine, which will be developed during construction, serving as a secondary water source. Under Alternative D, the rehabilitated gravel mine would be the primary water source during drilling and for the life of the project operations.

Impacts related to water supplies may include, but are not limited to, changes in the color, taste, odor, chemical content, and suspended particulate concentration, in such a way as to reduce the fitness of the water for consumption. Water can be rendered unpalatable or unhealthy by the addition of suspended particulates, viruses and pathogenic organisms, and dissolved materials. The expense of removing such substances before the water is delivered for consumption can be high. Discharges may also affect the quantity of water available for municipal and private water supplies. In addition, certain commonly used water treatment chemicals have the potential for combining with some suspended or dissolved substances from dredged or fill material to form other products that can have a toxic effect on consumers.

The use of the C-1 reservoir as a water source, existing water quality in the project area, and potential impacts to water quality from the Point Thomson project are discussed in Sections 2.4, Alternative Descriptions; 3.7, Water Quality; and 5.7 Water Quality of the Draft EIS. Water quality is further discussed in Section 1.3, Water Quality and Chemistry, above.

4.2. Recreational and Commercial Fishing (40 CFR 230.51)

Recreational and commercial fisheries consist of harvestable fish, crustaceans, shellfish, and other aquatic organisms used by humans. In the context of this Guidelines evaluation, it also includes subsistence fishing by local residents. The aquatic ecosystem in the project area supports human use through commercial and recreational fishing. Recreational fishing includes recreational fishing by non-local residents and subsistence fishing by local residents. Of these uses, subsistence fishing by local residents is the most common consumptive use of the aquatic resources. Sections 3.11, Marine Mammals; 3.12, Fish, Essential Fish Habitat, and Invertebrates; 3.18, Recreation; and 3.22 Subsistence and Traditional Land Use of the Draft EIS discuss the availability and harvest of marine mammals and fish in the project area.

Commercial fishing in the NSB is limited. In 2010, just five NSB residents held commercial fishing permits for arctic cisco in the Colville River, located west of the project area (ADCCED 2011). While no commercial fishing occurs in the vicinity of the project area, arctic cisco harvested in the Colville River use the project area as feeding, rearing, and migration habitat. Arctic cisco of younger age classes also overwinter in the Sagavanirktok River, on the western edge of the project area.

Recreational fishing by non-local residents occurs in the Point Thomson Project area; however, fishing is rarely the primary reason for recreational visits to the area. Most recreational use of the project area by non-local residents occurs along the Canning River, which forms the boundary between state land and the Arctic Refuge. Non-local residents occasionally kayak along the coastal corridor as well. All recreational use of the project area occurs at low levels; there may be no more than about 100 non-local recreationists on the ground in the area in a given year. Most non-local recreational visitors to the Arctic Refuge state indicate that solitude and experience of the “wilderness values” are primary motivators for their visit while hunting, river rafting, and hiking/backpacking are primary recreational activities (Christensen and Christensen 2009). However, a large proportion of non-local recreational visitors are believed to fish during their visits to the Arctic Refuge, even though fishing usually is not a primary reason for visiting. Non-local recreational fishing in the project area most likely to targets freshwater and diadromous species of fish.

The primary human use of fish, invertebrates, and other aquatic organisms, including marine mammals, in the project area is subsistence harvest by residents of local communities. The communities of Kaktovik and Nuiqsut are the two closest communities to the Point Thomson Project area and both communities use areas in or adjacent to the Point Thomson project area for subsistence purposes. In addition, residents from these communities also harvest subsistence resources which may migrate through the project area.

For the community of Kaktovik, the subsistence harvest of marine mammals provides a large portion (between 17 to 79 percent in the five years studied) of the total subsistence harvest by weight; fish harvests varied between 4 and 18 percent of the total annual subsistence harvests in those same years (Fuller and George 1999, Bacon, et al. 2009, ADF&G 2011). The yearly contribution of all species fluctuates depending on resource availability and harvest success. Kaktovik residents use the project area primarily for the harvest of caribou, however, residents report fishing along the coast in the project vicinity. Subsistence harvest of other aquatic resources, such as seals and waterfowl, also occurs at a minimal level in the project area, primarily in conjunction with the summer caribou hunt. Bowhead whale hunting for the community of Kaktovik does not occur in the project area, but residents expressed concern that bowhead whale harvests could be impacted if contamination of marine resources occurs.

For the community of Nuiqsut, the subsistence harvest of marine mammals ranged between 2 and 66 percent of the total annual subsistence harvest for the community in the six years studied. Fish harvest ranged between 9 and 56 percent of the total annual subsistence harvest in those same years (Brower and Hepa 1998, Fuller and George 1999, Bacon, et al. 2009, ADF&G 2011). Nuiqsut harvesters have reported subsistence-use areas in the vicinity of Point Thomson for bowhead whales, seals, and waterfowl. Bowhead whales are the resource most intensively harvested by Nuiqsut residents in the project area. Whaling crews travel to Cross Island, which is northeast of Prudhoe Bay and approximately 11 to 12 miles from shore, and hunt from there. Nuiqsut residents do not report fishing in the project area; however, Nuiqsut residents harvest arctic cisco in the Colville River. These fish pass through the project area while migrating from the Mackenzie River delta in Canada to (See Appendix Q of the Draft EIS).

4.2.1. Potential Impacts

The analysis of impacts related to commercial and recreational fishing, including subsistence fishing, will include consideration of potential changes in the suitability of recreational and commercial fishing grounds as habitat for populations of consumable aquatic organisms. Discharges can also result in the chemical contamination of recreational or commercial fisheries. They may also interfere with the reproductive success of recreational and commercially important aquatic species through disruption of migration and spawning areas. The introduction of pollutants at critical times in their life cycle may directly reduce populations of commercially important aquatic organisms or indirectly reduce them by reducing organisms upon which they depend for food. Any of these impacts may be of short duration or prolonged, depending upon the physical and chemical impacts of the discharge and the biological availability of contaminants to aquatic organisms.

Sections 5.11, Marine Mammals; 5.12, Fish, Essential Fish Habitat, and Invertebrates, 5.18, Recreation; and 5.22 Subsistence and Traditional Land Use of the Draft EIS discuss the potential impacts of the Point Thomson Project on fish, fish habitats, invertebrates, marine mammals, and consumptive use of these aquatic organisms through recreational and subsistence fishing. Impacts to commercial and recreational fishing may occur if impacts to fish, invertebrate and marine mammal populations were to occur. The potential for these impacts are discussed in Sections 2.2, Aquatic Food Web, and 2.3, Other Wildlife. Impact analysis of the proposed discharge on recreational and commercial fishing will be included in this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

4.3. Water-Related Recreation (40 CFR 230.52)

Water-related recreation encompasses activities undertaken for amusement and relaxation. Activities encompass two broad categories of use: consumptive and non-consumptive. Sections 3.18, Recreation and 3.22, Subsistence and Traditional Land Use of the Draft EIS describe water-related recreation in the project area.

Water-related recreation in the project area can be divided into two categories: recreational use of the project area by non-local residents and recreational use by local residents, often as a part of subsistence activities. As discussed in Section 4.2, Commercial and Recreational Fishing, non-local recreation in the project area is principally a backcountry and remote recreation experience. This is particularly true within the Arctic Refuge, on the eastern side of the Point Thomson project area. The Canning River, which forms the boundary between state land and federal land, is one of the main recreation corridors for river floaters and float hunters in the Arctic Refuge. Those using the river corridor may camp, hike, or hunt on state or refuge land. Besides the Canning River corridor, there is a coastal corridor of indeterminate width in which local residents travel by snowmobile or boat and camp for hunting and fishing, and in which visitors sometimes kayak. Occasional boats from Kaktovik with touring visitors also use the coastal corridor and may occasionally travel to the Point Thomson area. All non-local recreational use of the project area occurs at low levels.

Local residents typically do not label their activities in the general area as “recreation,” and many local residents interpreted recreation as “use of the Arctic Refuge by people who lived outside the local area (USFWS 1988).” There is, however, in western cultural terms a recreation component to traditional subsistence activities and camps. Scoping meetings for this project and the 2002 Point Thomson EIS effort did not generate comments from NSB residents about their own recreation, but did indicate that residents enjoy getting away from their usual home life for the quiet and change of pace of hunting and fishing camps, and that there was an appreciation of aesthetics of the land. As a result, a discussion of “recreation” by local residents is included in this section.

Local residents of the communities of Kaktovik and Nuiqsut use the project area for recreational purposes as they travel by boat for subsistence purposes. In addition to subsistence fishing, described in Section 4.2, residents travel by boat to harvest other important subsistence resources, such as caribou, in and around the project area.

4.3.1. Potential Impacts

The analysis of impacts related to water-related recreation will include consideration of the potential for impairment or destruction of the resources which support recreation activities. The disposal of dredged or fill material may adversely modify or destroy water use for recreation by changing turbidity, suspended particulates, temperature, dissolved oxygen, dissolved materials, toxic materials, pathogenic organisms, quality of habitat, and the aesthetic qualities of sight, taste, odor, and color.

Sections 5.18, Recreation and 5.22, Subsistence and Traditional Land Use of the Draft EIS describe impacts on water-related recreation in the project area. Impact analysis of the proposed discharge on water-related recreation will be included in this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

4.4. Aesthetics (40 CFR 230.53)

Aesthetics associated with the aquatic ecosystem consist of the perception of beauty by one or a combination of the senses of sight, hearing, touch, and smell. Aesthetics of aquatic ecosystems apply to the quality of life enjoyed by the general public and property owners. Sections 3.18, Recreation; 3.19, Visual Aesthetics; and 3.20, Noise of the Draft EIS discuss aesthetics in the project area.

The proposed Point Thomson Project is located in an undeveloped and uninhabited area within a few miles of the Arctic Refuge. Overall, the study area rated fairly high in visual quality based on seven characteristics such as landform, vegetation, and color. In particular, sensitivity was rated high in the Arctic Refuge and medium on most state land in the study area because most users of the area, both local and visitors, are thought to be fairly sensitive to visual changes and because the refuge is considered a special area. The Arctic Refuge is managed, in part for the preservation of the natural landscape, including natural visual environment and natural darkness. The State of Alaska does not manage its lands in the study area for visual resources.

The project area currently has low levels of noise from human activity. Existing sound levels during winter and summer conditions are dominated by natural sounds, atmospheric/meteorological phenomena, water features, and animals. Noise from human activities, other than currently permitted industrial activities, is largely absent from the ambient soundscape. Generally, sound levels in the coastal plains near surface water features are the loudest, while upland coastal plains areas without the influence of surface water features are the quietest.

4.4.1. Potential Impacts

The analysis of impacts to aesthetics in the project area will include consideration of potential changes in the beauty of natural aquatic ecosystems resulting from the degradation of water quality; creation of distracting disposal sites; encouragement of unplanned and incompatible human access; and the destruction of vital elements that contribute to the compositional harmony or unity, visual distinctiveness, or diversity of an area. The discharge of dredged or fill material can adversely affect the particular features, traits, or characteristics of an aquatic area which make it valuable to land owners and users. Activities which degrade water quality, disrupt natural substrate and vegetation characteristics, deny access to or visibility of the resource, or result in changes in odor, air quality, or noise levels may reduce the value of an aquatic area to private property owners.

Sections 5.19, Visual Aesthetics and 3.20, Noise of the Draft EIS describe impacts on aesthetics in the project area. Impact analysis of the proposed discharge on area aesthetics will be included in this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

4.5. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves (40 CFR 230.54)

Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves consist of areas designated under Federal or State laws or local ordinances to be managed for their aesthetic, educational, historical, recreational, or scientific value. The Arctic Refuge contains the Molly Beattie Wilderness, the only congressionally designated Wilderness area in proximity to the project area. The northwest corner of the Molly Beattie Wilderness is at the foot of the Sadlerochit Mountains 30 from the Point Thomson project area. The Arctic Refuge as a whole is discussed in Section 3.14, Arctic National Wildlife Refuge of the Draft EIS, and in Section 3.1, Sanctuaries and Refuges, above.

Cultural resources, such as pre-historic and historic sites, also exist in the project area. These include sites and materials of prehistoric Native American, historic European and Euro-American, and historic Iñupiaq origin such as cabin sites, camp sites, burial grounds, traditional subsistence harvest sites, and other traditional land use areas, landscapes, and place names. Between Endicott and Brownlow Point, there are

60 recorded cultural resources located in the proposed study area. Cultural resources in the project area are discussed in Section 3.21, Cultural Resources of the Draft EIS.

4.5.1. Potential Impacts

The analysis of impacts to parks, preserves, monuments, and other sites of importance will include consideration of potential modification of the aesthetic, educational, historical, recreational and/or scientific qualities thereby reducing or eliminating the uses for which such sites are set aside and managed. Sections 5.14, Arctic National Wildlife Refuge and 5.21, Cultural Resources of the Draft EIS describe potential impacts to the Arctic Refuge and cultural resources that my result from the proposed project. Impact analysis of the proposed discharge on area aesthetics will be included in this document after the public has had an opportunity to comment on the permit application and the Corps has published the Final EIS.

5. Subpart G: Evaluation of Dredged or Fill Material (40 CFR 230.60)

The purpose of the evaluation procedures and chemical and biological testing sequence outlined in this section is to provide the information needed to reach the factual determinations required by Proposed Disposal Site Determination in Appendix A, Section 6. To determine if additional chemical or biological testing is required, the Corps must consider available information regarding the proposed dredged and fill material, including prior evaluations, chemical and biological tests, scientific research, and past experience.

The Guidelines outline the decision-making procedure for this determination, which includes the following tests:

a) If the evaluation under Section B of Subpart G (below) indicates that the dredged and fill material is not a carrier of contaminants, then the required determination pertaining to the presence and effects can be made without testing. Dredged or fill material is most likely to be free from chemical, biological, or other pollutants where it is composed primarily of sand, gravel, or other naturally occurring inert material.

b) The extraction site shall be examined in order to access whether it is sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge material is not a carrier of contaminants. Factors to be considered include, but are not limited to:

- Potential routes of contaminants or contaminated sediments to the extraction site, based on maps, aerial photography, or other materials that show watercourses, surface relief, proximity to tidal movement, private and public roads, location of buildings, municipal and industrial areas, and agricultural or forest lands;
- Pertinent results from tests previously carried out on the material at the extraction site, or carried out on similar material for other permitted projects in the vicinity. Materials shall be considered similar if the sources of contamination, the physical configuration of the sites and the sediment composition of the materials are comparable. Tests from other sites may be relied on only if no changes have occurred at the extraction sites to render the results irrelevant;
- Any potential for significant introduction of persistent pesticides from land runoff or percolation;

- Any records of spills or disposal of petroleum products or substances designated as hazardous under section 311 of the CWA (See 40 CFR 116);
- Information in Federal, State and local records indicating significant introduction of pollutants from industries, municipalities, or other sources, including types and amounts of waste materials discharged along the potential routes of contaminants to the extraction site; and
- Any possibility of the presence of substantial natural deposits of minerals or other substances which could be released to the aquatic environment in harmful quantities by man-induced discharge activities.

c) Where the discharge site is adjacent to the extraction site and subject to the same sources of contaminants, and the materials at the two sites are substantially similar, the fact that the material to be discharged may be a carrier of contaminants is not likely to result in degradation of the disposal site. In such circumstances, when dissolved material and suspended particulates can be controlled to prevent carrying pollutants to less contaminated areas, testing will not be required.

d) Even if the above tests lead to the conclusion that there is a high probability that the material proposed for discharge is a carrier of contaminants, testing may not be necessary if constraints are available to reduce the contamination to acceptable levels within the disposal site and to prevent contaminants from being transported beyond the boundaries of the disposal site. In this case, constraints must be acceptable to the permitting authority and the potential discharger must be willing and able to implement such constraints. However, even if tests are not performed, the permitting authority must still determine the probable impact of the operation on the receiving aquatic ecosystem. Any decision not to test must be explained in the Factual Determinations (Appendix A).

If, upon evaluation of the proposed dredge or fill material, the Corps determines that additional chemical, biological, and physical testing is required, testing guidelines are outlined under Section 230.61 of the Guidelines. If additional testing is not required, the Corps may use the information outlined above in making the factual determination required in Appendix A, Section 6, Proposed Disposal Site Determination.

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Appendix C:

Actions to Minimize Adverse Effects (Subpart H)

Minimization includes actions which can be undertaken by the Applicant to minimize the adverse effects of discharges of dredged and fill material. Minimization measures are incorporated into the Corps' evaluation of the proposed project under the Factual Determinations (Appendix A) and Technical Evaluation Factors (Appendix B) as they have the potential to lessen adverse effects to waters of the U.S. and aquatic ecosystems. Minimization measures include, but are not limited to: actions concerning the location of the discharge; actions concerning the material to be discharged; actions controlling the material after discharge; actions affecting the method of dispersion; actions related to technology; actions affecting plant and animal populations; actions affecting human use; and other actions. Several examples of each of these action types are discussed below.

The Applicant has incorporated several measures to minimize impacts to waters of the U.S. into the design of Alternative B. All of these measures are outlined in the Applicant's Environmental Mitigation Report (ExxonMobil 2011d) and Final Department of the Army Permit Application (ExxonMobil 2011a). These measures are also discussed in detail in Section 4.4, Impact Avoidance, Minimization, and Mitigation of the Draft EIS and by resource section in Chapter 5, Environmental Consequences of the Draft EIS.

The Corps views the minimization measures outlined by the Applicant to represent a reasonable starting point for the development of the full scope of minimization measures that may be included in the evaluation of compliance with the Guidelines. However, the Corps has not yet determined if the Applicant's proposed minimization actions include all available, appropriate, and practicable measures. The Corps invites the public to comment on the current list of Applicant proposed minimization measures and to provide suggestions on additional minimization measures that may be practicable and appropriate to help reduce impacts to waters of the U.S. and aquatic ecosystems. A general list of example minimization measures have been grouped by type and are listed below. The list of examples is not exhaustive, but provides a starting point for consideration of the types of minimization measures that may be available to lessen potential impacts of the proposed project.

1. Actions concerning the location of the discharge (40 CFR 230.70)

The effects of the discharge can be minimized by the choice of the disposal site. Some of the ways to accomplish this are by:

a) Locating and confining the discharge to minimize smothering of organisms;

b) Designing the discharge to avoid a disruption of periodic water inundation patterns;

c) Selecting a disposal site that has been used previously for dredged material discharge;

d) Selecting a disposal site at which the substrate is composed of material similar to that being discharged, such as discharging sand on sand or mud on mud;

e) Selecting the disposal site, the discharge point, and the method of discharge to minimize the extent of any plume; and

f) Designing the discharge of dredged or fill material to minimize or prevent the creation of standing bodies of water in areas of normally fluctuating water levels, and minimize or prevent the drainage of areas subject to such fluctuations.

2. Actions concerning the material to be discharged (40 CFR 230.71)

The effects of a discharge can be minimized by treatment of, or limitations on the material itself, such as:

a) Disposal of dredged material in such a manner that physiochemical conditions are maintained and the potency and availability of pollutants are reduced.

b) Limiting the solid, liquid, and gaseous components of material to be discharged at a particular site; and

c) Adding treatment substances to the discharge material.

3. Actions controlling the material after discharge (40 CFR 230.72)

The effects of the dredged or fill material after discharge may be controlled by:

a) Selecting discharge methods and disposal sites where the potential for erosion, slumping or leaching of materials into the surrounding aquatic ecosystem will be reduced;

b) Maintaining and containing discharged material properly to prevent point and nonpoint sources of pollution; and

c) Timing the discharge to minimize impact, for instance during periods of unusual high water flows, wind, wave, and tidal actions.

4. Actions affecting the method of dispersion (40 CFR 230.73)

The effects of a discharge can be minimized by the manner in which it is dispersed, such as:

a) Where environmentally desirable, distributing the dredged material widely in a thin layer at the disposal site to maintain natural substrate contours and elevation;

b) Orienting a dredged or fill material mound to minimize undesirable obstruction to the water current or circulation pattern, and utilizing natural bottom contours to minimize the size of the mound;

c) Using silt screens or other appropriate methods to confine suspended particulate/turbidity to a small area where settling or removal can occur;

d) Making use of currents and circulation patterns to mix, disperse and dilute the discharge;

e) Minimizing water column turbidity by using a submerged diffuser system. A similar effect can be accomplished by submerging pipeline discharges or otherwise releasing materials near the bottom;

f) Selecting sites or managing discharges to confine and minimize the release of suspended particulates to give decreased turbidity levels and to maintain light penetration for organisms; and

g) Setting limitations on the amount of material to be discharged per unit of time or volume of receiving water.

5. Actions related to technology (40 CFR 230.74)

Discharge technology should be adapted to the needs of each site. In determining whether the discharge operation sufficiently minimizes adverse environmental impacts, the applicant should consider:

a) Using appropriate equipment or machinery, including protective devices, and the use of such equipment or machinery in activities related to the discharge of dredged or fill material;

b) Employing appropriate maintenance and operation on equipment or machinery, including adequate training, staffing, and working procedures;

c) Using machinery and techniques that are especially designed to reduce damage to wetlands. This may include machines equipped with devices that scatter rather than mound excavated materials, machines with specially designed wheels or tracks, and the use of mats under heavy machines to reduce wetland surface compaction and rutting;

d) Designing access roads and channel spanning structures using culverts, open channels, and diversions that will pass both low and high water flows, accommodate fluctuating water levels, and maintain circulation and faunal movement; and

e) Employing appropriate machinery and methods of transport of the material for discharge.

6. Actions affecting plant and animal populations (40 CFR 230.75)

Minimization of adverse effects on populations of plants and animals can be achieved by:

a) Avoiding changes in water current and circulation patterns which would interfere with the movement of animals;

b) Selecting sites or managing discharges to prevent or avoid creating habitat conducive to the development of undesirable predators or species which have a competitive edge ecologically over indigenous plants or animals;

c) Avoiding sites having unique habitat or other value, including habitat of threatened or endangered species;

d) Using planning and construction practices to institute habitat development and restoration to produce a new or modified environmental state of higher ecological value by displacement of some or all of the existing environmental characteristics. Use techniques that have been demonstrated to be effective in circumstances similar to those under consideration wherever possible;

e) Timing discharge to avoid spawning or migration seasons and other biologically critical time periods; and

f) Avoiding the destruction of remnant natural sites within areas already affected by development.

7. Actions affecting human use (40 CFR 230.76)

Minimization of adverse effects on human use potential may be achieved by:

a) Selecting discharge sites and following discharge procedures to prevent or minimize any potential damage to the aesthetically pleasing features of the aquatic site (e.g. viewscapes), particularly with respect to water quality;

b) Selecting disposal sites which are not valuable as natural aquatic areas;

c) Timing the discharge to avoid the seasons or periods when human recreational activity associated with the aquatic site is most important;

d) Following discharge procedures which avoid or minimize the disturbance of aesthetic features of an aquatic site or ecosystem; and

e) Selecting sites that will not be detrimental or increase incompatible human activity, or require the need for frequent dredge or fill maintenance activity in remote fish and wildlife areas.

8. Other actions (40 CFR 230.77)

a) In the case of fills, controlling runoff and other discharges from activities to be conducted on the fill;

b) When a significant ecological change in the aquatic environment is proposed by the discharge of dredged or fill material, the permitting authority should consider the ecosystem that will be lost as well as the environmental benefits of the new system.

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